FINAL PERFORMANCE REPORT
OCCUPATIONAL SAFETY AND HEALTH TRAINING FOR TELEWORKERS
GRANT NUMBER 1R43 OH07461-01

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Table of Contents

List of Figures

List of Tables

A. Abstract

The purpose of this research is to reduce the risk of occupational injury and illness to employees who telecommute from their homes (telework). The rapid growth of teleworking has raised several social and legal issues regarding an employer's responsibility for an employee's home office. OSHA policy states that employers are not responsible for home offices; yet, teleworkers may be more at risk from occupational safety and health hazards than their co-workers who commute. In a traditional workplace, risk factors are controlled or eliminated by the employer, building owner, or fire marshal. In the home workplace, employees must control or eliminate risk factors on their own.

During Phase I, researchers worked with a group of multidisciplinary experts to define the major occupational injury and illness prevention topics that affect home-based workers. The team developed a curriculum outline for teleworkers consisting of six modules. Module topics for teleworkers are — office ergonomics, fire safety, electrical safety, air quality/radon, falls/tripping and safety roles and responsibilities for telework program managers. As a prototype, researchers developed a detailed curriculum guide for the module on ergonomics and a computer-based training module titled "Ergonomics for Teleworkers" delivered on CD-ROM.

Researchers piloted tested the ergonomics CD-ROM. Study participants included 102 teleworkers who completed an on-line preregistration form. Participants were randomly assigned into a treatment (n = 51) or control (n = 51) group. Of the102 teleworkers who completed the on-line registration form, 51 completed the study as a member of the treatment group (n = 28) or control group (n = 23). The treatment group completed the ergonomics training and a pre- and posttest. The control group completed the pre- and posttests without training.

The study demonstrated the need for teleworker ergonomics training. More than 85% of participants had not received teleworker training before and 44% had experienced pain or discomfort while teleworking. Treatment group participants significantly improved their scores from pre- to posttest. Differences between the pre- and posttest mean scores were significant for the total score (t = 12.14, df = 27, p = .0005), for the Knowledge subtest (t = 8.36, df = 27, p = .0005), for the Attitudes subtest (t = 7.29, df = 27, p = .0005) and for the Practices subtest (t = 9.68, df = 27, p = .0005). Differences between mean scores for the Control Group were not significant for the total score or for any of the subtests.

During Phase II, researchers will develop the four remaining teleworker safety training modules and a fifth module for managers. Following a pilot-test of the new materials, researchers will conduct a national field test. Each module will have a CD-ROM and web-based format. The modules will combine text, graphics, sound, color illustrations, and animation to provide a fully interactive, media-rich learning environment. The web-based version of the training will take advantage of the latest advances in distance learning technology, including streaming media. Pre and posttests will be included, either on the CD-ROM or on-line as part of each module. Learners will be able to print out and save certificates of completion that they can e-mail to their managers to receive credit for completing the training.

B. Significant Findings & Usefulness of Findings

This study demonstrates the need for safety training for teleworkers. At pretest, seven participants (14%) indicated that they had received teleworker training. Of these seven participants, the majority indicated that the teleworker training was related to managing teleworkers rather than preventing injuries. Only one participant specifically indicated that he had received training related to safety or ergonomics. Twenty-two participants (44%) indicated on the pretest that they had experienced discomfort while teleworking. The most common complaints were sore/tired eyes, sore back, neck pain, and sore wrists. People who teleworked more days per month reported a greater incidence of work-related discomfort ($r = .347$, 48 df, $p = .016$). At pretest, nearly three-quarters of the participants (74%) indicated that they had never evaluated their home offices for ergonomic hazards. At posttest, 100% of Treatment Group participants indicated that they planned to evaluate their home offices for ergonomic hazards.

This study demonstrates the potential for training to improve teleworkers' ergonomic knowledge, attitudes and practices. The Treatment Group significantly increased overall scores between pre- and posttest, and also for scores on each subtest (knowledge, attitudes, practices). Differences between the pre- and posttest mean scores were significant for the total score ($t = 12.14$, df = 27, $p = .0005$), for the Knowledge subtest ($t = 8.36$, df = 27, $p = .0005$), for the Attitudes subtest ($t = 7.29$, df = 27, $p = .0005$) and for the Practices subtest ($t = 9.68$, df = 27, $p = .0005$). Differences between mean scores for the Control Group were not significant for the total score or for any of the subtests.

In the follow-up survey, participants indicated that they had made changes to their offices based on the training. Several participants indicated that pain or discomfort they had been experiencing was eliminated or reduced as a result of the training.

The findings also suggest that computer-based training is an effective training technique for teleworkers. All participants who completed a participant evaluation form ($n = 34$) thought that the training program was useful to them as teleworkers. Ninety-seven percent of the participants who completed an evaluation form said they would recommend the program to other teleworkers, that the information in the program was interesting to them personally, and that the computers were easy to use for training. Eighty-five percent said they would like to use a computer for future training courses. In addition, participants made positive comments in the course evaluation regarding using computer-based training, including the ability to progress through the materials at their own pace, the ability to complete the training at their convenience and the ability to complete the training in their home offices.

C. Phase I Final Report

1. **Project Dates**
   September 30, 2001 to September 29, 2002

2. **Specific Aims of Phase I (Phase I goals) and Summary of Results**
   The specific aims of the Phase 1 research were:

   a) **Develop a curriculum outline for *Safety for Teleworkers.***
   HSA convened a Focus Group of experts in office ergonomics, fire safety, electrical safety, indoor air quality/radon, lead-based paint, asbestos, office safety, telework, instructional design, and computer-based training. The Expert Focus Group defined and discussed the major occupational injury and illness prevention topics that affect home-based workers and developed a curriculum outline.

   b) **Develop a prototype computer-based training module on ergonomics for teleworkers.**
   HSA developed "Ergonomics for Teleworkers." This 50 minute, interactive computer-based (CB) training module includes text, graphics, animation, sound, and color illustrations.

   c) **Demonstrate the short-term effects of the CB ergonomics training on the knowledge, attitudes, and practices of teleworkers.**
   Harrington Software Associates (HSA) pilot-tested "Ergonomics for Teleworkers" with teleworkers from 10 federal agencies and several private companies. HSA evaluated the knowledge, attitudes, and practices of participants using pre- and posttests. The Treatment Group significantly improved their ergonomics knowledge, attitudes, and understanding of correct practices from pre- to posttest.

   d) **Evaluate the usability of computer-based training with the teleworker population.**
   Participants had no reported difficulties completing the pretest, posttest, course evaluation and retest on-line at the website, www.injurytraining.com. Participants indicated on the course evaluation that the computers were easy to use for training (97%) and that they would like to use computers for future training courses (85%). One hundred percent of the participants indicated that the training was useful to them as teleworkers.

3. **Summary of Phase I Tasks**

   a) **Develop the curriculum outline.**

   During Month One, HSA convened a Focus Group of experts. Members of that group are listed in Figure 1. Focus Group members defined and discussed the major occupational injury and illness prevention topics that affect home-based workers and developed the curriculum outline. Members identified the topics should be included in the Teleworker Safety program: office ergonomics, fire safety, electrical safety, and indoor air quality/radon. Members also decided that a module to help teleworker managers understand their roles and responsibilities toward teleworker safety would be

Figure 1: Expert Focus Group

Expert/Consultant	Area of Expertise	Title/Company
Susan S. Harrington, MS, PE	Multimedia; computer-based training; fire Safety	President, Harrington Software Associates, Inc.
Frank W. Connolly, PhD	Teleworking, computer-based training	Director, The Telework Coalition
Debra A. Dinnocenzo, MA, BS	Teleworking, teleworker training	President, AlLearnatives
Gail R. Guest	Teleworking	Worklife Program Specialist, Department of Labor
Dan F. MacLeod, MA, MPH, CPE	Office ergonomics	Certified Professional Ergonomist
William H. Michael	Teleworking	Senior Telework Program Analyst, U.S. General Services Administration
Steven P. Richard, BS, CSP	Radon, falls/tripping, indoor air quality, lead-based paint, asbestos, electrical safety	Chief of Safety, Environment, and Fire Protection Branch, General Services Administration (GSA/NCR)
William J. Smith, BA	Occupational safety and health	Team Leader, Office of General Industry Compliance Assistance, Occupational Safety and Health Administration
Bonnie L. Walker, PhD	Instructional design & evaluation	Associate, Harrington Software Associates, Inc.
Charles L. Wilsker	Teleworking	Executive Director, The Telework Coalition Past Executive Director, International Telework Association & Council
Deidre A. Willard, MA, BS, PE	Fire safety, safety, teleworking	Southeast Regional Supervisor, Risk Management Administration, Erie Insurance

b) Develop more detailed curriculum and storyboard for "Ergonomics for Teleworkers."

Following the Focus Group meeting, Susan S. Harrington, the Principal Investigator (PI) worked with Dan F. MacLeod (ergonomist) and Dr. Bonnie L. Walker (instructional designer) to develop learning objectives and a detailed curriculum guide for the ergonomics module. See Figure 2. The PI conducted a literature search to identify recent research on office ergonomics. Mr. MacLeod provided content and illustrations from his training booklet, "The User-Friendly Office" (MacLeod, 1998). The PI also reviewed other ergonomics training programs, including "Office Ergonomics" (Ohio State University, 2002), and "Ergonomics for the Office" (National Safety Council, 1999).

Figure 2: Ergonomics for Teleworkers Detailed Curriculum Outline

1. Introduction to Ergonomics

At the conclusion of Introduction to Ergonomics, participants will be able to:

- Define ergonomics.
- Identify the benefits of ergonomics training.

Topics:

a. What is ergonomics?
b. Why is ergonomics important?

2. Understanding MSDs

At the conclusion of Musculoskeletal Disorders, participants will be able to:

- Define musculoskeletal disorder (MSD).
- Identify the symptoms of MSDs.
- Identify the risk factors that contribute to the development of MSDs.
- Understand the importance of early detection and reporting of MSDs.

Topics:

a. What are musculoskeletal disorders (MSDs)?
b. Types of MSDs
c. Symptoms of MSDs
d. Risk factors
   i) Sitting for long periods without change
   ii) Working in awkward positions
   iii) Typing or writing for long periods without a break
   iv) Reaching for items in high or low places
   v) Lifting heavy objects
   vi) Repeating the same motion
e. Medical evaluation
f. Early detection and reporting of MSDs
g. Preventing MSDs
h. MSD review

3. Principles of Ergonomics

At the conclusion of Principles of Ergonomics, participants will be able to:

- Identify and define the 6 principles of ergonomics.

Topics:

a. Put on your ergonomics glasses
b. What are the principals of ergonomics?
c. Have good posture
   i) What is good posture?
   ii) Importance of good posture
   iii) Tips for working with good posture
   iv) Posture review
d. Move, exercise, stretch, and rest
   i) Importance of moving, exercising, stretching, and resting
   ii) Tips for workers who sit for long periods
   iii) Rest your eyes
   iv) Exercise review
e. Provide appropriate lighting
   i) Importance of good lighting
   ii) Tips for improving lighting
   iii) Lighting review
f. Minimize pressure points
   i) What are pressure points?
   ii) Tips for minimizing pressure points
   iii) Pressure points review
g. Reduce excessive force
   i) What is excessive force?
   ii) Tips for reducing excessive force
   iii) Excessive force review
h. Keeping everything in easy reach.
   i) Avoid reaching
   ii) Tips for minimizing reach
   iii) Reach review

4. Evaluating Your Home Office

At the conclusion of Designing a Home Office, participants will be able to:

- Identify how to configure their office area to reduce discomfort and increase productivity.
- Identify ergonomic features of office equipment.

Topics:

a. Evaluating Your Home Office
b. Desk
   i) Evaluating your desk
   ii) Desk purchase tips
c. Office chair
   i) Adjusting your chair height
   ii) Adjusting your chair back
   iii) Adjusting your armrests
   iv) Adjusting your lower back support
   v) Chair purchase tips
d. Monitor
   i) Adjusting your monitor
   ii) Monitor purchase tips
e. Document holder
   i) Placing your document holder
   ii) Document holder purchase tips
f. Telephone
   i) Using a telephone
   ii) Telephone and headset purchase tips
g. Workstation set-up review
h. Laptop computers

5. Stretching Exercises

At the conclusion of Stretching Exercises, participants will be able to:

- Understand the importance of stretching and moving.
- Identify exercises to reduce the risk of developing an MSD.

Topics:

a. Importance of breaks, stretching and moving
b. Exercises to reduce your risk

Using the "Ergonomics for Teleworkers" content outline, the PI developed a detailed storyboard. The storyboard included graphics/animations, screen title/text, narration, interaction, navigation, and participant responses for each screen. Members of the Expert Focus Group reviewed the storyboard for accuracy, content, and instructional design.

c) **Develop application-specific standards.**

HSA developed an application-specific standard for the project, building upon its previous work in this area (Harrington & Walker, 2002). See Figure 3.

Figure 3: Standards for "Ergonomics for Teleworkers" Computer Based Module

Design Object	Standard
Screen	Support minimum 800 X 600 resolution, 24 bit color
User Input	Use mouse and keyboard for user input (keyboard navigation option will be added in Phase II) Give user short lesson on using mouse at beginning of module
Navigation	Five navigation buttons, at bottom of every screen, consistent location: NEXT (move to next screen), AGAIN (replay current lesson), PAUSE (pause current screen), BACK (go back to previous lesson- will be added in Phase II), EXIT (exit lesson)
Text	Arial Bold/Regular Font, mixed case for readability Left justified where multiple lines exist Highlight key words in contrasting color
Colors	Subtle background colors since application will have numerous pictures/video (light/dark gray) Text color black, red text for incorrect responses, green text for correct responses; along with red X and green check mark
Still Graphics	High resolution, 24-bit color, JPEG compressed format. Sizes, locations consistent throughout
Audio	16-Bit mono, user can control volume through Microsoft Windows or speaker volume control on headsets
Video	Microsoft AVI (Audio-Video Interleaved) compressed format, Cinepak codec, 15 frames per second, limit to 500 KB/Sec.
Audible/Visual Reminders	After period of inactivity, audible reminder given to the user (i.e., press NEXT to continue, click on the picture to select the answer, etc.) Visible reminder given when user can go to the next lesson (flashing NEXT button)

d) **Determine content of each screen in the application.**

Using the storyboard, HSA developed the screen content for the "Ergonomics for Teleworkers" module. HSA subdivided major topics so that screen content was limited to one graphic/illustration/animation and a legible amount of text.

e) **Maintain an interactive design.**

At a minimum, each screen contained interaction, animation, or a color illustration designed to keep the learner focused. HSA was careful to make this module a fully interactive training tool. The goal was to design screen to screen navigation so that participants could move forward, pause, repeat a topic, or quit the lesson.

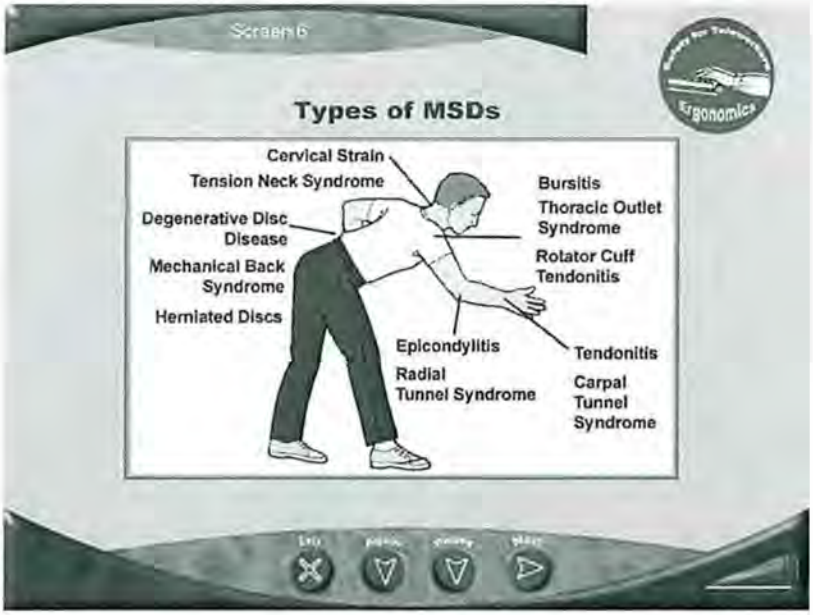
f) **Develop the program.**

HSA developed "Ergonomics for Teleworkers" using *Macromedia Authorware* 6.0. *Adobe Premiere 6.0* software was used to render video clips and save them in a Microsoft AVI format. Audio narration clips were recorded using *Cool Edit 2000* and saved in a WAV format. HSA contracted with illustrator Gary Huff to provide illustrations for the program. Illustrations were stored in jpg format. The "Ergonomics for Teleworkers" CD-ROM combines text, graphics, color illustrations, animation, and sound to provide a fully interactive, media-rich learning environment.

The program has 66 separate screens, with 49 color illustrations. Learners move from screen to screen by clicking on the Next button. Each of the five main topics has between 3 and 23 screens. Several of the screens have animations. The program has interactive reviews throughout, where learners click on their answers by selecting a button, picture, or word. See Figure 4 for a sample screen.

HSA staff, consultants, and members of the target population reviewed and tested the new module before the pilot test.

Figure 4: Sample Screen from Computer-Based Version of "Ergonomics for Teleworkers"



g) <u>Develop instruments to measure knowledge, attitudes, and practices.</u>

The PI with the assistance of the evaluation specialist, Dr. Walker, developed the criterion-referenced evaluation instrument for this study. They developed 64 items designed to assess the participants' knowledge, attitudes, and ergonomic safety practices. Each item was a statement about ergonomics to which participants would be asked to respond Agree, Disagree, or Don't Know.

Members of the Focus Group reviewed the draft instrument for content accuracy and clarity. In addition, a small group from the target population (n = 10) were recruited to try-out the test items. The try-out group consisted of 5 males and 5 females who were employees of the GSA and local private companies. *These 10 people did not participate in any of the other evaluation activities.*

HSA used a split-half reliability analysis to eliminate items in which low scorers outperformed high scorers. HSA also eliminated items that Focus Group reviewers found confusing or those on which they disagreed on the answers. The final items that were selected included from 2 to 9 items for each learning objective. Items also were chosen so that the instrument included a balanced number of knowledge, attitude, and practice items. The final instrument consisted of 26 items: 10 knowledge items, 6 attitude items, and 10 practices items.

Consent Form: The evaluation team developed an informed consent statement for participants to read and complete prior to participating in the training. The informed consent included information on the purpose of the study, risks/benefits to participants, and contact information for questions. It also stated that participation was voluntary, that they could choose not to participate at any time, and that they could choose not to answer any of the questions. In order to match pre- and posttest results, researchers asked participants to identify themselves by name on the pre- and posttest.

Pretest: To obtain information about the pilot test population, the pretest form requested the following demographic information from participants: name, date, job title, gender, ethnicity, age, and educational level. The pretest also asked participants specific questions about their teleworking status: days per month, years teleworking, previous

teleworker training, previous ergonomics training, teleworking location, who purchased teleworking equipment, reasons for teleworking, percentage of day spent writing reports, working on the computer, reading documents, or using the telephone, type of Internet connection; and whether participants had experienced discomfort, soreness, or pain while teleworking. The training evaluation items were 26 statements about ergonomics. Participants were asked to select one of three choices: Agree, Disagree, or Don't Know.

Posttest: The posttest included the same 26 items about ergonomics that appeared on the pretest with one change. The 10 practice items were changed from the pretest version to indicate participants intended practices. For example, the pretest item "I have evaluated my home office for ergonomic hazards." was changed on the posttest version to read, "I plan to evaluate my home office for ergonomic hazards."

Participant Evaluation: The participant evaluation form was adapted from one previously developed for a similar study (Harrington & Walker, 2001). Researchers administered the participant evaluation separately. Participants did not identify themselves by name. The form included thirteen statements designed to elicit the participants' opinions about the usefulness of the program and the content. The first 8 items were written as statements, such as, " The training program was useful to me as a teleworker." For each item, participants were asked to select a response from three options: Agree, Disagree, No Opinion. Items 9 to 12 were open-ended items: "What did you like most about the training?" "What did you dislike about the training?" "How can we make the program more useful or interesting?" and "What changes do you plan to make as a result of this training?" Item 13 asked participants to check topics from a list of other safety areas that would be of interest to them.

h) Try out the training with a small sample of teleworkers prior to the pilot test.

Prior to the pilot test, HSA tested the CD-ROM with 10 teleworkers recruited from the General Services Administration (GSA). HSA conducted the training in a conference room at GSA in Washington, DC. Three different training times were offered: 10:00 a.m., 11:00 a.m., and 1:00 p.m. The GSA employees completed the training using computers provided by HSA. The PI observed participants while they completed the training.

Information from the pre-pilot tryout was used to finalize the training for the pilot test. The average time to complete the training was 50 minutes. This time was within the acceptable limits and so no time adjustments were needed. One software problem was identified and eliminated prior to the pilot test.

The PI and evaluation specialist determined the appropriate statistical procedures and analyzed the pre-pilot tryout data. The total scores for the pre- and posttest were calculated as well as the scores of three subtests: knowledge, attitudes, and practices. A paired sample *t*-test was used to determine whether differences from pre- to posttest were significant for the 10 GSA participants. The average pretest score was 13.7 (52.7%), the average posttest score was 24 (92.3%). The mean increase was 10.3 items (39.6%). The t value of 8.63 (df = 9) was significant at $p = .0005$. Pre- to posttest increases on the knowledge ($t = 4.99$, $p = .001$), attitudes ($t = 3.07$, $p = .05$) and practices ($t = 6.10$, $p = .0005$) subtests were also significant.

i) Conduct pilot test.

1) Design of the Study

The design for the pilot test study was a Two Group Comparison Study with Random Assignment to Groups. The 102 teleworkers who completed the pretest were randomly assigned to one of two conditions: Treatment Group or Control Group. Participants in the Treatment Group completed the pretest, ergonomics training program, posttest, and course evaluation. Participants in the Control Group completed the pretest, and then without completing the training completed the

pretest a second time (referred to as the retest). The paradigm for the pilot test study had the following configuration:

(R) Treatment Group	M1 (pretest)	X1 (CB training)	M2 (posttest)
(R) Control Group	M1 (pretest)	no training	M2 (retest)

2) Research Questions

1. Did the computer-based training significantly affect the participants' knowledge, attitudes, and practices related to ergonomics?
2. Did the computer-based training program significantly affect the participants' knowledge, attitudes, and practices related to ergonomics as compared to the Control Group?
3. Did the participants like the computer-based format for training?
4. What changes should be made to the prototype module for Phase II?

3) Participant Recruitment and Pretest Data Collection

For the purpose of this study, a *teleworker* is defined as a person who works in his or her home one or more days a month. A teleworker may work for a business, academic institution, or government agency, or be self-employed.

To recruit participants for this study, HSA sent an e-mail message to 331 teleworkers. These individuals included teleworker/employees from the General Services Administration (GSA) in the Washington, DC area; federal agency telework program coordinators (who forward the e-mail to their agency teleworkers), and teleworkers who worked in private industry or academic institutions. HSA obtained the e-mail addresses for federal participants from William H. Michael, Senior Telework Program Analyst, GSA and Steven P. Richard, Chief of Safety, Environment, and Fire Protection Branch, GSA. Additional participants consisted of teleworkers known to HSA in private industry and academic settings.

The target population for this study consists of the 102 teleworkers who volunteered to participate in the study by completing the consent form and pretest at the website (www.injurytraining.com) established by HSA for that purpose. The recruitment e-mail described the purpose of the project, risk/benefits, tasks to be completed, and gave them a contact person. Of the 102 participants, 10 worked for the GSA, 81 worked for other federal agencies, and 11 were teleworkers from private industry or academic institutions.

4) Setting of the Study

All of the data collection took place at the website that HSA had created for the study, www.injurytraining.com. The website contained links for the pretest, posttest, course evaluation and retest. Participants completed all tests on-line in their home offices or remote worksites. These data were stored in a secure ISP database.

The "Ergonomics for Teleworkers" training program was stored on a CD-ROM which was mailed to participants. Study participants completed the CD-ROM training on their computers in their home offices or remote worksites.

5) Data Collection and Assignment to Groups

The 102 study participants who completed a pretest were randomly assigned to one of the two groups: Treatment Group (n = 51) or Control Group (n = 51). HSA mailed Treatment Group participants a copy of the CD-ROM and instructed these participants to complete the training, then go to www.injurytraining.com to complete the posttest and course evaluation. Control Group participants were instructed to go to www.injurytraining.com and complete the retest. The average time interval between the pretest and the posttest/retest was 27.3 days for the Treatment Group

and 27.9 days for the Control Group. The Control Group members also received a copy of the CD-ROM for their own use. See Figure 5 below.

Figure 5: Pilot Test Procedures

1. Recruitment e-mails sent out to teleworkers. (May)
2. Participants go to www.injurytraining.com and complete the on-line consent and pretest. (May-June)
3. The 102 participants who complete a pretest are randomly assigned to the Treatment or Control Groups. (June)
4. Treatment Group members complete the "Ergonomics for Teleworker" CD-ROM training and take the posttest and course evaluation on-line at www.injurytraining.com. (June/July)
5. Members of the Control Group go to www.injurytraining.com and complete the retest. (June/July)

6) Treatment

The treatment consisted of a 50-minute CD-ROM "Ergonomics for Teleworkers" completed by participants in their home offices. See Figure 4 for a sample screen and Figure 2 for the content outline.

7) Data Analysis

At both pretest and posttest (or retest), the participants selected one of three choices: Agree, Disagree, or Don't Know for each item. Their choices were stored on the secure website database. HSA staff imported participant data into an Excel spreadsheet. Items were coded in the spreadsheet and scored as correct or incorrect. In each case, Don't Know or "no response" was scored as incorrect. The total number of correct responses by each participant was calculated. Subtest scores were calculated for Knowledge (10 items), Attitude (6 items) and Practice items (10 items). Each item was also assigned to one of the five module objectives.

Responses on the Participant Evaluation Forms were also analyzed. For items 1-8 and 13 on the evaluation instrument, a mean for each item was calculated and converted to a percentage. Items 9-12 were placed into tables and reviewed to determine what changes should be made to the module for Phase II.

An item analysis was also performed. Researchers counted the number of times participants selected each correct response and either the wrong response, Don't Know, or no response on the pretest and posttest. This information will be used to revise poor items. Items that were answered correctly by all participants at pretest will be revised or eliminated before the field test.

Data were analyzed using *SPSS 10 (2000).* The level of significance required to reject the null hypotheses was established at $p < .05$. Specific procedures are described in the Findings Section.

8) Findings

a) *Demographics of the Study Population*

One-hundred and two people completed an on-line pretest. Of those, 50 completed a posttest or retest and constituted the sample population for the pilot test. Using Chi square for categorical variable and *t*-test for numerical data, researchers compared the participants who had completed the study (n = 50) with those who had only completed the pretest (n = 52). None of the differences were significant with regards to age, sex, ethnicity, educational level, pretest total and pretest subtests, years telecommuting, days per month telecommuting, and previous training. See Table 1.

The reasons given by people who did not complete the study are listed in Table 2.

Table 1: Characteristics of the Pretest Participants (*N*=102)

Variables	Total	Pretest/Posttest Group *N=50*	Pretest Only Group *N*= 52	Chi square X^2 (df)
Sex				.001 (1) n.s.
Male	43 (42%)	21 (42%)	22 (42%)	
Female	59 (58%)	29 (58%)	30 (58%)	
Total	102 (100%)	50 (100%)	52 (100%)	
Ethnicity				1.506 (1) n.s.
Minority	19 (19.2%%)	12 (24%)	7 (14.3%)	
White	80 (80.8%%)	38 (76%)	42 (85.7%%)	
Total	99 (100%)	50 (100%)	49 (100%)	
Education				.248 (2) n.s.
HS Graduate and some college	18 (18%)	9 (18%)	9 (18%)	
College Graduate	22 (24%)	12 (24%)	10 (20%)	
Graduate School	60 (58%)	29 (58%)	31 (62%)	
Total	100 (100%)	50 (100%)	50 (100%)	
Previous Ergonomics Training				.000 (1) n.s.
Yes	20 (20%)	10 (20%)	10 (20%)	
No	80 (78%)	40 (80%)	40 (80%)	
Total	100 (100%)	50 (100%)	50 (100%)	
Previous Teleworker Training				.039 (1) n.s.
Yes	15 (15%)	7 (14%)	8 (15%)	
No	87 (85%)	43 (86%)	44 (85%)	
Total	102 (100%)	50 (100%)	52 (100%)	

Table 2: Reasons Cited for Not Completing the Study (*N*=52)

Reason	Frequency	Percent
Not a teleworker	2	3.8%
Not teleworking at present	3	5.8%
Doesn't have a PC	3	5.8%
Too busy, on vacation	6	11.5%
Didn't receive CDROM in time	3	5.8%
No reason given	35	67.3%

b) Demographics of Pretest/Posttest Population

Of the 50 participants who completed the study, 28 (56%) were members of the Treatment Group; 22 (44%) were members of the Control Group. These participants included teleworkers from 10 federal agencies (n = 42), and 4 private companies (n = 8). The federal agencies included: GSA, NIH, US Coast Guard, CPSC, OPM, FDA, USDA, DISA, DTRA, and DOT. The private firms included Zurich North America, COLA, SAIC, and Information Management Services Inc. Participants teleworked in 11 states and the District of Columbia. The states included: Maryland, Texas, Virginia, North Carolina, Tennessee, Nebraska, Illinois, New York, Michigan, Florida, and Pennsylvania,

The participants consisted of 28 (56%) males and 22 (44%) females. Thirty-eight were white (78%) and the others were members of different minority groups (22%). The dominant minority group was African American (n = 8); there was one Asian and two Hispanics. One person did not indicate ethnic group. All of the participants were high

school graduates with a minimum of some college. Forty-one people had a bachelor's degree; of those, 29 had completed some graduate level work.

Participants teleworked an average of 8 days per month and had been teleworking for 3.5 years. Twenty-one participants (42%) had a room or area of their home used exclusively for teleworking. Twenty-nine participants (58%) purchased their own home office equipment, while 12 (24%) indicated that some of their equipment was purchased by their employer and 8 (16%) indicated that their employer purchased all of their equipment. Forty-three participants (86%) had not received teleworker training and forty (80%) had never completed ergonomics training. Participants spent an average of 64% of their time using a computer, 16% reading documents that are not on the computer, 10% on the phone, and 8% writing reports or other documents using a pen or pencil.

Participants cited the following reasons for teleworking: 34 (68%) "reduces time spent going to and coming from work"; 6 (12%) "my employer requires it"; 5 (10%) "I can be at home when children come home from school"; 17 (34%) "I prefer working by myself at home"; 24 (48%); "flexible hours"; 1 (2%) "I have a health problem or disability that makes traveling to and from work difficult;" and 1 (2%) "I can smoke in my home office".

Researchers performed a Chi-square analysis to determine whether there were significant differences between the two groups (treatment and control) related to gender, ethnicity, education, and previous training. Differences were not significant.

Researchers used a *t*-test to determine whether differences were significant for age and time spent teleworking. The mean age for the total group (n = 46) was M = 44, SD = 9.6. (Four participants did not provide age data.) For the Treatment Group (n = 28), M = 45, SD = 8.81; for the Control Group (n = 18), M = 43, SD = 10.7, t = .80 (44 df). The mean years of teleworking for the total group was M = 4, SD = 4.28. For the Treatment Group (n = 27), M = 4; SD = 4.74; for the Control Group (n = 22), M = 4; SD = 3.75, t = .01 (47 df). The mean days per month of teleworking for the total group was M = 8, SD = 8.87. For the Treatment Group (n = 27), M = 8; SD = 9.69; for the Control Group (n = 22), M = 7; SD = 7.92, t = .45 (47 df). In all three cases, the differences were not significant.

Researchers performed a correlation analyses using Pearson Product Movement to determine if any of the demographic variables were related to either pretest or posttest scores. Only ethnicity was found to be related to pretest scores (r = .305, df = 50; p = .031.) The mean score on the pretest for whites was 14.86 and for minorities was 12.08. Using a one way ANOVA, the difference was shown to be significant (F = 4.912, p = .031). Posttest scores were not related to any of the tested variables including the pretest.

c) Estimates of Instrument Reliability

Reliability of the test instrument was investigated to allow researchers to improve the instrument in Phase II. Researchers calculated a Cronbach alpha as a measure of internal stability. At pretest, the alpha (with 50 cases and 26 items) was .66. At posttest, alpha = .87. None of the items had zero variance. At pretest Item 5, "I think my risk of developing a musculoskeletal disorder increases if I sit for long periods of time." was negatively correlated with the item total score. (Participants who scored higher on the test as a whole got this item wrong more often than those who scorer lower on the test.) At posttest responses to this item were positively correlated to the total score. Item 20 at posttest was negatively correlated with the total score. (I plan to adjust my computer monitor's brightness and contrast so the screen is easier to see.) Those items will be examined and may be revised for the field test version. The reliability of the instrument,

however, appears to be within the acceptable limits for this type of test (Crocker & Algina, 1986).

d) Pre- Posttest Differences for Treatment Groups

The means and standard deviations for the pre- and posttest scores were calculated for the total group and each group for the total test and for each subtest. (See Table 3.) A Paired Samples Test was used to calculate a *t*-score for each of the comparisons. For the Treatment Group, differences between the pre- and posttest mean scores were significant for the total score ($t = 12.14$, df = 27, $p = .0005$, for the Knowledge subtest ($t = 8.36$, df = 27, $p = .0005$), for the Attitudes subtest ($t = 7.29$, df = 27, $p = .0005$) and for the Practices subtest ($t = 9.68$, df = 27, $p = .0005$). Differences between mean scores for the Control Group were not significant for the total score or for any of the subtests.

Table 3: Mean Differences Between Groups, Time, and Tests

		Total		Knowledge		Attitude		Practices	
Group	Time	*M*	SD	*M*	SD	*M*	SD	*M*	SD
Treatment ($n = 28$)	Pre	14.0	4.4	5.3	1.9	4.0	1.3	4.7	2.4
	Post	23.7	1.9	8.9	1.2	5.6	.5	9.2	.9
Control ($n = 22$)	Pre	14.5	3.4	5.2	2.0	4.2	1.4	5.0	2.3
	Post	14.8	3.5	4.1	1.5	4.1	1.5	5.2	2.3
Total ($n = 50$)	Pre	14.2	3.9	5.2	1.9	4.1.	1.3	4.9	2.3
	Post	20.0	5.2	7.4	2.2	5.0	1.3	7.4	2.6

e) Item Differences from pre- to posttest

In order to evaluate participant learning on specific items, researchers performed a t-test for pre- to posttest scores on each of the 26 items. Participants improved significantly on all of the items except for Item 2. The mean posttest score was higher than the mean pretest score, however. The most difficult items were 13, 15, 16, and 21.

f) Training Effect on Knowledge, Attitudes and Practices Related to Ergonomics

A repeated measures analysis was performed with module scores measured at two points in time (pre- and posttest) as the dependent variables (See Table 4). The one within subjects variable was time and the one between subjects variable was group (treatment versus control). The main effect of time and the interaction of time by group were both significant. The main effect of time indicates that posttest scores were higher than pretest scores. The significant interaction of time by group suggests that the improvement from pre- to posttest was not uniform across groups. See Table 3 for means and standard deviations for Treatment and Control Groups which shows that Treatment Group mean scores were significantly higher than Control Group scores.

Table 4: Tests of Within-Subjects Contrasts

Source	Type III Sum of Squares	df	Mean Square	*F*	Sig.
TIME (pre- and posttest)	614.401	1	614.401	89.628	.0005
TIME * GROUP (treatmen vs. control)	549.121	1	549.121	80.105	.0005
Error(TIME)	329.039	48	6.855		

g) Participant Discomfort

Twenty-two participants (44%) indicated on the pretest that they had experienced discomfort while teleworking. People who teleworked more days per month reported a greater incidence of work-related discomfort ($r = .347$, 48 df, $p = .016$). The most common complaints were sore/tired eyes, sore back, neck pain, and sore wrists.

h) Participant Evaluation

Participants in the treatment group from the pilot test study (n = 25) and the GSA pre-pilot test study (n = 9) completed an anonymous on-line course evaluation immediately following the training. The pilot test study participants completed the course evaluation at their remote worksites and the GSA participants completed the evaluation in a conference room at GSA. Not every participant completed an evaluation. For each item, participants were asked to read a statement about the training and respond: Agree, Disagree, or No Opinion. For the purposes of this analysis, the responses Disagree and No Opinion were grouped together as negative responses to the program (except for Item #3 for which the opposite is true). The participants were very positive toward the training. The responses are presented in Table 5.

Table 5: Program Evaluation Results for Items 1-8

Evaluation Items	*N*	Positive Response	Negative Response
1. The training program was useful to me as a teleworker.	34	34 (100%)	0 (0%)
2. The information in this program was interesting to me personally.	34	33 (97%)	1 (3%)
3. The program was too long.	34	28 (82%)	6 (18%)
4. I learned a great deal from this program.	34	27 (79%)	7 (21%)
5. I would recommend this program to others.	34	33 (97%)	1 (3%)
6. The computer was easy to use for training.	34	33 (97%)	1 (3%)
7. I enjoyed the computer-based training more than instructor-led training.	34	20 (59%)	14 (41%)
8. I want to use the computer for future training classes.	34	29 (85%)	5 (15%)

i) Participants' Anticipated Changes

Participants were also invited to respond to four open-ended questions on the course evaluation. The first question asked participants "What did you like most about the training?" The most common responses included: "I was able to choose items of particular interest and take it at my own pace", "the simplicity and ease of the program, "it was informative," and "the program was useful to me as a teleworker." The second question asked participants "What did you dislike about the training?" The most common response included: "there was no back button", "too slow," "too long," and "too much clicking on the next button," The third question asked participants "How can we make the program more useful and more interesting?" The most common response was "I wouldn't change anything." Other common responses included: "take more breaks and stretch more," "add more interactive sections," "make it less redundant," and "show more examples of workstations that are ergonomically correct." The last question asked participants what changes they plan to make as a result of the training. A summary of participant responses are shown in Figure 6.

Figure 6: Participant Evaluation: Summary of Responses to the question: What changes do you plan to make as a result of this training?

I plan to purchase a new chair. (5)*
I plan to adjust my chair and workstation. (3)
I will be more aware of my posture. (3)
Moved my monitor slightly closer to about arm's length. Will use my computer glasses, instead of my progressive all the time.
I plan to adjust my chair and document holder at home as well as purchase a footrest.
I plan to make some changes at home regarding the position of my computer in the room.
I will use the speakerphone more, clean my screen more often, put heavy books in arm's reach, etc.
Try to apply what I learned about ergonomics
I plan to move my mouse and monitor, and move heavy items that I use frequently. Also, take frequent breaks.
I'm very guilty of keeping a dirty computer screen, and I'll change that. I'm going to mention what I learned to my husband, who wears tri-focal glasses and works for long periods of time on the computer.

I will give thought to posture and reaching (especially). I will also share the need for ergonomic thinking with my staff.
I will be ergonomically aware each time I use the computer and adjust my surroundings accordingly.
Very few, but will look into a headset for my telephone.
Align monitor directly in front of keyboard. Ensure my wrists are more in line with forearms. Focus more on my posture while sitting in my chair. Move around more frequently during the day.
Make sure my posture, desktop, etc. and phone are properly positioned, make sure I avoid eyestrain through improper lighting or glare, make sure to do periodic exercises and take frequent breaks.

* Number of people with a similar response

j) Participant Follow-up Survey

Researchers sent a follow-up e-mail to participants in the Treatment Group (n = 28) one month after they completed the posttest. Participants were asked to respond to the question: "What changes have you made to your office or work habits since completing the training?" Seventeen participants (61%) responded to the follow-up e-mail. Participants indicated that the training had reduced or eliminated work-related pain to their backs, eyes, fingers, or shoulders. Responses are summarized in Figure 7.

Figure 7: Summary of Responses to Follow-up Survey

What changes have you made to your office or work habits since completing the training?

- Adjusted chair (6 responses)
- Walk around and stretch more frequently (4 responses)
- Increased awareness of posture (4 responses)
- Adjusted keyboard height (3 responses)
- Moved computer screen to avoid window glare (3 responses)
- Started using a footrest (3 responses)
- Adjusted monitor height (2 responses)
- Adjusted mouse location (2 responses)
- Purchased a new chair
- Plan to purchase a new computer desk and keyboard stand
- Plan to purchase a new chair
- Purchased a table lamp with a light that is easier on my eyes
- Purchased an extended key pad so the keyboard and mouse are at the same height
- Purchased wrist pads
- Adjusted chair armrests
- Ordered larger monitor
- Purchased telephone headset
- Started using a document holder
- Purchased a new mouse
- Purchased a new phone cradle
- Plan to purchase a new keyboard for a laptop
- Changed from using progressive lenses back to contact lenses and computer glasses

4. Summary of Phase I Findings and Implications for Phase II

This study demonstrates the need for safety training for teleworkers. It also demonstrates the potential for computer-based training to improve teleworkers' knowledge about

ergonomics. Findings suggest that computer-based training is an effective technique. Additional findings are summarized below.

- Participants were able to complete the pretest, posttest, course evaluation and retest on-line at the website, www.injurytraining.com.
- Participants were able to use the CD-ROM training program on their personal computers.
- At pretest, only 7 Control and Treatment Group participants (14%) indicated that they had received teleworker training in the past. Of these 7 participants, the majority indicated that the teleworker training was related to managing teleworkers. Only one participant specifically indicated that he had received training related to safety or ergonomics.
- Twenty-two participants (44%) indicated on the pretest that they had experienced discomfort while teleworking. The most common complaints were tired eyes, sore back, neck pain, and sore wrists.
- At pretest, nearly three-quarters of the participants (74%) indicated that they had never evaluated their home office for ergonomic hazards. At posttest, 100% of Treatment Group participants indicated that they planned to evaluate their home office for ergonomic hazards.
- At pretest, the Treatment and Control Groups had equivalent scores on a test of knowledge, attitudes, and practices related to ergonomics.
- The Treatment Group significantly increased their scores between pre- and posttest for overall score, and also for scores on each subtest (knowledge, attitudes, practices) while the Control Group did not.
- The test instrument developed for this study appears to be reliable and stable and therefore useful as a measure of participant learning from this training.
- At posttest, the Treatment Group significantly outperformed the Control Group on knowledge of ergonomics, attitude toward ergonomics, and intended ergonomic practices.
- All participants who completed a participant evaluation form (n = 34) indicated that the training program was useful to them as teleworkers.
- Ninety-seven percent of the participants who completed an evaluation form indicated that they would recommend the program to other teleworkers, the information in the program was interesting to them personally, and that the computers were easy to use for training. Eighty-five percent indicated that they would like to use a computer for future training courses.
- Teleworkers made positive comments in the course evaluation regarding using computer-based training, including the ability to progress through the materials at their own pace, the ability to complete the training at their convenience and the ability to complete the training in their home office.
- In the follow-up survey, participants indicated that they had made changes to their offices based on the training. Several participants indicated that pain or discomfort they had been experiencing was eliminated or reduced as a result of the training.
- At the GSA pre-pilot tryout, HSA staff members observed participants interacting with the computer program and following along by "trying out" the different postures, positions, and exercises that the program recommended.
- During Phase II, HSA will add more advanced navigation, including a main menu, back button, and bookmark feature. The bookmark feature will allow users to quit the program, and then return at a later time to the screen where they left off.

- HSA will evaluate all recommendations made by participants and incorporate appropriate changes to the prototype module prior to the development of new modules in Phase II.

5. Limitations of Phase I

- During Phase I, changes in participant practices were evaluated by measurement of "intended future" practices, and not by an actual change in practice. During Phase II, HSA will conduct a follow-up study with all field test participants to determine what actual changes they have made to their workstations and work habits as a result of the training.
- The attrition rate for this study was 51%. HSA attributes part of this problem to a short timeframe for completion and the timing of the study close to the start of summer vacations. After the deadline, 8 people completed the posttest and were not included in the data analysis. During Phase II, steps will be taken to increase the percentage of completions and reduce the attrition. Participants will be told the completion dates for each stage in the recruitment e-mail and reminded by e-mails after they complete the pretest, after they have received the CD-ROM, and 5 days prior to the deadline. Other incentives for completing the study within the required timeframe will be discussed at the Expert Focus Group meeting at the start-up of Phase II.
- This study was limited to participants who had PC-based computers. Although the CD-ROM developed by HSA will run on a Macintosh system running *Virtual PC*, three participants who completed the pretest on-line reported being unable to complete the training because of having Macintosh computers systems. In Phase II, the web version will be Mac compatible.

6. References

Harrington, SS, & Walker, BL (2001) A comparison of computer-based and instructor-led training for long-term care staff. *Journal of Continuing Education in Nursing, 33*(1), 39-44.

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MacLeod, D. (1999). *The office ergonomics kit*. Washington DC: Lewis Publishers.

National Safety Council. (1999). Ergonomics for the Office. Itasca, Illinois: National Safety Council.

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D. Phase I Products & Publications

Products:

"Ergonomics for Teleworkers" CD-ROM

"Safety for Teleworkers" curriculum outline

Publications:

Harrington, S.S. & Walker, B.L. (Submitted) The effects of ergonomics training on the knowledge, attitudes, and practices of teleworkers. Submitted to the *Journal of Safety Research.*

Presentations:

Harrington, S.S. (2002, June). *Safety for Teleworkers*. Paper presented at the e-Commute training seminar.

Occupational Safety and Health Training for Teleworkers:

A Curriculum Outline

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Table of Contents

Introduction

Project Goals
The long-range goals of this project are:

(1) To develop a validated computer-based occupational safety and health training program for workers who telecommute from their homes;

(2) To demonstrate the short- and long-term effects of the training on the knowledge, attitudes, and practices of teleworkers; and

(3) To demonstrate the effect of the safety training on the occupational injury and illness rates of teleworkers.

Review of the Literature
In preparation for writing this curriculum outline, HSA project staff conducted a review of the research literature related to teleworking, ergonomics, radon, fire safety, electrical safety, and slips/trips/falls. Refer to the bibliography at the end of this curriculum outline for a list of references.

The Expert Focus Group
Another source of information for the curriculum outline was the Expert Focus Group. Members are listed in Figure One. During Phase I of the project, these experts met for a one-day meeting to define and discuss the major occupational injury and illness prevention topics that affect home-based workers. Members identified the topics that should be included in the Teleworker Safety program: office ergonomics, fire safety, electrical safety, and indoor air quality/radon. Members also decided that a module to help teleworker managers understand their roles and responsibilities toward teleworker safety would be useful.

The Curriculum Outline
The curriculum outline lists the main topics that should be included in the computer-based training materials. A detailed curriculum outline was developed for the module on office ergonomics. HSA staff used this detailed outline to develop the computer-based training module on office ergonomics that was pilot tested in Phase I.

Program Materials
The curriculum outline will be the basis for the development of the program materials. During Phase II, HSA staff will develop a detailed outline for the modules on fire safety, electrical safety, radon, slips/trips/falls, and safety roles and responsibilities for telework program managers. HSA will use the detailed outline to develop the computer-based training modules.

Figure One: Expert Focus Group

Expert/Consultant	Area of Expertise	Title/Company
Susan S. Harrington, MS, PE	Multimedia; computer-based training; fire Safety	President, Harrington Software Associates, Inc.
Frank W. Connolly, PhD	Teleworking, computer-based training	Director, The Telework Coalition
Debra A. Dinnocenzo, MA, BS	Teleworking, teleworker training	President, AlLearnatives
Gail R. Guest	Teleworking	Worklife Program Specialist, U.S. Department of Labor
Dan F. MacLeod, MA, MPH, CPE	Office ergonomics	Certified Professional Ergonomist
William H. Michael, BA	Teleworking	Senior Telework Program Analyst, U.S. General Services Administration
Steven P. Richard, BS, CSP	Radon, falls/tripping, indoor air quality, lead-based paint, asbestos, electrical safety	Chief of Safety, Environment, and Fire Protection Branch, General Services Administration (GSA/NCR)
William J. Smith, BA	Occupational safety and health	Team Leader, Office of General Industry Compliance Assistance, Occupational Safety and Health Administration
Bonnie L. Walker, PhD	Instructional design & evaluation	Associate, Harrington Software Associates, Inc.
Charles L. Wilsker	Teleworking	Executive Director, The Telework Coalition Past Executive Director, International Telework Association & Council
Deidre A. Willard, MA, BS, PE	Fire safety, safety, teleworking	Southeast Regional Supervisor, Risk Management Administration, Erie Insurance

The Target Audience

The primary target audience for *Safety for Teleworkers* will be individuals who work from home one or more days per month. International Telework Association and Council researchers (2000a) found that there are 16.5 million regularly employed teleworkers in the US who telework at least one day per month and are at least 18 years old. Slightly more than 17%, 2.8 million, of these are new teleworkers. There are 9.3 million US teleworkers who telework at least one full day per week. Eighty-nine percent of teleworkers work out of their home; the remaining 11% work at telecommuting centers. On average, home-based teleworkers telework about 20 hours per week.

Teleworkers are found in every business or industry classification, but 56% are in managerial or professional occupations. The breakdowns are 17% executive or manager, 11% educational professionals, 4% health care professionals, 4% engineer or scientist, 7% computer professionals and 13% other professionals. Eleven percent of respondents are in sales, 13% in skilled crafts or trades and 7% in administrative support. Seven percent are in blue-collar services, 2% are technicians, and 3% refused to give occupations. While a few years ago most teleworkers worked for small to medium-sized organizations, now half of the teleworker population is employed by organizations with at least 1,500 employees (ITAC, 2000a).

There are teleworkers in every region in the U.S., although the highest percentages are in the New England, Mountain, and Pacific states. Males are predominant (65%)

among home teleworkers. The average home-only teleworker is in his/her early 40s. Eighty-two percent of home-based teleworkers have a college education. Median annual income for home-only teleworkers is in the lower $50,000 range (ITAC, 2000a). The primary home telework activity is computer work (55%), followed by telephoning, reading, and face-to-face meetings. Teleworkers tend to be heavier users of computer technology than non-teleworkers. The average ownership for home telecommuters is one PC for work and another for non-work purposes. The top three non-computer technologies in use by teleworkers, in decreasing order of popularity, are the telephone, pager, and fax. Half the teleworkers use email at least 3 hours per week, but the average is 7 hours because of some heavy users. Forty-six percent of the teleworkers pay for both their equipment and its maintenance, with the employer covering all costs in only 29% of the cases. Less than 20% of the teleworkers get intensive training in the use of their technology. Slightly more than three-quarters of the home-only teleworkers have analog modems to connect them to their employers or the Internet, with DSL leading (9%) among the broadband digital alternatives (ITAC, 2000a).

Program Objectives

At the conclusion of each module, participants will be able to:

1. Understand why teleworkers are at risk of injury in their home offices.
2. Identify the environmental and behavioral risk factors that contribute to teleworker injuries.
3. Identify how to modify teleworking environments and behaviors to prevent injuries.
4. Identify resources for additional information.

Curriculum Outline for "Safety for Teleworkers"

ERGONOMICS

1. Introduction to Ergonomics

At the conclusion of Introduction to Ergonomics, participants will be able to:

- Define ergonomics.
- Identify the benefits of ergonomics training.

Topics:

a. What is ergonomics?
b. Why is ergonomics important?

2. Understanding MSDs

At the conclusion of Understanding MSDs, participants will be able to:

- Define musculoskeletal disorder (MSD).
- Identify the symptoms of MSDs.
- Identify the risk factors that contribute to the development of MSDs.
- Understand the importance of early detection and reporting of MSDs.

Topics:

a. What are musculoskeletal disorders (MSDs)?
b. Types of MSDs
c. Symptoms of MSDs
d. Risk factors
    i) Sitting for long periods without change
    ii) Working in awkward positions
    iii) Typing or writing for long periods without a break
    iv) Reaching for items in high or low places
    v) Lifting heavy objects
    vi) Repeating the same motion
e. Medical evaluation
f. Early detection and reporting of MSDs
g. Preventing MSDs

3. Principles of Ergonomics

At the conclusion of Principles of Ergonomics, participants will be able to:

- Identify and define the 6 principles of ergonomics.

Topics:

a. What are the principals of ergonomics?
b. Have good posture
    i) What is good posture?

ii) Importance of good posture
iii) Tips for working with good posture

c. Move, exercise, stretch, and rest
   i) Importance of moving, exercising, stretching, and resting
   ii) Tips for workers who sit for long periods
   iii) Rest your eyes
d. Provide appropriate lighting
   i) Importance of good lighting
   ii) Tips for improving lighting
e. Minimize pressure points
   i) What are pressure points?
   ii) Tips for minimizing pressure points
f. Reduce excessive force
   i) What is excessive force?
   ii) Tips for reducing excessive force
g. Keeping everything in easy reach.
   i) Avoid reaching
   ii) Tips for minimizing reach

4. Evaluating Your Home Office

At the conclusion of Evaluating Your Home Office, participants will be able to:

- Identify how to configure their office area to reduce discomfort and increase productivity.
- Identify ergonomic features of office equipment.

Topics:

a. Desk
   i) Evaluating your desk
   ii) Desk purchase tips
b. Office chair
   i) Adjusting your chair height
   ii) Adjusting your chair back
   iii) Adjusting your chair armrests
   iv) Adjusting your chair lower back support
   v) Chair purchase tips
c. Monitor
   i) Adjusting your monitor
   ii) Monitor purchase tips
d. Document holder
   i) Placing your document holder
   ii) Document holder purchase tips
e. Telephone
   i) Using a telephone
   ii) Telephone and headset purchase tips
f. Using laptop computers

5. Stretching Exercises

At the conclusion of Stretching Exercises, participants will be able to:

- Understand the importance of stretching and moving.
- Identify exercises to reduce the risk of developing an MSD.

Topics:

a. Importance of breaks, stretching and moving
b. Exercises to reduce your risk

6. Ergonomic Resources

At the conclusion of Ergonomic Resources, participants will be able to:

- Identify where to obtain help with ergonomic questions.

Topics:

a. Occupational safety and health office
b. Ergonomist
c. NIOSH, OSHA, and other federal agencies
d. Internet
e. Other resources

II. FIRE SAFETY

1. The Risk of Fire Death and Injury

At the conclusion of The Risk of Fire Death and Injury, participants will be able to:

- Identify the number of fires that occur in residential structures.
- Identify why teleworkers are at risk from home fires.

Topics:

a) Number of fires that occur in residential structures each year
b) Risk to teleworkers

2. Fire Hazards in the Home Office

At the conclusion of Fire Hazards in the Home Office, participants will be able to:

- Identify fire hazards in their home offices.

Topics:

a) Fuel load (paper/clutter)
b) Electrical equipment
c) Cooking
d) Inadequate number of exits
e) Blocked exit paths
f) Smoking
g) Space heaters
h) Radiators

3. Preventing Home Office Fires

At the conclusion of Preventing Home Office Fires, participants will be able to:

- Identify how to prevent fires in home offices.
- Identify fire safety devices that can make their home offices safer.
- Identify how fire safety devices operate.
- Identify where to install fire safety devices.
- Identify how much fire safety devices cost.

Topics:

a) Selecting an office location
b) Exit routes
c) Evacuation planning
d) Fire safety devices
    i) Smoke detectors
        (1) What are smoke detectors?
        (2) How do they operate?
        (3) Where should they be located?
        (4) How much do they cost?
    ii) Sprinkler systems
        (1) What are sprinkler systems?
        (2) How do they operate?
        (3) Where should they be located?
        (4) How much do they cost?
    iii) Fire extinguishers
        (1) What are fire extinguishers?

(2) How do they operate?
(3) What are the types?
(4) Where should they be located?
(5) How much do they cost?

e) Fire safety checklist

4. Fire Safety Resources

At the conclusion of Fire Safety Resources, participants will be able to:

- Identify where to obtain help with fire safety questions.

Topics:

a) Occupational safety and health office
b) Fire marshal / fire department
c) National Fire Protection Association
d) Internet
e) Other resources

III. ELECTRICAL SAFETY

1. The Risk of Electrical Fires

At the conclusion of The Risk of Electrical Fires, participants will be able to:

- Identify the number of electrical fires that occur in residential structures.
- Identify why teleworkers are at risk from electrical fires.

Topics:

a) Number of electrical fires that occur in residential structures each year
b) Risk to teleworkers

2. Electrical Hazards in the Home Office

At the conclusion of Electrical Hazards in the Home Office, participants will be able to:

- Identify electrical hazards in their home offices.

Topics:

a) Electrical appliances and equipment
b) Overloaded outlets and circuits
c) Extension cords
d) Wires/cords run under furniture or equipment
e) Frayed cords
f) Lightning
g) Shocks / GFCI

3. Preventing Electrical Hazards

At the conclusion of Preventing Electrical Hazards, participants will be able to:

- Identify how to prevent electrical hazards in home offices.

Topics:

a) Outlets
   i) Number of devices plugged in
   ii) Loose-fitting plugs
   iii) Missing or broken wall plates
   iv) Number of wall outlets
   v) Correctly wired, three-prong electrical outlets
   vi) Breaker/fuse box and circuits
b) Cords
   i) Condition of cords - not frayed or cracked
   ii) Cord placement - out of traffic areas, not stapled, not under carpet/rugs/furniture
c) Extension cords
   i) Not intended as permanent household wiring
   ii) Unplug when not in use
d) Plugs
   i) Plugs & outlets
   ii) Never remove the ground pin (the third prong)
e) Ground fault circuit interrupters (GFCIs)
   i) Areas with water and electricity
f) Light bulbs
   i) Wattage

g) Circuit breakers/fuses
   i) Correct size current rating
   ii) Electrical evaluation
   iii) Replacing fuses
h) Computers and office equipment
   i) Damaged equipment
   ii) Shocks
   iii) Surge protectors
i) Lightning
   i) Procedures for preventing lighting damage
j) Hiring a certified electrical contractor
f) Electrical safety checklist

4. Electrical Safety Resources

At the conclusion of Electrical Safety Resources, participants will be able to:

- Identify where to obtain help with electrical safety questions.

Topics:

a) Occupational safety and health office
b) Fire marshal / fire department
c) National Fire Protection Association
d) National Electrical Safety Foundation
e) Electrical contractor
f) Internet
g) Other resources

IV. RADON

1. The Risk of Radon

At the conclusion of The Risk of Radon, participants will be able to:

- Identify why radon poses a potential health risk to teleworkers.

Topics:

a) Number of estimated deaths per year from radon exposure
b) Risk of lung cancer
c) Risk to teleworkers

2. What is Radon?

At the conclusion of What is Radon, participants will be able to:

- Define radon.
- Identify how radon enters a home.

Topics:

a) What is radon?
b) Where does radon come from?
c) How does radon get into your home?

3. Preventing Radon Exposure

At the conclusion of Preventing Radon Exposure, participants will be able to:

- Identify how to test for radon
- Identify how to interpret test results
- Identify how to lower radon levels in homes

Topics:

a) Testing for radon
    i) Radon test kits
    ii) Short term testing
    iii) Long-term testing
    iv) Professional help
b) Interpreting test results
    i) EPA guidelines
c) Radon remediation
    i) Hiring a contractor
    ii) Types of radon reduction methods

4. Radon Resources

At the conclusion of Radon Resources, participants will be able to:

- Identify where to obtain help with questions on radon.

Topics:

a) Occupational safety and health office
b) Environmental Protection Agency
c) Internet
d) Other resources

V. SLIPS/TRIPS/FALLS

1. The Risk of Slips/Trips/Falls

At the conclusion of The Risk of Slips/Trips/Falls, participants will be able to:

- Identify why teleworkers are at risk

Topics:

a) Slipping/tripping/falling in the home office
b) Office clutter
c) Risk to teleworkers

2. Preventing Slip/Trip/Fall Hazards

At the conclusion of Preventing Slip/Trip/Fall Hazards, participants will be able to:

- Identify hazards.
- Identify how to prevent slip/trip/fall hazards.

Topics:

a) Flooring
    i) Torn carpeting
    ii) Worn flooring
    iii) Chipped tiles
b) Cords - electrical and telephone
c) Clutter on the office floor
d) Office chairs
e) Stairs
f) Filing cabinets

3. Slips/Trips/Falls Resources

At the conclusion of Slip/Trip/Fall Resources, participants will be able to:

- Identify where to obtain help with questions on slips/trips/falls.

Topics:

e) Occupational safety and health office
f) OSHA
g) NIOSH
h) Internet
i) Other resources

VI. SAFETY ROLES AND RESPONSIBILITIES FOR TELEWORK PROGRAM MANAGERS

1. The Risk of Injury to Teleworkers

At the conclusion of The Risk of Injury to Teleworkers, participants will be able to:

- Identify why teleworkers are at risk

Topics:

a) Most teleworkers set up their own home offices.
b) Without guidance, teleworkers can create home office hazards.
   i) Ergonomic hazards
   ii) Fire hazards
   iii) Electrical hazards
   iv) Radon
   v) Slips/trips/falls
c) In a corporate or government workplace, occupational safety and health risk factors are controlled or eliminated by the employer, the building owner, or the local fire marshal.
d) In the home workplace, employees must control or eliminate risk factors on their own.
e) Many of the prevention ideas may seem like common sense. However, without increased awareness, teleworkers may not realize that they are at risk and may not correct the safety hazards.
f) Teleworkers must be their own "OSHA inspector".

2. OSHA and Federal Rules/ Regulations

At the conclusion of OSHA and Federal Rules/Regulations, participants will be able to:

- Identify OSHA's policy on teleworker safety.
- Identify how workman's compensation laws apply to teleworkers.

Topics:

a) OSHA's policy
   i) OSHA Instruction on Home-Based Worksite Inspections (dated February 25, 2000) - Excerpt:
      (1) The Occupational Safety and Health Administration (OSHA) will not conduct inspections of employees' home offices.
      (2) OSHA will not hold employers liable for employees' home offices, and does not expect employers to inspect the home offices of their employees.
      (3) If OSHA receives a complaint about a home office, the complainant will be advised of OSHA's policy. If an employee makes a specific request, OSHA may informally let employers know of complaints about home office conditions, but will not follow-up with the employer or employee.
b) Workman's Compensation Insurance
c) Employment laws

3. Safety Responsibilities of Telework Program Managers

At the conclusion of Safety Responsibilities of Telework Program Managers, participants will be able to:

- Identify the responsibilities of telework program managers for teleworker safety.

- Develop a teleworker safety policy.
- Identify reporting procedures for teleworker injuries.
- Manage a teleworker safety program.

Topics:

a) Develop a Teleworker Safety Policy
   i) Home office safety checklist
   ii) Teleworker safety training
   iii) Inspection of home offices
   iv) Follow-up safety checklist
b) Managing a teleworker safety program
c) Reporting of teleworker injuries/illnesses

4. Safety Responsibilities of Teleworkers

At the conclusion of Safety Responsibilities of Teleworkers, participants will be able to:

- Identify the safety responsibilities of teleworkers.

Topics:

a) Follow the Teleworker Safety Policy
b) Set up home offices following the safety guidelines
c) Periodically perform self-inspections of offices for hazards
d) Report injuries that occur while teleworking to supervisors

5. Safety Resources

At the conclusion of Safety Resources, participants will be able to:

- Identify where to obtain help with questions on managing a telework safety program.

Topics:

a) Occupational safety and health office
b) OSHA
c) NIOSH
d) NFPA
e) NESF
f) Teleworker associations, such as ITAC
g) Internet
h) Other resources

Detailed Curriculum Guide for Ergonomics Module

Introduction to Ergonomics

At the conclusion of Introduction to Ergonomics, participants will be able to:

- Define ergonomics.
- Identify the benefits of ergonomics training.

Topics:

1) What is ergonomics?
   a) Ergonomics is the science that seeks to change work or working conditions to suit the worker.
   b) Ergonomics means fitting your job to you. Very often, it means changing your work area so that it fits you better.
2) Why is ergonomics important?
   a) Using ergonomics to design your home office can make you less tired, more comfortable and more productive.
   b) Studies have shown that you can increase your productivity as much as 25% when you work in an ergonomically designed office.
   c) When your office is not designed correctly, you can injure yourself. These injuries often include musculoskeletal disorders or MSDs.

Understanding MSDs

At the conclusion of Understanding MSDs, participants will be able to:

- Define musculoskeletal disorder (MSD).
- Identify the symptoms of MSDs.
- Identify the risk factors that contribute to the development of MSDs.
- Understand the importance of early detection and reporting of MSDs.

Topics:

1) What are musculoskeletal disorders (MSDs)?
   a) Musculoskeletal disorders (MSDs) are injuries to your muscles, nerves, tendons, ligaments, joints, cartilage or spinal disks.
   b) MSDs are caused by "wear and tear" on the tissue surrounding your joints.
   c) They can affect every joint in your body, but injuries to the lower back, arms, shoulders and wrists are the most common.
2) Types of MSDs
   a) Common types of MSDs include:
   b) Degenerative Disc Disease
      i) Chronic degeneration, narrowing, and hardening of a spinal disc, typically with cracking of the disc surface.
      ii) The primary symptom of degenerative disc disease is midline back pain.
   c) Herniated Disc
      i) Rupturing or bulging out of a spinal disc.
      ii) Common symptoms of a herniated or "slipped" disc is leg and/or back pain. The most common complaint is that of shooting pain down one or, although uncommon, both legs.
   d) Mechanical Back Syndrome
      i) Degeneration of the spinal facet joints (part of the vertebrae).
      ii) Symptoms may include pain in the lower back. The pain may spread to the buttocks, thighs or knees. Many people may also experience spasms with mechanical back pain.
   e) Cervical Strain
      i) A stretch injury to the muscular and ligamentous elements of the cervical spine.
      ii) Symptoms can include localized neck pain; pain that extends to the shoulder, arm, or upper back; limited movement; and, sometimes, headaches.
   f) Tension Neck Syndrome
      i) Neck soreness, mostly related to tenseness of the neck muscles. People with desk jobs that allow little head and neck motion may experience tension neck syndrome.
      ii) Symptoms can include stiffness, often accompanied by a dull headache and neck pain and tenderness.
   g) Thoracic Outlet Syndrome
      i) Compression of nerves and blood vessels between the neck and shoulder.
      ii) Symptoms can include: numbness, tingling, weakness of arms and hands, swelling of fingers and hands.
   h) Rotator Cuff Tendonitits

i) Inflammation of a tendon in the shoulder.
ii) Symptoms can include, pain, weakness, and a popping sensation in the shoulder.

i) Bursitis
   i) Inflammation of the bursa (small pockets of fluid in the shoulder and elbow which helps the tendons glide.)
   ii) Symptoms can include pain, inflammation, and swelling in the shoulders and elbows; restricted range of motion in a joint, with or without immediate pain; muscle weakness; and loss of motion, especially affecting the shoulder.

j) Epicondylitis
   i) "Tennis elbow" or inflammation of a tendon in the elbow.
   ii) The symptoms can include difficulty holding onto, pinching, or gripping objects, pain, stiffness, or insufficient elbow and hand movement, forearm muscle tightness, and tenderness in the elbow.

k) Radial Tunnel Syndrome
   i) Compression of the radial nerve in the forearm.
   ii) Symptoms can include tenderness and pain at the lateral side of the elbow. Although the cause is different, the symptoms are the same as "tennis elbow".

l) Tendonitis
   i) Inflammation of a tendon.
   ii) Symptoms can include pain in the wrist, made worse by attempts at movement; and swelling, heat or redness.

m) Carpal Tunnel Syndrome
   i) The compression of the median nerve as it passes through the carpal tunnel.
   ii) The median nerve is a connection between the fingers and the spinal cord. It travels through a tunnel deep in the wrist, along with nine tendons that connect to the fingers. The nerve and each of the tendons are almost as wide as a pencil. The tunnel is slightly over an inch wide, just barely wide enough to hold the nerve and tendons. If the tendons become irritated, they swell, putting pressure on the median nerve.
   iii) Symptoms can include numbness, tingling, burning, and pain in the base of the thumb and the index and middle fingers.

3) MSDs are common
   a) Musculoskeletal diseases are the most common, most expensive, and most preventable workplace injuries in the country.
   b) Most of us will experience a musculoskeletal disorder during our lives; often sports related or just lower back pain from everyday life.
   c) Usually, symptoms are mild and disappear with rest. However, sometimes MSDs can become very painful and disabling.

4) Symptoms of MSDs
   a) Symptoms of MSDs include:
      i) Soreness, pain, or discomfort.
      ii) Numbness or tingling sensations.
      iii) Weakness and clumsiness.
      iv) Burning sensations.
      v) Limited range of motion.

vi) Popping and cracking in your joints.
vii) Redness, swelling, and skin warmth.

5) Risk factors
   a) Your work environment and the way you work can increase your risk of developing a musculoskeletal disorder.
   b) Risk factors include:
      i) Sitting for long periods without change.
      ii) Working in awkward positions.
      iii) Typing or writing for long periods without a break.
      iv) Reaching for items in high or low places.
      v) Lifting heavy objects.
      vi) Repeating the same motion.
6) Early detection and reporting of MSDs
   a) It is important to identify MSDs when you first feel the symptoms.
   b) If you have pain or discomfort while working, see your doctor.
   c) In early stages, you can treat most MSDs with ice packs and anti-inflammatory drugs. However, if the disorder progresses, surgery may be needed.
7) Preventing MSDs
   a) You can decrease your risk of developing MSDs by:
      i) Changing some of your work habits.
      ii) Designing your home office following ergonomic principles.
8) MSD review

Principles of Ergonomics

At the conclusion of Principles of Ergonomics, participants will be able to:

- Identify and define the 6 principles of ergonomics.

Topics:

1) What are the principles of ergonomics?
   a) The principles of ergonomics include:
      i) Have good posture.
      ii) Keep moving.
      iii) Use correct lighting.
      iv) Reduce pressure points.
      v) Reduce force.
      vi) Reduce reach.
2) Have good posture
   a) What is good posture?
      i) Posture is the way you carry your body. Good posture is the state of muscular and skeletal balance. It means you carry your body in a balanced way.
      ii) Think of your skeletal structure as a series of stacked building blocks. If the building blocks are stacked and balanced over each other, you create a tall, strong, structure. Gravity holds the blocks in place. The same is true of good posture. If you have good posture, your bones fall naturally into place, and you do not need to use your muscles to hold them. A good natural balance produces skeletal alignment.
   b) Importance of good posture
      i) Good posture helps you prevent injuries and increases your efficiency.
      ii) Poor posture increases the stress and strain on your body.
      iii) A common example of poor posture is leaning forward and slumping your shoulders. If you slump, your back muscles support the weight of your shoulders and head. However, if you keep your head and neck balanced over your spine, the weight of your shoulders and head falls naturally over your skeletal structure, and your back muscles are not tense.
   c) Tips for working with good posture
      i) Keep a natural "S-curve" in your back
         (1) The middle part of your back is made up of a bony spinal column surrounded by muscles and ligaments. Viewed from the side, your spine forms an "S" shape. It is important to keep this natural S-curve of your back.
         (2) Some tips for keeping the s-curve include:
            (a) Use your chair to fully support your body. Distribute your weight evenly so you feel the entire seat and backrest. Do not lean forward.
            (b) Use additional back support to keep the S-curve in the small of your back.
      ii) Keep your neck in alignment with your spine.
         (1) Keep your neck in alignment by not bending, twisting, or tilting your head.
         (2) Some tips for keeping your neck in alignment include:

(a) Place your computer monitor directly in front of you, so you do not need to turn your head to look at the screen.
(b) If you wear bifocals, trifocal, or progressive lens glasses, get a pair of "computer glasses" that are set for the focal distance to the computer.
(c) If you use the telephone for long periods, purchase a phone cushion, phone cradle, speakerphone, or headset.
(d) Use a document holder if you often refer back and forth between papers and the computer screen.

iii) Hang your elbows naturally at your sides
(1) Some tips for keeping your elbows comfortable include:
(a) Let your elbows hang naturally at your sides, with your shoulders relaxed. Don't "wing' your arms out to the side.
(b) If your chair has armrests, adjust them so that your elbows rest lightly. Resting your elbows too heavily on the armrests causes tension in your shoulders.

iv) Keep your wrists in the same plane as your forearms.
(1) Keep your wrists and hands in the same plane as your forearm. Wrist rests help you keep this alignment.
(2) Angle your hands slightly forward and in. Hang your arms at your side while standing and you will see that your wrists naturally angle slightly in. You want this same angle while typing.

d) Posture review

3) Move, exercise, stretch, and rest
a) Although it is important for you to have good posture, no single posture is correct for an entire day. To be healthy, your body needs activity. You need to keep moving.
b) Tips for workers who sit for long periods:
i) Avoid sitting in one position for a long time.
ii) Take short breaks.
(1) Stop and stretch or get up and walk around for a minute or two.
(2) Frequent short breaks are better than fewer, longer breaks.
(3) If you find that you forget to take breaks, use a timer or specialized software.
(4) There are several software tools available that remind you to take breaks at the intervals you specify.

iii) Vary your tasks throughout the day and look for opportunities to stand.
(1) Examine your work habits and the types of tasks you do. Try to vary and break up the tasks, so you are not sitting for a long time.

iv) Rest your eyes.
(1) When you are using the computer or reading documents, give your eyes frequent breaks by periodically looking away from the monitor or document and focusing on a distant point.
(2) Close your eyes for a few seconds to give them a rest.

c) Exercise review

4) Provide appropriate lighting

a) The most common lighting problems include glare that reflects or shines off your computer monitor into your eyes and shadows that hide details.
b) Lighting problems cause eyestrain and fatigue.
c) Tips for improving lighting
    i) Use light fixtures with globes or shades that spread the light evenly. Avoid using light fixtures with exposed bulbs.
    ii) Position your monitor to avoid light sources.
        (1) One way to check for glare is to turn your monitor brightness level down to purposely locate the reflections, then move your monitor to avoid those spots.
    iii) Place your monitor so that it is not directly facing or directly behind a window. Facing a window creates shadows, being behind a window creates glare.
    iv) Close your window blinds if light from the windows is reflecting off your computer screen.
    v) Use monitor hoods, glare guards, or screens.
        (1) Use guards or screens as a last resort, if you cannot eliminate glare another way.
        (2) Guards and screens can make it harder for you to see the screen and can cause eyestrain.
    vi) If you use a computer often, dim the ceiling lighting and add task lighting or desk lights.
b) Lighting review

2) Minimize pressure points
    a) What are pressure points?
        i) Pressure points are areas of your body where furniture or other objects apply direct pressure.
        i) For example, if your chair is too high, the backs of your knees will press against the edge of your chair. You can feel pressure or pain on the backs of your knees. The backs of your knees are the pressure points. If your thighs hit the edge of your desk, your thighs are the pressure points.
    b) Tips for minimizing pressure points
        i) Use a chair with good cushioning.
        ii) If you have sat on metal bleachers or on a metal folded chair for long periods, you can appreciate the importance of good cushioning.
        iii) Use footrests or adjust the height of your chair so that your feet rest comfortably on the floor.
        iv) Avoid leaning any part of your body, particularly your wrists, against the hard edge of a desk or other sharp objects.
            (1) Sharp edges can bruise the sensitive tissue on your wrists. If your forearms are hitting an edge, adjust the height of your chair or the height of the work surface.
    c) Pressure points review

3) Reduce excessive force
    a) What is excessive force?

i) Reducing force means reducing the strength or exertion that you need to do something. Reducing your exertion reduces your chance for injury.

b) Tips for reducing excessive force:
   i) Type lightly.
      (1) Try not to bang hard on the keys to type. Banging the keys can strain your fingers. Remember to type lightly and tap the mouse lightly.
   ii) Use proper lifting techniques.
   iii) Lift objects comfortably, not necessarily the quickest or easiest way. Lift, push, and pull with your legs, not your arms or back.
   iv) Get help or use a mechanical aid such as a dolly when you move heavy or bulky objects.
   v) Avoid lifting objects higher than your shoulder height.
      (1) Use a step stool or ladder to move objects to higher locations.
   vi) Never twist at the waist while you hold an object.
   vii) Carry heavy objects close to your body and avoid carrying them in one hand.
   viii) Avoid twisting in your chair to reach something. The twisting motion can strain your back. Get up out of your chair and keep your back straight as you reach.

c) Excessive force review

4) Keeping everything in easy reach.
   a) Avoid reaching
      i) Keep items you use often within easy reach.
      ii) Long reaches can cause you to twist, bend, and strain.
   b) Tips for minimizing reach:
      i) Place items you use often within easy reach.
      ii) Do not arrange your work area in a way that causes you to repeatedly strain forward to see or reach items.
      iii) Place your mouse adjacent to and at the same height as your keyboard.
      iv) If necessary, use a wider keyboard tray, reconfigure the layout of the area, or switch to a touchpad (which is smaller and can often fit closer to the keyboard.)
      v) Consider purchasing an "L" shaped desk.
         (1) These desks provide room for your computer monitor and additional workspace to the side for other tasks.
   c) Reach review

Evaluating Your Home Office

At the conclusion of Evaluating Your Home Office, participants will be able to:

- Identify how to configure their office area to reduce discomfort and increase productivity.
- Identify ergonomic features of office equipment.

Topics:

1) Desk
   a) Evaluating your desk
      i) To avoid glare and shadows, place your desk so that it is not directly facing or directly behind a window.
      ii) Organize your desk. Survey your desk and decide which items you use the most. Place those items in easy reach. Relocate unnecessary or less frequently used items to another area.
      iii) Place heavy books and files you use often at about waist height, to make them easier to lift. Never place these items on the lowest or highest shelf.
      iv) Be sure your desk has enough knee room. Older-style desks with center drawers or built in filing cabinets can cause you to bang your knees under the desk. If you find yourself banging your knees, remove the center drawer or consider purchasing a new desk.
   b) Desk purchase tips
      i) Before you go shopping:
         (1) List the work-related equipment you currently own and add what you are likely to buy. For example, many home offices have a computer, printer, mouse, mousepad, keyboard, wristrest, telephone, electric pencil sharpener, stapler, fax machine, scanner, lights, speakers, and tape dispenser.
         (2) Measure the size of your existing equipment, particularly your larger equipment.
      ii) When you go shopping:
         (1) Bring your equipment list, measurements, and a tape measure.
         (2) Imagine yourself working at the desk you are thinking of buying.
         (3) Visualize placing each item in or *on* the desk. Visualize the items and *all* of the wires, cables, and transformers each one requires. Consider where the wires will run.
         (4) Measure the top of the desk and compare those measurements to your equipment list. Remember that your equipment will need a few additional inches in the back for cables. Consider purchasing an L or U-shaped desk, as these types of desks give you an area for your computer and an additional work surface.
         (5) If you use a computer often, be sure the desk has an adjustable keyboard tray. Adjustable keyboard trays allow you to sit more comfortably and correctly while working on the computer. Be sure there is enough room on the keyboard tray for your mouse and wristrest.

(6) Think about the design of the storage system. Imagine the drawers full of files. Will they still be easy to pull in and out, or will they sag if stuffed with files?
(7) Examine how your ergonomic chair will fit with the desk. Be sure your knees have plenty of clearance under the desk.
(8) Check to see if the desk has built in task lighting. Although built-in lighting is not critical, it is a nice feature to have.

2) Office chair
   a) Adjusting your chair height
      i) If your work surface or keyboard tray is height-adjustable, set your chair height from the bottom up.
         (1) Put your feet flat on the floor.
         (2) Adjust the seat height to reduce the pressure points on your thighs and behind your knees; your feet should rest comfortably on the floor;
         (3) Then adjust the keyboard or work surface to be at about elbow height.
      ii) If you do not have an adjustable work surface, make the adjustments the other way around.
         (1) Adjust your chair height so that you are working at about elbow height.
         (2) If your feet do not reach the floor, use a footrest.
         (3) If your feet touch the ground, but your knees are raised from the front of the chair, you may need to purchase an adjustable keyboard tray or taller desk.
   b) Adjusting your chair back
      i) Be sure that the back of your knees do not come in direct contact with the edge of the seat pan.
         (1) There should be 2-3 inches between the edge of the seat and the back of your knee.
      ii) If your knee is hitting the edge of the chair, adjust the back of your chair forward. If your chair is not adjustable, consider buying an adjustable chair.
   c) Adjusting your armrests
      i) If your chair has adjustable armrests, place them at the same height as your keyboard. Be sure your elbows and lower arms rest lightly on the armrests.
      ii) If your chair has fixed armrests that are too low, wrap some padding around them.
      iii) If the armrests are fixed and too high, consider purchasing another chair.
   d) Adjusting your lower back support
      i) If your chair has adjustable lower back support, match the contours of the chair's backrest to the natural s-curve of your lower spine.
      ii) If your chair does not have built in support, use a rolled towel or lumbar pad to support your lower back.
   e) Chair purchase tips
      i) When you purchase a chair, look for the following ergonomic features:
         (1) Good lower back support. The contours of the chair should match the s-curve of your lower spine.
         (2) Adjustable seat height, preferably with an automatic lift operated by a lever.

(3) Adjustable chair back height.
(4) Adjustable tilt mechanism, for tilting forward and backward, with a locking mechanism.
(5) Adjustable armrests.
(6) Rounded front edge (not square).
(7) Casters (wheels) and a 5-point wheel base to ease movement and reduce possible tipping.

3) Adjusting your monitor
   a) Tips for adjusting your monitor include:
      i) If you use a computer monitor for several hours a day, place the monitor directly in front of you, so you do not have to turn your head to see it.
      ii) Adjust the height of your monitor so that the top of the screen is at about eye level or slightly lower. If you need to raise your monitor higher, purchase a monitor holder, or, for a less expensive fix, place wood blocks underneath it.
      iii) If you wear bifocal, trifocal, or progressive lens glasses, adjust your monitor height so you can focus without tipping your head back. You may need to position your monitor lower than eye level to bring the screen into focus.
      iv) Place your monitor at a comfortable viewing distance, about an arms length away.
      v) Tilt the top of the monitor back to avoid glare.
      vi) Keep your monitor clean and free of dust. Use a cleaner specially designed for monitor cleaning to reduce dust.
      vii) Adjust your monitor's brightness and contrast levels so it is easy to see and comfortable for your eyes.
   b) Monitor purchase tips
      i) A high-quality monitor with good resolution.
      ii) Avoid inexpensive monitors that flicker.
      iii) Large monitor size. If you use a computer for long hours, consider buying a 17-inch monitor, instead of the smaller 15-inch screen.
      iv) An adjustable base. You should be able to move and position the monitor to suit your height and desk arrangement.
4) Document holder
   a) Placing your document holder
      i) If you spend most of your day reading documents (not on the computer), place your document holder directly in front of you. Place it high enough that you do not have to tilt your head forward to read it.
      ii) If you spend most of your time on the computer, place your computer monitor directly in front of you and place your document holder directly beside and at the same height as your computer monitor.
   b) Document holder purchase tips
      i) Sturdiness
      ii) Enough space for the type of hardcopy you use.
      iii) Adjustments for height, tilt and side-to-side movement.
5) Telephone
   a) Using a telephone

i) If you use your telephone often, place it in easy reach. Consider purchasing a phone cushion, phone cradle, speakerphone, or headset. These devices will help reduce neck and shoulder strain.
ii) If you type or refer to papers while on the phone, a headset is your best alternative. Headsets range in price from $20 (if your phone already has a jack) to over $300 (for added comfort and better sound quality).

b) Telephone and headset purchase tips
i) When you purchase a new telephone, look for the following ergonomic features:
(1) A speakerphone option.
(2) A jack for connecting a future headset.
(3) If you want a headset, purchase a phone/headset package.
(4) If you are purchasing a headset for an existing telephone, check the phone to see if it has a built in headset jack.
(a) If it has a jack, you will only need to purchase a headset.
(b) If it does not have a jack, you will need to purchase a headset kit that comes with an interface to connect the headset to your phone's receiver.

6) Laptop computers
a) Some ergonomic tips for using a laptop include:
i) Attach a regular keyboard to the laptop and use this keyboard instead of the laptop's built in keyboard. This will allow you to raise the laptop screen to a more appropriate height.
ii) If you do not have access to a regular keyboard, use the laptop's keyboard following the ergonomic principles you have just learned. Be sure your elbows are level with or slightly higher than the keyboard. Angle your elbows at approximately 90 degrees, with your wrists level and upper arms hanging relaxed at your sides.
iii) When you look down at the screen, be careful not to bend your neck and head forward. Instead, tilt your chin down, keeping your head and neck balanced over your spine.

Stretching Exercises

At the conclusion of Stretching Exercises, participants will be able to:

- Understand the importance of stretching and moving.
- Identify exercises to reduce the risk of developing an MSD.

Topics:

1) Importance of breaks, stretching and moving
   a) You need to move and stretch from time to time.
   b) Exercise reduces the tension in your muscles and promotes the flow of blood. You feel refreshed and less tired.
   a) Check with your doctor before doing any exercises.
   b) Some exercises can make injuries worse.
   c) If you feel pain or discomfort while exercising, stop immediately and see your doctor.
2) Exercises to reduce your risk
   a) Do exercises gently and cautiously throughout the workday.
   b) Do them slowly. If you do the exercises too quickly, you can pull a muscle.
   c) Repeat them several times.
3) Some of the exercises you can do include:
   a) Stretching up, back, and down.
   b) Turning your head around and then from side to side.
   c) Gently pulling your fingers back, and expanding them out.

Evaluation Items for Ergonomics Module

1. Ergonomics means adjusting your body to fit your work environment.	Agree	Disagree	Don't know
2. If I use a laptop computer, attaching a regular keyboard is usually a good idea.	Agree	Disagree	Don't know
3. I can injure my wrists by typing too hard.	Agree	Disagree	Don't know
4. My computer desk should face a window for best lighting.	Agree	Disagree	Don't know
5. I think my risk of developing a musculoskeletal disorder increases if I sit for long periods of time.	Agree	Disagree	Don't know
6. I think about my posture when I am working at my desk.	Agree	Disagree	Don't know
7. My arms should rest lightly on the chair armrests when I am typing.	Agree	Disagree	Don't know
8. The backs of my knees should press firmly on the front edge of my chair seat.	Agree	Disagree	Don't know
9. I include neck and wrist exercises in my daily work plan.	Agree	Disagree	Don't know
10. A chair with a perfectly straight back provides the best support.	Agree	Disagree	Don't know
11. If I design my office using ergonomics, I can get more done.	Agree	Disagree	Don't know
12. My mouse should be at the same height as my keyboard.	Agree	Disagree	Don't know
13. I think people who work from home are at risk of developing a musculoskeletal disorder.	Agree	Disagree	Don't know
14. I clean my computer screen at least weekly.	Agree	Disagree	Don't know
15. I should place heavy books on a shelf at knee height.	Agree	Disagree	Don't know

16. I use a document holder when I'm on the computer and need to refer to paper documents	Agree	Disagree	Don't know
17. I have evaluated my home office for ergonomic issues.	Agree	Disagree	Don't know
18. I type with my elbows positioned away from my sides.	Agree	Disagree	Don't know
19. If I use ergonomics to design my office, I will be less tired.	Agree	Disagree	Don't know
20. I adjust my computer monitor's brightness and contrast so the screen is easier to see.	Agree	Disagree	Don't know
21. When I type, I bend my wrists slightly upwards.	Agree	Disagree	Don't know
22. Exercise reduces my risk of developing a musculoskeletal disorder.	Agree	Disagree	Don't know
23. Musculoskeletal disorders are caused by a build up of tissue around your joints.	Agree	Disagree	Don't know
24. I use a speakerphone, phone headset or phone cushion when I'm on the phone for more than a few minutes.	Agree	Disagree	Don't know
25. I vary my tasks throughout the day and look for opportunities to stand.	Agree	Disagree	Don't know
26. It's important to recognize the symptoms of musculoskeletal disorders when they first appear.	Agree	Disagree	Don't know

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PAPER SUBMITTED TO: JOURNAL OF SAFETY RESEARCH

The Effects of Ergonomics Training on the Knowledge, Attitudes, and Practices of Teleworkers

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Abstract

The rapid growth of teleworking has raised several social and legal issues regarding an employer's responsibility for the safety of an employee's home office. In this paper, researchers discuss the need for safety training for teleworkers and the effectiveness of a home office ergonomics training program. Study participants included 102 teleworkers who completed an on-line preregistration form. Participants were randomly assigned into a treatment (n = 51) or control (n = 51) group. The treatment group completed the ergonomics training and a pre- and posttest. The control group completed the pre- and posttests without training. The study demonstrated the need for teleworker ergonomics training. More than 85% of participants had not received teleworker training before and 44% had experienced pain or discomfort while teleworking. Participants who completed the training significantly improved their scores on knowledge, attitude, and practices subtests.

Author Keywords: Ergonomics, Training, Teleworkers

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INTRODUCTION

The Growth of Teleworking

Teleworking, also known as telecommuting, means using information technology and telecommunications to replace work-related travel. With teleworking, employees work at home or at a local telework center one or more days per week. Communication is accomplished by phone, fax, modem, and teleconferencing.

Teleworking is changing the way millions of Americans communicate, commute, and work. Over the last several years, both private industry and the federal government have joined together to encourage these changes, many of which have proven to be beneficial to the economy, to the environment, and to families. In 2001, there were an estimated 28 million Americans who teleworked one day a week or more (Davis & Polonko, 2001).

The National Performance Review (Gore, 1993) and former President Clinton's Climate Change Action Plan (Clinton & Gore, 1993) identified teleworking as one method to help the U.S. achieve environmental goals, to conserve national resources, and to enhance the quality of work life. In his memorandum dated July 11, 1994, former President Clinton wrote, "The executive branch must implement flexible work arrangements to create a family-friendly workplace. The head of each executive department or agency is hereby directed to establish a program to encourage and support the expansion of flexible family-friendly work arrangements, including: job sharing; career part-time employment; alternative work schedules; and telecommuting and satellite work locations." In 1996, the President's Management Council approved the National Telecommuting Initiative Action Plan, launching a three year initiative to significantly increase the number of federal telecommuters (Lieber & Wohl, 1996). In December 1999, U.S. Representative Frank Wolf of Virginia announced details of a federal telework program that could dramatically increase the number of teleworkers nationwide. According to Representative Wolf, "the congestion and mobility crisis is perhaps the greatest single threat to continued prosperity and most certainly our quality of life and the family unit. Telecommuting is

the information age's answer to reducing traffic congestion, nurturing environmental stewardship, and strengthening the family, " (International Telework Association and Council, 1999).

The rapid growth of teleworking has raised several social and legal issues regarding an employer's responsibility for an employee's home office. On November 15, 1999, the Occupational Safety and Health Administration (OSHA) sent a letter to a Texas employer stating that he was responsible for federal safety and health violations that occur in his employee's home office. The letter suggested that employers could be liable for any unfavorable incidents met by an employee who chose to work at home, such as unsafe stairs, improper lighting, and inadequate ventilation in home offices. This policy interpretation created a national uproar, causing some firms to cancel or postpone giving teleworking rights to their employees.

In January 2000, the U.S. Department of Labor withdrew the advisory letter and asked the National Economic Council to convene an interagency working group to examine the broad social and economic effects of teleworking. On February 25, 2000, OSHA issued a new compliance directive to formalize agency policy on home-based work. According to the new policy, OSHA will not inspect home offices for violations of federal safety and health rules and employers are not expected to conduct home office inspections. The only exception to this policy is for a home where factory-type manufacturing occurs.

The purpose of the Occupational Safety and Health Act of 1970 is to assure as far as possible every working man and woman in the nation safe and healthful working conditions. The question remains—who is responsible for the workplace safety and health of teleworkers in the virtual workplace? Many still believe the responsibility lies with the employer. "Taking the OSHA statement as a faithful interpretation of the rules, managers should demonstrate best efforts and thorough safety planning for all alternative workspaces, including home offices," says John Girard, an analyst with the Gartner Group in Stamford Connecticut (Zbar, 2000). Despite the

Labor Department's retraction of the OSHA letter, Girard suspects OSHA will revisit the issue of home office safety within the next five years as teleworking increases.

The Risk of Musculoskeletal Disorders

Musculoskeletal disorders (MSDs) are injuries and disorders of the muscles, nerves, tendons, ligaments, joints, cartilage, and spinal disks. Examples of MSDs include carpal tunnel syndrome, tendonitis, sciatica, herniated disc and lower back pain. MSDs are one of the most significant problems in the workplace today. Work-related MSDs account for more than one-third of all occupational injuries and illnesses that are serious enough to result in days away from work. Each year more than 620,000 employees suffer lost-workday because of MSDs. These MSD injuries cost businesses $15 to $20 billion in workers' compensation costs each year. Indirect costs may run as high as $45 to $60 billion. Carpal tunnel syndrome, one form of MSD, results in more days away from work than any other workplace injury (OSHA, 1999).

According to a study by the International Telework Association and Council (Davis & Polonko, 2001), the primary home telework activity is using a computer (87%). The relationship between computer-use and the development of musculoskeletal disorders (MSDs) is well-documented (Bergqvist, Wolgast, Nilsson, & Voss, 1995a; Bergqvist, Wolgast, Nilsson, & Voss, 1995b; Demure, et al., 2000; Faucett & Rempel, 1994; Ferreira, Conceicao, & Saldiva,1997; Hales, et al., 1994; Marcus & Gerr, 1996; Ong, 1994; Yu & Wong, 1996). The very technology that is powering the Information Age is also leaving many of its workers with this painful malady.

Workplace factors that increase the risk for computer-related MSDs include: improper workstation design; incorrect monitor, mouse, and keyboard placement; poor posture; incorrect chair height; improper office lighting; and intense typing without resting periods (Aaras, Horgen, Bjorset, Ro, & Thoresen, 1998; Demure et al., 2000; Keir, Bach, & Rempel, 1999; McHugh & Schaller, 1997; Ong, 1994). In a corporate or government workplace, many of these risk factors are controlled. The company purchases and sets up the computer workstations. Corporate

safety officers inspect for ergonomics hazards. Lighting is engineered and designed for office use. Rest periods are common, as other workers are nearby and interruptions are likely. However, in the home office, these risk factors may not be so easily controlled. Studies have shown that teleworkers typically set up their own offices without assistance (Center for Office Technology, 1999). Teleworkers may place their computers on coffee tables or old desks, creating numerous ergonomic hazards. Without training, teleworkers are unaware of workplace factors that increase their risk of developing MSDs.

A poll of the nation's leading technology and business executives in February 2000 found that only 9% of respondents had set safety guidelines for employees who work at home, with 80% having no guidelines and 11% unsure if their companies had set guidelines (Chief Information Officer, 2000). "This is a critical issue to everyone who works from home," says Debra A. Dinnocenzo, President of the teleworking consultant firm AlLearnatives. "Utilizing basic home office safety guidelines can prevent injury, productivity losses and property damage, all of which have significant payoff to the individual home office worker, whether or not OSHA mandates it." (Zbar, 2000).

Research has shown that ergonomics training and environmental intervention decrease the incidence of musculoskeletal disorders. Businesses that have implemented ergonomics programs report significant decreases in accidents, injuries, illnesses, and health-care costs over time, along with increases in productivity, quality of work, and worker morale (Cook & Pinelli, 1995; *Cumulative Trauma Disorder News*, 1995a; *Cumulative Trauma Disorder News*, 1995b). While the effectiveness of ergonomics intervention is well documented in the corporate environment, there is little research available on the effectiveness of ergonomics training in the home office setting.

The purpose of this research was to evaluate the short-term effects of an ergonomics training program on the knowledge, attitudes, and practices of a group of teleworkers.

METHODS

The Training Program

Researchers developed a 45 minute computer-based training module on home office ergonomics. Researchers developed learning objectives (see Figure 1) and a detailed curriculum guide for the ergonomics module. The main topics were: Introduction to Ergonomics, Understanding Musculoskeletal Disorders, the Principles of Ergonomics, Evaluating Your Home Office, and Ergonomic Stretching Exercises.

INSERT FIGURE 1 about here

Using the Ergonomics for Teleworkers curriculum guide, the researchers developed a detailed storyboard. The storyboard included graphics/animations, screen title/text, narration, interaction, and navigation for each screen. Experts in ergonomics, teleworking, computer-based training, instructional design, and program evaluation reviewed the storyboard for accuracy, content, and instructional design.

The Computer Software

The "Ergonomics for Teleworkers" program combines text, graphics, color illustrations, animation, and sound to provide a fully interactive, media-rich learning environment. The program has 66 separate screens, with 61 colored illustrations. Each of the five main topics has between 3 and 23 screens. Each screen contains interaction, animation, or a color illustration designed to keep the learner focused. The program included screen to screen navigation so that participants could move forward, pause, repeat a topic, or quit the lesson. See Figure 2 for a sample screen.

"Ergonomics for Teleworkers" was developed using *Macromedia Authorware 6.0. Adobe Premiere 6.0* software was used to render video clips and save them in a Microsoft AVI format. Audio narration clips were recorded using *Cool Edit 2000* and saved in a WAV format. Illustrations were stored in jpg format.

INSERT FIGURE 2 about here

Measurement Tools

The researchers developed 64 criterion-referenced items designed to assess the participants' knowledge, attitudes, and ergonomic safety practices at pre- and posttest. Each item was a statement about ergonomics to which participants were asked to respond Agree, Disagree, or Don't Know. Content experts reviewed the items for content accuracy and clarity. A small group from the target population (n = 10) were recruited to try-out the test items. Researchers used a split-half reliability analysis to eliminate items in which low scorers outperformed high scorers. They also eliminated items that the content experts found confusing or those on which they disagreed on the answers. Items were selected to include from 2 to 9 items for each learning objective and to include a balanced number of knowledge, attitude, and practice items. The final instrument consisted of 26 items: 10 knowledge items, 6 attitude items, and 10 practices items.

The evaluation team also developed an informed consent statement for participants to read and complete before participating in the training. The informed consent included information about the purpose of the study, risks/benefits to participants, and contact information for questions. The consent letter stated that participation was voluntary, that they could choose not to participate at any time, and that they could choose not to answer any of the questions. In order to match pre- and posttest results, researchers asked participants to identify themselves by name on the pre- and posttest.

Participants provided the following demographic information on the pretest: name, date, job title, gender, ethnicity, age, and educational level. Participants also provided information about their teleworking status: days per month, years teleworking, previous teleworker training, previous ergonomics training, teleworking location, who purchased teleworking equipment, reasons for teleworking, percentage of day spent writing reports, working on the computer,

reading documents, or using the telephone, type of Internet connection; and whether participants had experienced discomfort, soreness, or pain while teleworking.

The posttest included the same 26 items about ergonomics that appeared on the pretest with one change. The 10 practice items were changed from the pretest version to indicate participants intended practices. For example, the pretest item "I have evaluated my home office for ergonomic hazards," was changed on the posttest version to read, "I plan to evaluate my home office for ergonomic hazards."

A participant evaluation form was adapted from one developed for a similar study (Harrington & Walker, 2001). Researchers administered the participant evaluation anonymously. The form included thirteen statements designed to elicit the participants' opinions about the usefulness of the program and the content. The first eight items were written as statements, such as, "The training program was useful to me as a teleworker." For each item, participants were asked to select a response from three options: Agree, Disagree, No Opinion. Items 9 to 12 were open-ended questions: "What did you like most about the training?" "What did you dislike about the training?" "How can we make the program more useful or interesting?" and "What changes do you plan to make as a result of this training?" Item 13 asked participants to check topics from a list of other safety areas that would be of interest to them.

Program Try-Out

Prior to the pilot test study, researchers tested the training with a small sample of teleworkers ($N = 10$). These ten teleworkers attended a training session at the General Services Administration using computers provided by the researchers. Participants were observed while they completed the training. The average time to complete the training was fifty minutes. Information from the tryout was used to revise the training before the pilot test.

Total scores for the pre- and posttest were calculated as well as the scores of three subtests: knowledge, attitudes, and practices. A paired sample *t*-test was used to determine

whether differences from pre- to posttest were significant. The average pretest score was 13.7 (52.7%), the average posttest score was 24 (92.3%). The mean increase was 10.3 items (39.6%). The t value of 8.63 (df = 9) was significant at $p = .0005$. Pre- to posttest increases on the knowledge ($t = 4.99$, $p = .001$), attitudes ($t = 3.07$, $p = .05$) and practices ($t = 6.10$, $p = .0005$) subtests were also significant.

Pilot Test Study

The design for the pilot test study was a Two Group Comparison Study with Random Assignment to Groups. The 102 teleworkers who completed the pretest were randomly assigned to one of two conditions: Treatment Group or Control Group. Participants in the Treatment Group completed the pretest, the ergonomics training program, posttest, and course evaluation. Participants in the Control Group completed the pretest, and then without completing the training completed the pretest a second time (referred to as the retest) four to five weeks later.

The research questions were:

1. Did the computer-based training significantly affect the participants' knowledge, attitudes, and practices related to ergonomics?
2. Did the computer-based training program significantly affect the participants' knowledge, attitudes, and practices related to ergonomics as compared to the Control Group?
3. Did the participants like the computer-based format for training?

Participant Recruitment and Pretest Data Collection

For the purpose of this study, a *teleworker* was defined as a person who works in his or her home or in a telecommuting center one or more days a month. A teleworker may work for a business, academic institution, or government agency, or be self-employed.

To recruit participants for this study, researchers sent an e-mail message to 331 teleworkers. These individuals included teleworker/employees from the federal government, private industry and academic institutions.

The target population for this study consisted of the 102 teleworkers who volunteered to participate by completing the consent form and pretest at the website established by researchers for that purpose. The recruitment e-mail described the purpose of the project, risk/benefits, tasks to be completed, and gave them a contact person. Of the 102 participants, 91 worked for federal agencies and 11 were teleworkers from private industry or academic institutions.

Setting of the Study

The data collection took place at the website that researchers created for the study. The website contained links for the pretest, posttest, course evaluation and retest. Participants completed all tests on-line in their home offices or remote worksites. These data were stored in a secure ISP database.

The "Ergonomics for Teleworkers" training program was stored on a CD-ROM which was mailed to participants. Study participants completed the CD-ROM training on their computers in their home offices or remote worksites. Participants were given 3 weeks to complete the training.

Data Analysis

At both pretest and posttest (or retest), participant responses to test items were stored on the secure website database. The researchers imported participant data into an Excel spreadsheet. Items were coded in the spreadsheet and scored as correct or incorrect. In each case, Don't Know or "no response" was scored as incorrect. The total number of correct responses by each participant was calculated. Subtest scores were calculated for Knowledge

(10 items), Attitude (6 items) and Practice items (10 items). Each item was also assigned to one of the five module objectives. A mean pretest and posttest score were calculated for the Treatment Group, the Control Group, and the sample as a whole. Mean scores were calculated for each of the subtests.

Responses on the Participant Evaluation Forms were analyzed. For items 1-8 and 13 on the evaluation instrument, a mean for each item was calculated and converted to a percentage. Items 9-12 were placed into tables and reviewed to determine what changes should be made to improve the module.

Data were analyzed using *SPSS Version 10.* In each case, the level of significance required to reject the null hypotheses was established at $p < .05$.

RESULTS

Demographics of the Study Population

One-hundred and two people completed an on-line pretest. Of those, 50 completed a posttest or retest and constituted the sample population for the pilot test. Twenty-eight (56%) of the participants were members of the Treatment Group and 22 (44%) were members of the Control Group. These participants included teleworkers from 10 federal agencies ($n = 42$), and 4 private companies ($n = 8$). Participants teleworked in 11 states and the District of Columbia. The states included: Maryland, Texas, Virginia, North Carolina, Tennessee, Nebraska, Illinois, New York, Michigan, Florida, and Pennsylvania,

The participants consisted of 28 (56%) men and 22 (44%) females. Thirty-eight were white (78%) and the others were members of different minority groups (22%). The dominant minority group was black ($n = 8$); there were one Asian and two Hispanics. One person did not indicate ethnic group. All of the participants had completed some college courses. Forty-one people had a bachelor's degree; of those, 29 had completed some graduate level work.

Forty-nine of the study participants (98%) teleworked from home. They teleworked an average of eight days per month and had been teleworking for an average of 3.5 years. Twenty-one participants (42%) had a room or area of their home used exclusively for teleworking. Twenty-nine participants (58%) purchased their own home office equipment, while 12 (24%) indicated that some of their equipment was purchased by their employer and 8 (16%) indicated that their employer purchased all of their equipment. Forty-three participants (86%) had not received teleworker training and forty (80%) had never completed ergonomics training. Participants spent an average of 64% of their time using a computer, 16% reading documents that are not on the computer, 10% on the phone, and 8% writing reports or other documents using a pen or pencil.

Participants cited the following reasons for teleworking: 34 (68%) "reduces time spent going to and coming from work;" 6 (12%) "my employer requires it;" 5 (10%) "I can be at home when children come home from school;" 17 (34%) "I prefer working by myself at home;" 24 (48%); "flexible hours;" 1 (2%) "I have a health problem or disability that makes traveling to and from work difficult;" and 1 (2%) "I can smoke in my home office."

Researchers performed a Chi-square analysis to determine whether there were significant differences between the two groups (treatment and control) related to gender, ethnicity, education, and previous training. Differences were not significant. See Table 1.

INSERT TABLE 1 about here

Researchers used a *t*-test to determine whether differences were significant for age and time spent teleworking. The mean age for the total group (n = 46) was M = 44, SD = 9.6. For the Treatment Group (n = 28), M = 45, SD = 8.81; for the Control Group (n = 18), M = 43, SD = 10.7, t = .80 (44 df). The mean years of teleworking for the total group was M = 4, SD = 4.28. For the Treatment Group (n = 27), M = 4; SD = 4.74; for the Control Group (n = 22), M = 4; SD = 3.75, t = .01 (47 df). The mean days per month of teleworking for the total group was M = 8, SD

= 8.87. For the Treatment Group (n = 27), M = 8; SD = 9.69; for the Control Group (n = 22), M = 7; SD = 7.92, t = .45 (47 df). In each case, the differences were not significant.

Researchers performed a correlation analyses using Pearson Product Movement to determine if any of the demographic variables were related to either pretest or posttest scores. Only ethnicity was found to be related to pretest scores (r = .305, df = 50; p = .031.) The mean score on the pretest for Caucasians was 14.86 and for minorities was 12.08. Using a one way ANOVA, the difference was shown to be significant (F = 4.912, p = .031). Posttest scores were not related to any of the tested variables including the pretest. These findings indicate that minority participants had less knowledge than Caucasians participants initially but by the end of the training these differences disappeared.

Estimates of Instrument Reliability

Reliability of the test instrument was investigated to allow researchers to improve the instrument for future research. Researchers calculated a Cronbach alpha as a measure of internal stability. At pretest, the alpha (with 50 cases and 26 items) was .66. At posttest, alpha = .87. None of the items had zero variance. Pretest Item 5, "I think my risk of developing a musculoskeletal disorder increases if I sit for long periods of time," was negatively correlated with the item total score. (Participants who scored higher on the test as a whole got this item wrong more often than those who scored lower on the test.) At posttest responses to this item were positively correlated to the total score. Item 20 at posttest was negatively correlated with the total score. (I plan to adjust my computer monitor's brightness and contrast so the screen is easier to see.) Those items will be examined and may be revised for future research. The reliability of the instrument, however, appears to be within the acceptable limits for this type of test (Crocker & Algina, 1986).

Pre- Posttest Differences for Treatment Groups

The means and standard deviations for the pre- and posttest scores were calculated for the total group and each group for the total test and for each subtest. (See Table 2.) A Paired Samples Test was used to calculate a *t*-score for each of the comparisons. For the Treatment Group, differences between the pre- and posttest mean scores were significant for the total score ($t = 12.14$, df = 27, $p = .0005$), for the Knowledge subtest ($t = 8.36$, df = 27, $p = .0005$), for the Attitudes subtest ($t = 7.29$, df = 27, $p = .0005$) and for the Practices subtest ($t = 9.68$, df = 27, $p = .0005$). Differences between mean scores for the Control Group were not significant for the total score or for any of the subtests.

INSERT TABLE 2 about here

Item Differences from pre- to posttest

In order to evaluate participant learning on specific items, researchers performed a *t*-test for pre- to posttest scores on each of the 26 items. Participants in the Treatment Group improved significantly on all of the items except for Item 2. (If I use a laptop computer, attaching a regular keyboard is usually a good idea.) However, the mean posttest score was higher than the mean pretest score.

Training Effect on Knowledge, Attitudes and Practices Related to Ergonomics

A repeated measures analysis was performed with module scores measured at two points in time (pre- and posttest) as the dependent variables. See Table 3. The one within subjects variable was time and the one between subjects variable was group (treatment versus control). The main effect of time and the interaction of time by group were both significant. The main effect of time indicates that posttest scores were higher than pretest scores. The significant interaction of time by group suggests that the improvement from pre- to posttest was not uniform across groups. See Table 2 above for means and standard deviations for Treatment

and Control Groups which shows that Treatment Group mean scores were significantly higher than Control Group scores.

INSERT TABLE 3 about here

Participant Discomfort

Twenty-two participants (44%) indicated on the pretest that they had experienced discomfort while teleworking. People who teleworked more days per month reported a greater incidence of work-related discomfort (r = .347, 48 df, p = .016). The most common complaints were sore/tired eyes, sore back, neck pain, and sore wrists.

Participant Evaluation

Participants in the Treatment Group from the pilot test study (n = 28) and the program try-out at the General Services Administration (GSA) (n = 10) were invited to completed an anonymous on-line course evaluation immediately following the training. Thirty-four participants (89.5%) completed an evaluation. The pilot test study participants completed the course evaluation at their remote worksites and the GSA participants completed the evaluation in a conference room at GSA. Not every participant completed an evaluation. For each item, participants were asked to read a statement about the training and respond: Agree, Disagree, or No Opinion. For the purposes of this analysis, the responses Disagree and No Opinion were grouped together as negative responses to the program (except for Item #3 for which the opposite was true). The participants were positive toward the training. The responses are presented in Table 4.

INSERT TABLE 4 about here

Participants' Anticipated Changes

Participants were also invited to respond to four open-ended questions on the course evaluation. Twenty-seven participants (71%) responded to the questions. The first question was

"What did you like most about the training?" The most common responses were: "flexibility and ability to work at my own pace " (n=6), "the simplicity and ease of the program" (n=7), and "it was informative" (n=6). The second question asked participants "What did you dislike about the training?" The most common responses were "there was no back button" (n=6), "too slow" (n=3), "too long" (n=3), and "too much clicking on the next button" (n=2). The third question asked participants "How can we make the program more useful and more interesting?" The most common response was "I wouldn't change anything" (n=5). Other responses included: "take more breaks and stretch more," "add more interactive sections," "make it less redundant," and "show more examples of workstations that are ergonomically correct that people adapt for their homes." The last question asked participants what changes they plan to make as a result of the training. A summary of participant responses to this question are shown in Figure 3.

INSERT FIGURE 3 about here

Participants were also asked to check topics from a list of other safety training topics that would be of interest to them as teleworkers. Fifteen participants (44%) checked electrical safety, thirteen (38%) checked fire safety, and nineteen (56%) checked radon.

Participant Follow-up Survey

Researchers sent a follow-up e-mail to participants in the Treatment Group (n = 28) one month after they completed the posttest. Participants were asked to respond to the question: "What changes have you made to your office or work habits since completing the training?" Seventeen participants (61%) responded to the follow-up e-mail. Participants indicated that the training had reduced or eliminated work-related pain to their backs, eyes, fingers, or shoulders. Responses are summarized in Figure 3.

INSERT FIGURE 3 about here

CONCLUSION

Discussion

This study demonstrates the need for safety training for teleworkers. At pretest, seven participants (14%) indicated that they had received teleworker training. Of these seven participants, the majority indicated that the teleworker training was related to managing teleworkers rather than preventing injuries. Only one participant specifically indicated that he had received training related to safety or ergonomics. Twenty-two participants (44%) indicated on the pretest that they had experienced discomfort while teleworking. The most common complaints were sore/tired eyes, sore back, neck pain, and sore wrists. People who teleworked more days per month reported a greater incidence of work-related discomfort (r = .347, 48 df, p = .016). At pretest, nearly three-quarters of the participants (74%) indicated that they had never evaluated their home offices for ergonomic hazards. At posttest, 100% of Treatment Group participants indicated that they planned to evaluate their home offices for ergonomic hazards.

This study also demonstrates the potential for training to improve teleworkers' ergonomic knowledge, attitudes and practices. The Treatment Group significantly increased overall scores between pre- and posttest, and also for scores on each subtest (knowledge, attitudes, practices). In the follow-up survey, participants indicated that they had made changes to their offices based on the training. Several participants indicated that pain or discomfort they had been experiencing was eliminated or reduced as a result of the training.

The findings also suggest that computer-based training is an effective training technique for teleworkers. All participants who completed a participant evaluation form (n = 34) thought that the training program was useful to them as teleworkers. Ninety-seven percent of the participants who completed an evaluation form said they would recommend the program to other teleworkers, that the information in the program was interesting to them personally, and that the computers were easy to use for training. Eighty-five percent said they would like to use a computer for future training courses. In addition, participants made positive comments in the

course evaluation regarding using computer-based training, including the ability to progress through the materials at their own pace, the ability to complete the training at their convenience and the ability to complete the training in their home office.

Limitations of the Study

The attrition rate from pre- to posttest was 51% (of the 102 participants who took the pretest, 50 participated in the study by completing the training or retest). One contributing factor was the short timeframe for completion and the timing of the study. Participants were given three weeks to complete the training during the month of June. Reasons cited for not completing the training included: too busy or on vacation (6), and not yet teleworking (5).

Although the CD-ROM developed by researchers will run on a Macintosh system running *Virtual PC*, three participants who completed the pretest on-line reported being unable to complete the training because of having Macintosh computers systems.

Additional studies need to examine the benefits of safety training for teleworkers in other areas. Study participants indicated that electrical safety, radon, and fire safety are some areas of interest.

The computer-based training materials used in this study were stored on a CD-ROM. In the future the training will also be accessible on a website. This will eliminate the need to ship a CD-ROM to each teleworker. Developers can revise web-based courses whenever the content is out-of-date. Technology is constantly improving and allowing more rapid transfer of complex data, such as graphics, video and sound, from website to learner. These methods of training will help to meet an ever-growing need for skills and information for teleworkers.

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Figure 1: Ergonomics for Teleworkers Learning Objectives

1. Define ergonomics.
2. Identify the benefits of ergonomics training.
3. Define musculoskeletal disorder and give examples (MSD).
4. Identify the symptoms of MSDs.
5. Identify the risk factors that contribute to the development of MSDs.
6. Understand the importance of early detection and reporting of MSDs.
7. Identify and define the six principles of ergonomics.
8. Identify how to configure their office area to reduce discomfort and increase productivity.
9. Identify ergonomic features of office equipment.
10. Understand the importance of stretching and moving.
11. Describe exercises to reduce the risk of developing an MSD.

Figure 2: Sample Screen from "Ergonomics for Teleworkers"

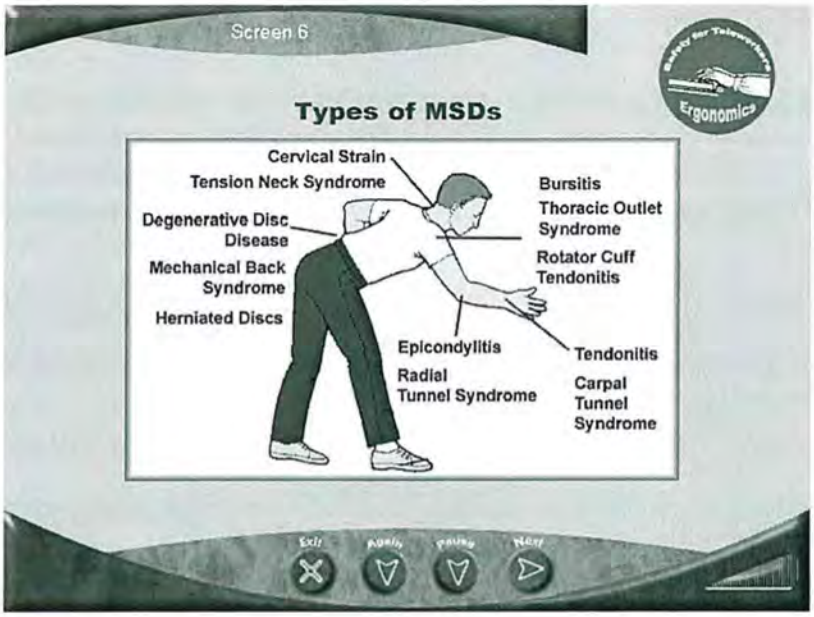

Table 1: Characteristics of the Sample Population (*N* = 50)

Variables	Total *N* = 50 (100%)[b]	Treatment Group *n* = 28 (56%)	Control Group *n* = 22 (44%)	Chi square χ^2 (df)
Sex				3.498 (1) n.s.
Male	21 (42%)	15 (54%)	6 (27%)	
Female	29 (58%)	13 (46%)	16 (73%)	
Ethnicity				.035 (1) n.s.
Minority	11 (24%)	6 (22%)	5 (23%)	
White	38 (76%)	21 (78%)	17 (77%)	
Education				.257 (2) n.s.
HS Graduate and some college	9 (18%)	5 (18%)	4 (18%)	
College Graduate	12 (24%)	6 (21%)	6 (27%)	
Graduate School	29 (58%)	17 (61%)	12 (55%)	
Previous Ergonomics Training				.183 (1) n.s.
Yes	10 (20%)	5 (18%)	5 (23%)	
No	40 (80%)	23 (82%)	17 (77%)	
Previous Teleworker Training				.004 (1) n.s.
Yes	7 (14%)	4 (14%)	3 (14%)	
No	43 (86%)	24 (86%)	19 (86%)	

Table 2: Mean Differences between Groups, Time, and Tests

	Total		Knowledge		Attitude		Practices		
Group	Time	*M*	SD	*M*	SD	*M*	SD	*M*	SD
Treatment (*n* = 28)	Pre	14.0	4.4	5.3	1.9	4.0	1.3	4.7	2.4
	Post	23.7	1.9	8.9	1.2	5.6	.5	9.2	.9
Control (*n* = 22)	Pre	14.5	3.4	5.2	2.0	4.2	1.4	5.0	2.3
	Post	14.8	3.5	4.1	1.5	4.1	1.5	5.2	2.3

Table 3: Tests of Within-Subjects Contrasts

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
TIME (pre- and posttest)	614.401	1	614.401	89.628	.0005
TIME * GROUP (treatment vs. control)	549.121	1	549.121	80.105	.0005
Error(TIME)	329.039	48	6.855		

Table 4: Program Evaluation Results for Items 1 to 8

Evaluation Items	*n*	Positive Response	Negative Response
1. The training program was useful to me as a teleworker.	34	34 (100%)	0 (0%)
2. The information in this program was interesting to me personally.	34	33 (97%)	1 (3%)
3. The program was too long.	34	28 (82%)	6 (18%)
4. I learned a great deal from this program.	34	27 (79%)	7 (21%)
5. I would recommend this program to others.	34	33 (97%)	1 (3%)
6. The computer was easy to use for training.	34	33 (97%)	1 (3%)
7. I enjoyed the computer-based training more than instructor-led training.	34	20 (59%)	14 (41%)
8. I want to use the computer for future training classes.	34	29 (85%)	5 (15%)

Figure 3: Participant Planned Changes

What changes do you plan to make as a result of this training?

- I plan to purchase a new chair. (5 responses)
- I plan to adjust my chair and workstation. (3 responses)
- I will be more aware of my posture. (3 responses)
- Moved my monitor slightly closer to about arm's length. Will use my computer glasses, instead of my progressive all the time.
- I plan to adjust my chair and document holder at home as well as purchase a footrest.
- I plan to make some changes at home regarding the position of my computer in the room.
- I will use the speakerphone more, clean my screen more often, put heavy books in arm's reach, etc.
- Try to apply what I learned about ergonomics
- I plan to move my mouse and monitor, and move heavy items that I use frequently. Also, take frequent breaks.
- I'm very guilty of keeping a dirty computer screen, and I'll change that. I'm going to mention what I learned to my husband, who wears tri-focal glasses and works for long periods of time on the computer.
- I will give thought to posture and reaching (especially). I will also share the need for ergonomic thinking with my staff.
- I will be ergonomically aware each time I use the computer and adjust my surroundings accordingly.
- Very few, but will look into a headset for my telephone.
- Align monitor directly in front of keyboard. Ensure my wrists are more in line with forearms. Focus more on my posture while sitting in my chair. Move around more frequently during the day.
- Make sure my posture, desktop, etc. and phone are properly positioned, make sure I avoid eyestrain through improper lighting or glare, make sure to do periodic exercises and take frequent breaks.

Figure 4: Summary of Responses to Follow-up Survey

What changes have you made to your office or work habits since completing the training?

- Adjusted chair (6 responses)
- Walk around and stretch more frequently (4 responses)
- Increased awareness of posture (4 responses)
- Adjusted keyboard height (3 responses)
- Moved computer screen to avoid window glare (3 responses)
- Started using a footrest (3 responses)
- Adjusted monitor height (2 responses)
- Adjusted mouse location (2 responses)
- Purchased a new chair
- Plan to purchase a new computer desk and keyboard stand
- Plan to purchase a new chair
- Purchased a table lamp with a light that is easier on my eyes
- Purchased an extended key pad so the keyboard and mouse are at the same height
- Purchased wrist pads
- Adjusted chair armrests
- Ordered larger monitor
- Purchased telephone headset
- Started using a document holder
- Purchased a new mouse
- Purchased a new phone cradle
- Plan to purchase a new keyboard for a laptop
- Changed from using progressive lenses back to contact lenses and computer glasses

Teleworker Safety

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Presented at the e-Commute Seminar- June 27, 2002

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Overview

- Risk to Teleworkers
- Safety Hazards
- Responsibility
- Prevention
- Safety Resources

Why are teleworkers at risk?

- Teleworkers set up their own home offices.
- Without guidance, teleworkers can create home office hazards.
- Workers at telecommuting centers may share workstations.

Corporate Space vs. Home Office

- Corporate or Federal Office Space
  - Occupational safety and health office
  - Fire marshal
  - Purchasing department
  - Building owner / maintenance shop
- Teleworking Home Office
  - Teleworker

Teleworker Safety

Teleworkers must be their own "OSHA inspectors."

Awareness is the key.

Teleworker Safety Hazards

- Ergonomic hazards
- Fire & electrical hazards
- Radon
- Slips, trips, & falls

Ergonomics

- What is ergonomics?
  - Ergonomics is the science that seeks to change work or working conditions to suit the worker.
  - Ergonomics means fitting your job to you.

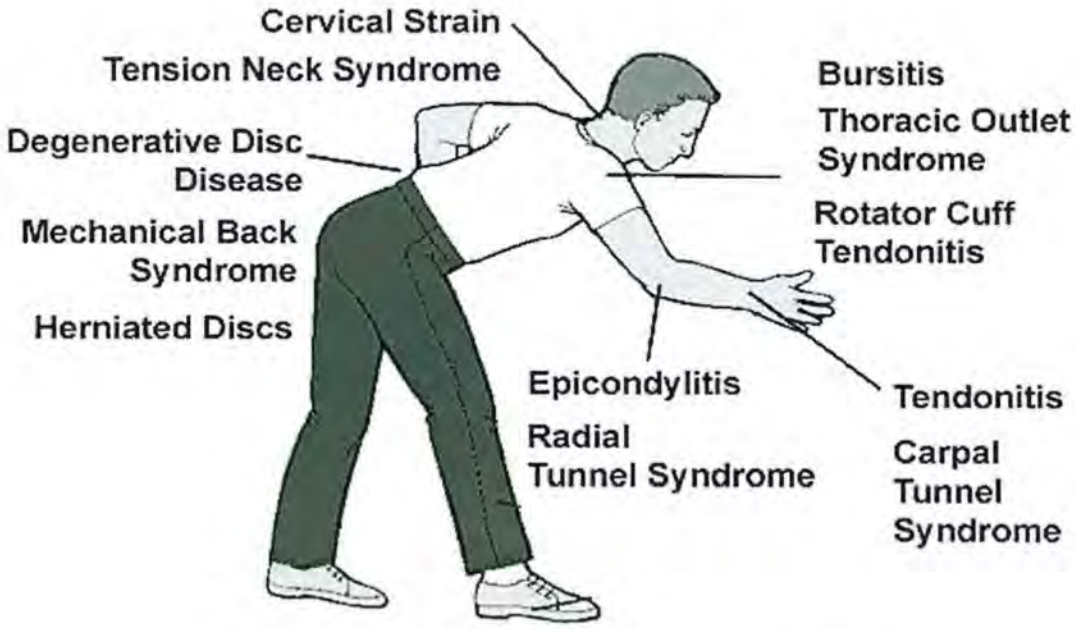
- Poor ergonomic design of work space can lead to cumulative trauma disorders or "CTDs".

CTDs

What are CTDs?

- Cumulative Trauma Disorders (CTDs) are injuries and disorders of the muscles, nerves, tendons, ligaments, joints, cartilage and spinal disks.
- CTDs result from "wear and tear" on the tissue surrounding your joints.

Common Types of CTDs



graphic from: *The Office Ergonomics Kit*, by Dan MacLeod

CTDs

Work-related CTDs are the most significant safety/health problem in the workplace today.

- They account for more than 1/3 of all occupational injuries and illnesses that are serious enough to result in days away from work.
- These injuries cost businesses $15 to $20 billion in workers' compensation costs each year.

Poor Office Design

Poor office design can result in:

- Carpal tunnel syndrome
- Tendonitis
- Stiff neck
- Back sprain
- Lower back pain
- Eye strain / fatigue
- Headaches

Why are teleworkers at risk?

Home Office Teleworkers:

- Set up their own offices.
- Purchase their own furniture or use old "make-shift" arrangements.
- May be on the phone or work on computers for long periods of time without interruption.

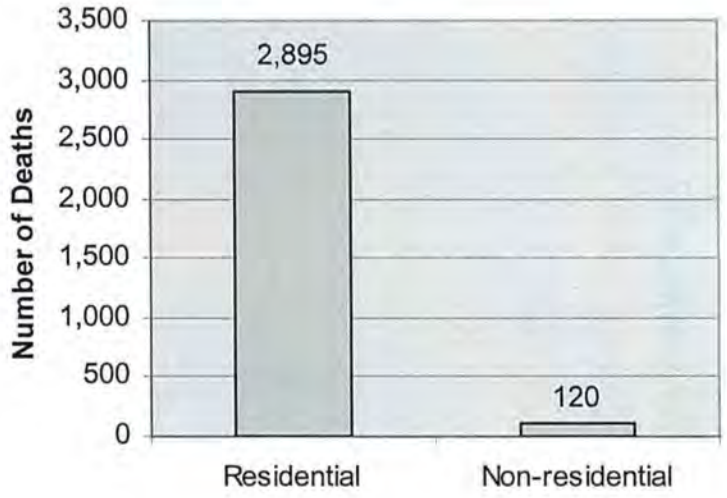
Why are teleworkers at risk?

Telecommuting Center Teleworkers:

- May share workstations with several other employees at the telecommuting center.
- May be on the phone or work on computers for long periods of time without interruption.

Fire & Electrical Safety

- A home fire occurs every 85 seconds.
- Over ninety percent of all civilian fire deaths occur in the home.



(Source: *The US Fire Problem*, NFPA, 2001)

Why are teleworkers at risk?

Teleworkers create fire hazards by:

- Overloading electrical circuits.
- Using extension cords.
- Using space heaters.
- Smoking in cluttered home offices.
- Creating a home office in an attic or basement with only one exit.

Why are teleworkers at risk?

In a corporate workplace, fire risk factors are controlled by the employer and the fire marshal.

- Fire marshals conduct regular fire inspections.
- Space heaters are often prohibited.
- Smoking is not allowed in most offices.
- Office workspaces are professionally designed with adequate numbers of exits.

Radon

What is radon?

- Radon is a radioactive gas that originates from the natural decay of uranium in soil, rock, and water.
- It typically moves up through the ground to the air above and into homes through cracks in the foundation.
- Homes can trap radon inside, where it can build up to dangerous levels.

Radon

- According to the EPA, nearly 1 out of every 15 homes in the United States is estimated to have elevated radon levels.
- Radon is estimated to cause approximately 14,000 deaths per year.
- Only smoking causes more lung cancer deaths.

Why are teleworkers at risk?

Over time, exposure to high levels of radon increases a person's risk of developing lung cancer.

- Teleworkers who work in homes with high radon levels increase their risk.
- Not only are they exposed to radon in the evening and weekend, but during their workday as well.
- Workers with basement offices are at an even greater risk of radon exposure.

Slips, Trips, & Falls

- Slips, trips, and falls are among the most frequent types of accidents, second only to motor-vehicle accidents as a cause of death.

- More than a million people suffer from a slip, trip, or fall injury each year; over 11,000 die as a result of falls alone.

Why are teleworkers at risk?

- Insufficient space for filing creates office clutter.
- Clutter in the office, such as magazines/papers left on the floor create a tripping hazard.
- Electrical cords and phone cords can cause tripping hazards.

Responsibility

Who's responsible for teleworker safety?

- OSHA?
- Employer?
- Employee?

OSHA

OSHA Instruction on Home-Based Worksite Inspections (February 25, 2000):

- OSHA will not conduct inspections of employees' home offices.
- OSHA will not hold employers liable for employees' home offices, and does not expect employers to inspect the home offices of their employees.

Employer's Responsibilities

- Develop and implement a Teleworker Safety Policy.
  - Developing and following a policy can prevent injuries, productivity losses, and property damage.
- Include the safety office in the development process.
- Follow agency or company reporting procedures for teleworker injuries.

Teleworker Safety Policy

- Include a home office "self-certification" safety checklist for employees to fill out and sign as part of the formal Teleworking Agreement.
- Provide safety training or guidance to teleworkers.
- Reserve the right to inspect home offices, particularly if injuries or other problems arise.
- Provide a follow-up safety checklist for employees who have worked at home for 6 months or more.

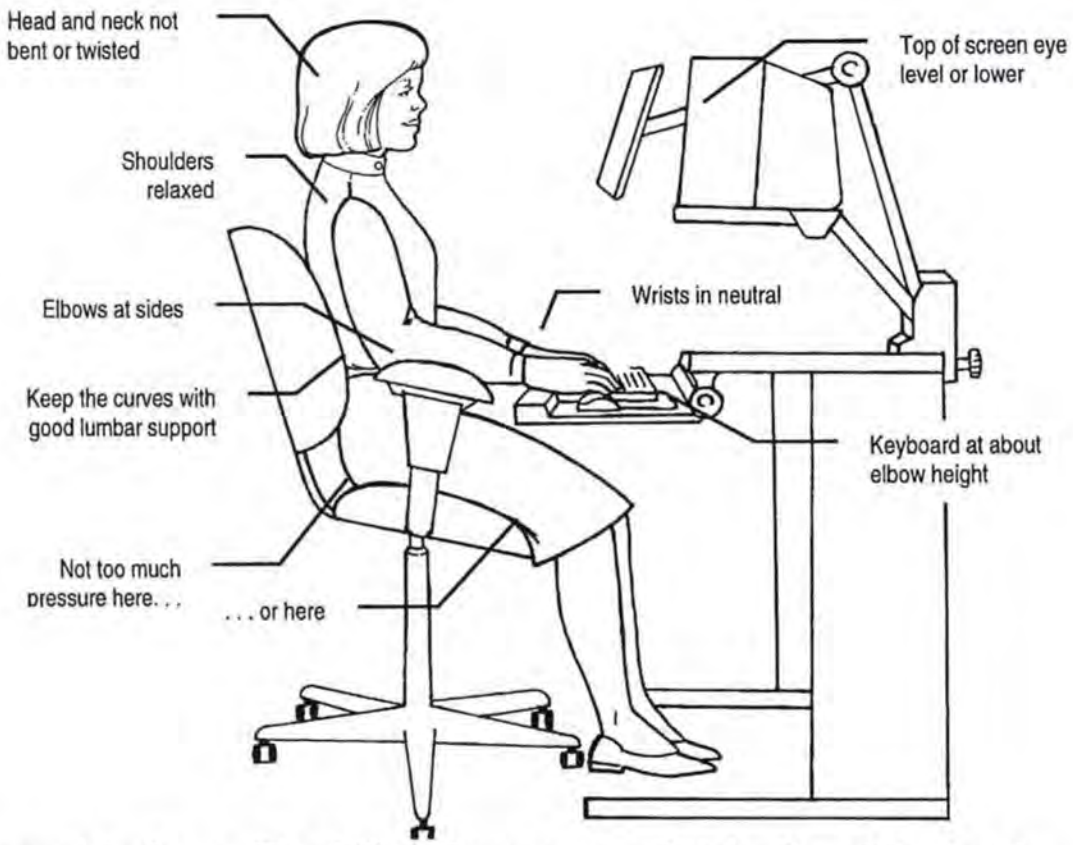
Employee's Responsibilities

- Follow the Teleworker Safety Policy.
- Fill out the self-certification safety checklist.
- Set up home office following the safety guidelines.
- Periodically perform self-inspection of office for hazards.
- Report injuries that occur while teleworking to a supervisor.

Ergonomics Prevention Ideas

- Learn and use appropriate postures.
- Take frequent rest and exercise breaks from typing.
- Reduce glare on computer screens by adjusting lighting or purchasing anti-glare filters.
- Keep everything within easy reach.
- Use copy holders.

The Classic Typing Position



graphic from: *The Office Ergonomics Kit*, by Dan MacLeod

Fire Safety Prevention Ideas

- Install a smoke detector in the home office.
- Avoid smoking in cluttered office areas.
- Keep a multipurpose ABC fire extinguisher in the office area, mount it on the wall, and learn how to use it properly.
- Avoid using space heaters.
- Don't place papers or other combustibles on or near the radiators.
- Never leave cooking unattended.

Electrical Safety Prevention Ideas

- Don't overload electrical circuits. Have an electrician evaluate the system or add outlets if necessary.
- Avoid using extension cords.
- Never nail or staple cords to the wall, baseboard, or other object.
- Never place cords under carpets or furniture.
- Use correctly wired, three-prong grounded outlets.

Electrical Safety Prevention Ideas

- If your office equipment repeatedly blows a fuse or trips a circuit breaker, have an electrician evaluate the circuits that feed the home office.
- Use a surge suppressor to protect against hardware damage from electrical surges.
- If an electrical appliance smokes or smells unusual, unplug it immediately and have it serviced before using it again.

Radon Prevention Ideas

- The EPA recommends that all homes be tested for radon because people are most likely to get their greatest radon exposure at home, where they spend most of their time.
- Testing for radon is relatively simple.
- There are many low-cost, "do-it-yourself" radon test kits available in hardware and other retail stores.

Slips, Trips & Falls Prevention Ideas

- Replace torn carpet or other worn flooring.
- Keep electrical and telephone cords out of the walkway.
- Keep the floor clear of paper and other debris.
- Never use a chair for climbing.
- Never lean back in a chair to reach for something.
- Keep stairs clear.
- Install handrails on all stairs.

General Office Safety

- Open only one file drawer at a time.
- Fill file cabinets from the bottom up, not from the top down.
- Keep unattended file drawers closed.

Research Grant

- Phase I SBIR funded by the National Institute for Occupational Safety and Health
- Grant Purpose:
  - To identify safety and health issues that affect home teleworkers.
  - To develop and pilot test a safety training program for teleworkers.
- For additional information, contact:
  - Susan Harrington, (540) 349-8074, susan@hsainc.net

Safety Resources

- Your occupational safety and health office
- National Institute for Occupational Safety and Health
  - www.cdc.gov/niosh/homepage.html
- Occupational Safety and Health Administration
  - www.osha.gov
- National Fire Protection Association (NFPA)
  - www.nfpa.org
- National Electrical Safety Foundation (NESF)
  - www.nesf.org
- National Safety Council
  - www.nsc.org

Safety Resources

- Environmental Protection Agency
  - www.epa.gov/iaq/radon
- GSA/OPM Website
  - www.telework.gov; www.telework.gov/gsapolic.htm
- International Telework Association & Council
  - www.telecommute.org
- ErgoWeb
  - www.ergoweb.com
- *The Office Ergonomics Kit*, by Dan MacLeod

Title:	Occupational Safety and Health Traininig for Teleworkers
Investigator:	Susan Shemanski Harrington, M.S.
Affiliation:	Harrington Software Associates, Inc.
City & State:	VA
Telephone:	(540) 349-8074
Award Number:	1 R43 OH007461-01
Start & End Date:	9/30/2001–9/29/2002
Total Project Cost:	$99,971
Program Area:	Intervention Effectiveness Research Methods
Key Words:	

Final Report Abstract:
The purpose of this research is to reduce the risk of occupational injury and illness to employees who telecommute from their homes (telework). The rapid growth of teleworking has raised several social and legal issues regarding an employer's responsibility for an employee's home office. OSHA policy states that employers are not responsible for home offices; yet, teleworkers may be more at risk from occupational safety and health hazards than their coworkers who commute. In a traditional workplace, risk factors are controlled or eliminated by the employer, building owner, or fire marshal. In the home workplace, employees must control or eliminate risk factors on their own.

During Phase I, researchers worked with a group of multidisciplinary experts to define the major occupational injury and illness prevention topics that affect home-based workers. The team developed a curriculum outline for teleworkers consisting of six modules. Module topics for teleworkers are - office ergonomics, fire safety, electrical safety, air quality/radon, falls/tripping and safety roles and responsibilities for telework program managers. As a prototype, researchers developed a detailed curriculum guide for the module on ergonomics and a computer-based training module titled "Ergonomics for Teleworkers" delivered on CD-ROM.

Researchers piloted tested the ergonomics CD-ROM. Study participants included 102 teleworkers who completed an on-line preregistration form. Participants were randomly assigned into a treatment (n = 51) or control (n = 51) group. Of the102 teleworkers who completed the on-line registration form, 51 completed the study as a member of the treatment group (n = 28) or control group (n = 23). The treatment group completed the ergonomics training and a pre- and post-test. The control group completed the pre- and post-tests without training.

The study demonstrated the need for teleworker ergonomics training. More than 85% of participants had not received teleworker training before and 44% had experienced pain or discomfort while teleworking. Treatment group participants significantly improved their scores from pre- to post-test. Differences between the pre- and post-test mean scores were significant for the total score ($t = 12.14$, $df = 27$, $p = .0005$), for the Knowledge sub-test ($t = 8.36$, $df = 27$, $p = .0005$), for the Attitudes sub-test ($t = 7.29$, $df = 27$, $p = .0005$) and for the Practices subt-est ($t = 9.68$, $df = 27$, $p = .0005$). Differences between mean

scores for the Control Group were not significant for the total score or for any of the sub-tests.

During Phase II, researchers will develop the four remaining teleworker safety training modules and a fifth module for managers. Following a pilot-test of the new materials, researchers will conduct a national field test. Each module will have a CD-ROM and web-based format. The modules will combine text, graphics, sound, color illustrations, and animation to provide a fully interactive, media-rich learning environment. The web-based version of the training will take advantage of the latest advances in distance learning technology, including streaming media. Pre and post-tests will be included, either on the CD-ROM or on-line as part of each module. Learners will be able to print out and save certificates of completion that they can e-mail to their managers to receive credit for completing the training.

Publications:
No publications to date.

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service
Centers for Disease Control
and Prevention (CDC)

Memorandum

Date: October 30, 2003

From: , Program Official
Office of Extramural Programs, NIOSH,

Subject: Final Report Submitted for Entry into NTIS for Grant 1 R43 OH007461-01.

To: William D. Bennett
Data Systems Team, Information Resources Branch, EID, NIOSH, P03/C18

The attached final report has been received from the principal investigator on the subject NIOSH grant. If this document is forwarded to the National Technical Information Service, please let us know when a document number is known so that we can inform anyone who inquires about this final report.

Any publications that are included with this report are highlighted on the list below.

Attachment
cc: Sherri Diana, EID, P03/C13

List of Publications