Evaluation of the Back and Upper Limb Injury Prevention Course in the Context of an Off-the-Job Safety Program in Small Workplaces

by

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ABSTRACT

Workplace injuries contribute to significant costs for employers and reduced quality of life for workers. Back related injuries are the most common, accounting for an estimated 29% to 34% of all compensable workplace injuries in Canada. Although nearly 40% of workplaces reportedly offer back injury preventive courses to their employees, these courses are rarely evaluated.

The Waterloo Safe Communities Program (WSCP) is a multi-faceted intervention aimed at improving safety knowledge and practices to prevent injury both in and outside smaller sized workplaces. Companies participating in the WSCP may share proportionately in a 75% incentive refund of any savings in their group's annual WSIB claim costs. The Off-the-Job Safety Component of the WSCP, began in 1999, consists of an optional value-added set of courses for participating companies (e.gs., car seat safety, recreational safety, bike safety and fire extinguisher safety). The purpose of the present thesis was twofold, first to examine the level of interest of local companies in the Off-the-Job Safety courses, and secondly to evaluate a back injury prevention course developed by experts at the University of Waterloo and offered in Ontario workplaces such as the GM plant.

To assess the extent of interest and commitment in off-the-job safety courses, a needs assessment was conducted with 78 small and medium sized companies in Waterloo. First, company representatives were invited to a presentation describing potential topics such as preventive back care, first aid, fire safety and recreational safety. A brief survey was distributed to those in attendance; mailed to those invited who did not attend. The 53 companies who expressed an initial interest were subsequently contacted and interviewed in person or over the phone.

Overall, 83% of company contacts interviewed indicated potential interest in preventive back care. Employers were generally willing to pay for workers' time and course fees because they

perceived a linkage existed between back injury prevention in the home and at work. While many company contacts also expressed interest in other courses, most were unwilling to pay for worker time (92%) or for course fees (64%) unless the course was directly related to workplace safety. These findings illustrate the importance of examining indicators of commitment and not simply interest.

The next study consisted of an outcome evaluation of the *Back Course* in which 230 employees from seven worksites were assessed at entry and immediately following the course. The four hour *Back Course* aims to increase awareness and knowledge of five main biomechanical principles, and change the lifting practices of course participants. The course was offered in 18 different sessions for the purposes of this evaluation with between 8 and 17 participants per session. Overall, there was a significant increase in immediate recall of course information (knowledge) for participants from all seven companies. However, participants had difficulty applying the course content to videoclips of risk situations. The understanding of the level of injury risk and injury risk factors had the smallest score increase from pre to post course and the lowest average pre and post course scores (40% and 53% respectively). The outcome evaluation also showed improvements from pre to post course for self-efficacy (confidence in one's ability to minimize risk of back, shoulder and neck injury) and self-reported behaviour with respect to lifting practices, although there were ceiling effects on the measure.

A concurrent process evaluation of the *Back Course* was also conducted, consisting of course observation, focus groups with program participants and interviews with company contact people. Observation of eight *Back Course* sessions revealed that while course content quite was consistent from session to session, there was considerable variation in location, set-up, group size, and level of interaction between instructor and participants. Readability of course materials, examined

independently by two assessors using three readability formulae, revealed that exercise hand-outs required a Grade Equivalent of 6-8, overheads an equivalent of Grade 9 level, while the ergonomic checklist required a Grade 8-9 reading level. Overall, 11% of respondents had less than a high school level of education making the course materials difficult for them to understand. It is likely that many of those who did not complete the questionnaire also had difficulties with the comprehension of course materials.

Eight focus groups were conducted with 39 participants of the *Back Course* between three and six months after taking the course to obtain their impressions and in-depth feedback on the course. Participants were generally positive about the content, particularly about the videoclips shown in the course of job tasks within each company, course examples, practice sessions and exercises. Several suggestions for improvements of course content included: adding more content on the upper limb and doing a refresher course about six months later to reinforce the principles. In addition, some participants indicated that they had difficulties understanding the course content due to language issues and suggested that the instructor use more pictures or offer a train the trainer approach to some employees to diffuse the information throughout the company. Focus group members reported increased awareness, increased knowledge and changes in behaviour. Those from one company noted that some changes were made to their work equipment and job design as a result of their recommendations after taking the course. Barriers identified that prevent individuals from making behaviour changes in their workplace included: time, equipment, the work environment, and tensions between management and employees.

Based on the findings from the outcome and process evaluation, four primary recommendations were made concerning the *Back Course*: 1) develop a refresher course for *Back Course* participants to review biomechanical principles, discuss practical issues about handling

materials, and practice handling materials in the workplace; 2) develop an additional course about the upper limb to reinforce the principles described in the *Back Course* and provide new information; 3) design a train-the-trainer approach for diffusing information throughout a company; and 4) continue to include the knowledge quiz before and after taking the course in order to be sure that the course results in the same impacts in knowledge as found in this study. The results of this study may not be generalizable to offerings of the *Back Course* without the pre course knowledge quiz.

Future studies examining back education interventions should include measures of longer-term retention of information. It would also be desirable to objectively measure behaviour change by: 1) videotaping or directly observing participants in both a clinical (laboratory) and an applied setting to determine whether the job design influences the behaviour; or 2) asking participants to record their activities in a diary or log. Future studies should also examine the influence of gender on behaviour and their interaction with reporting of injuries and pain symptoms. While gender was a significant predictor of behaviour change in the present study, small sample size precluded subgroup comparisons. Finally, injury prevention efforts must consider factors at several levels within a company–the entire organization, worksite, team, occupation and individual. However, current measurement tools, data collection and analysis of employees in the workplace generally do not take into consideration the complex hierarchical levels within an organization. Through the process of continuous evaluation and subsequent program modifications, the workplace and the programs that are offered in it will take strides in reaching their safety goals to help prevent injuries and provide high quality programs for employees.

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Chapter 1: Introduction and Overview

1.2 Statement of the Problem

Workplace injuries contribute to significant costs for employers and reduced quality of life for workers. Back related injuries, followed by injuries of the upper extremities, are the most common types, accounting for 29%-34%, and 20%-24%, respectively, of all compensable workplace injuries based on statistics from 1989 to 1998 (Workplace Safety and Insurance Board, WSIB, 1998). Back and upper limb injuries, particularly strains and sprains, affect the majority of adults sometime in their lives (National Institute of Occupational Safety and Health, NIOSH, 1997), and constitute the largest category of lost time claims (45% to 57%) in Ontario for workplace injuries (WSIB, 1998).

Workplaces are increasingly offering programs to improve both on-the-job and off-the-job safety to reduce workplace injuries (Craig et al., 1994). However, integrating these two approaches into comprehensive workplace programs is not common (Eakin and Weir, 1995), although this approach has been recommended (McDaniel, 1987; Sloan, 1987). Offering a program to address the interrelationships between both on-the-job and off-the-job safety promotes the connection between safety at work and safety at home. For example, handling materials safely at work will not matter if an injury occurs at home or during recreational activities.

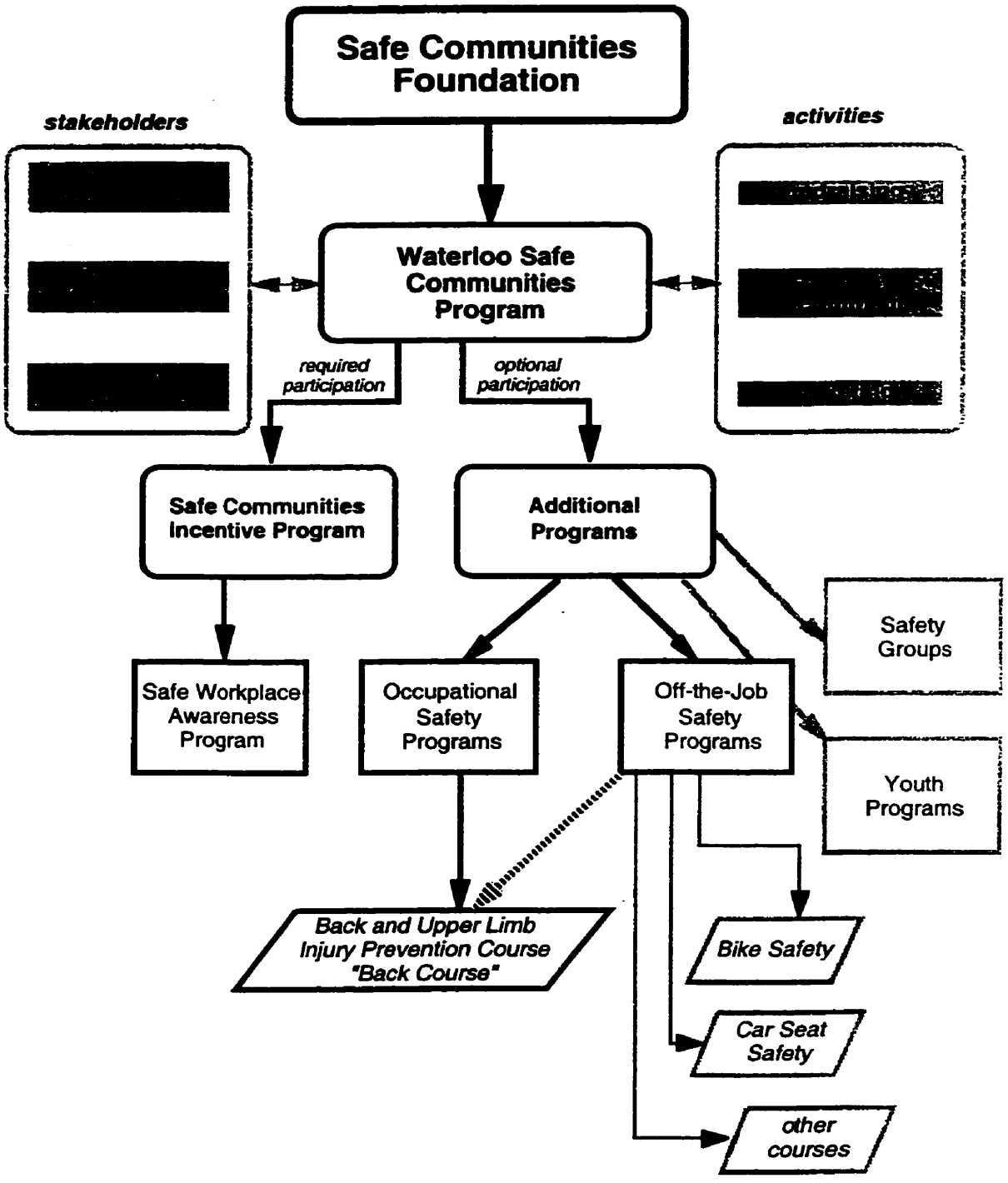
Safety programs are commonly offered in large workplaces. However, in Canada, 80% of workers are employed in businesses with 50 employees or fewer (WSIB, 2000). Small businesses are reported to have documented health and safety problems in their workplaces (Spiegel and Yassi, 1989; Tuskes and Key, 1988). Furthermore, small businesses have few

resources including time and money, so adequate safety training and education for workers is rare (Heath, 1982). The definition of small business is inconsistent in the literature. It has been variously defined using the number of workers in the workplace as the criterion for the definition (e.g., fewer than 50 workers (WSIB, 2000) or fewer than 100 workers (Craig et al., 1994)), or using workplace insurance board premiums of less than $90,000 in insurance premiums as the criterion (Waterloo Safe Communities Program see below).

The Waterloo Safe Communities Program (WSCP) is a multifaceted initiative intended to address the challenge of reaching smaller size businesses/workplaces, as well as the challenge of addressing off-the-job, in addition to on-the-job or occupational health and safety. Figure 1.1 illustrates the structure and functions of the WSCP. The WSCP is only one of several such initiatives (there are currently 14 other communities in Ontario and five in Alberta participating in this venture). The Safe Communities Foundation began in 1996 as a partnership between the private and public sectors, designed to target smaller size local businesses and address community-wide safety. Waterloo submitted an application for funding to this foundation in 1996, which received approval and support. Figure 1.1 shows the primary stakeholder groups. It is important to note that the "coalition committee" is comprised of individuals who manage or deliver on and off-the-job safety courses.

As can be seen from Figure 1.1, there are two program arms–the Safe Communities Incentive Program and Additional Programs. The Safe Communities Incentive Program is mandatory for local participating companies, while the remaining programs are optional. Companies that complete the required component may share in a 75% incentive rebate of any savings in their group's annual WSIB claim costs. In return, they are required to direct 10% of

Figure 1.1 Waterloo Safe Communities Program



their rebate back into the WSCP. Participating companies receive occupational safety training, worksite evaluation and mentoring from qualified safety consultants to assist in developing action plans, and closer partnerships with community safety groups (e.g., police, fire services).

The Off-the-Job Safety Program initiated in spring of 1999, is an optional value-added set of services for participating companies. This component of the WSCP targets employees and, indirectly their families, by including courses that are related to safety both on and off the job (such as car seat safety, recreational safety, bike safety and fire extinguisher safety). The goals of this umbrella program are to improve the "safety culture" in the workplace, increase safety knowledge, and change safety practices at home as well as in the workplace. One program falling under this umbrella, namely the *Back and Upper Limb Injury Prevention* course, bridges on-the-job and off-the-job safety education.

The conceptual basis for the Off-the-Job Safety Program came from DuPont Canada, a large, multinational chemical company based in Kingston, Ontario. Bertera (1990 [a and b], 1993) has reported that DuPont's program in the United States (very similar to the Canadian program) reduces disability days. DuPont Canada boasts a very low reported rate of occupational injuries. They assert that the educational component of their safety program helps to develop a culture of safety at home and in the workplace, and also appears to prevent injuries in their workplace. Although DuPont's program has not been formally evaluated, the Executive Committee of the WSCP decided to offer a comparable program in smaller size companies in the city of Waterloo and evaluate the program's effectiveness.

1.2 Back and Upper Limb Injury Prevention Course

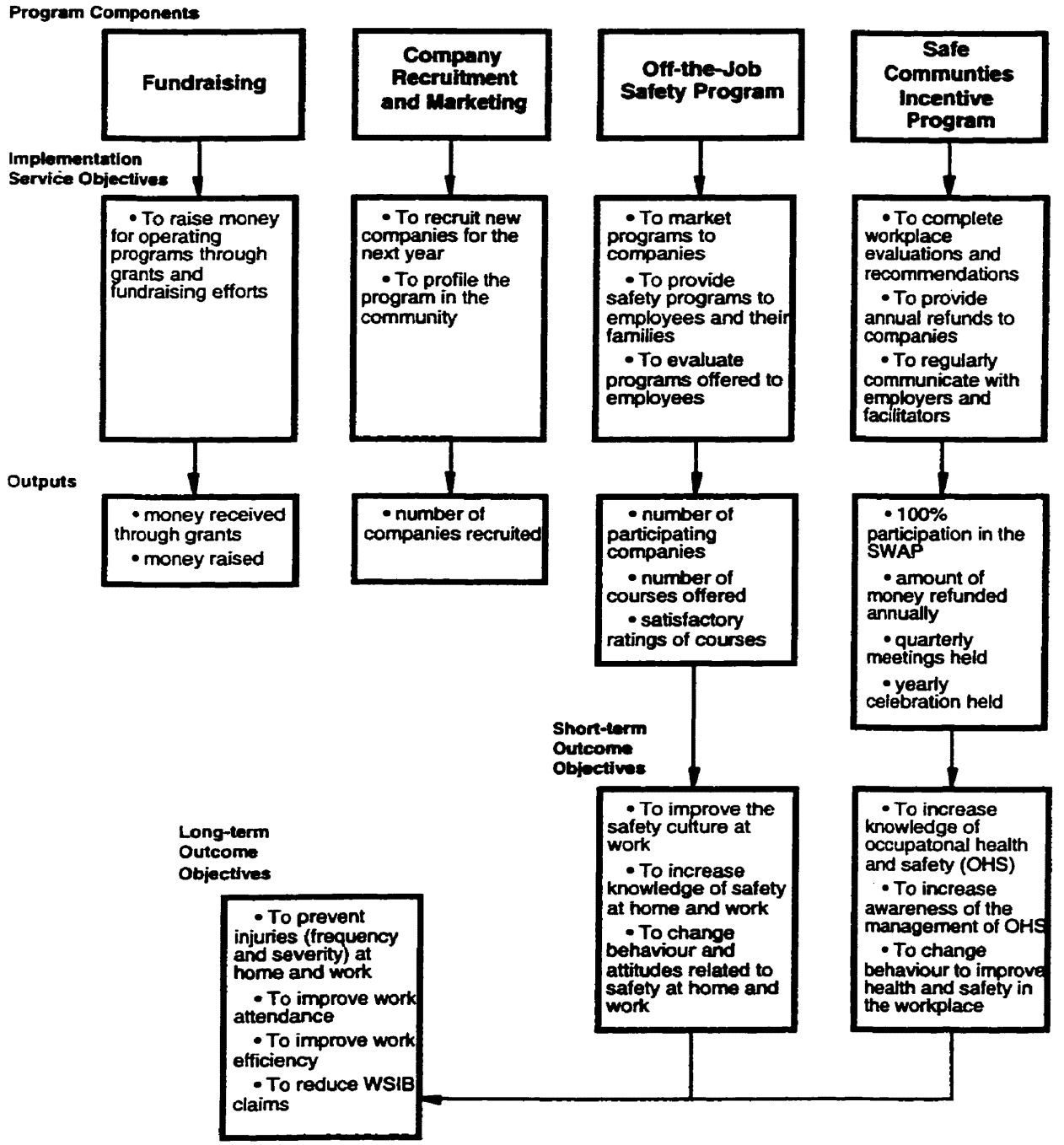
The *Back and Upper Limb Injury Prevention* course, hereafter referred to as the *Back Course,* was initially developed in 1988 at the University of Waterloo by Dr. Robert Norman and Ms. Margo Frazer. The *Back Course* is based on five basic principles for appropriate handling of materials to prevent injury, namely: (1) moving after prolonged immobility; (2) lightly tensing of torso muscles before handling materials; (3) maintaining low moment (torque) forces at all joints; (4) maintaining normal spinal curve; and (5) avoiding extreme twisting of the spine. These basic principles are supported by scientific evidence from ergonomic studies (McGill & Norman, 1993) and considered relevant to a wide range of on-the-job and off-the-job activities.

1.3 Rationale for the Current Project

The author of the present study and a thesis committee member were approached to assist with the evaluation of the Waterloo Safe Communities Program (WSCP) initiative. As part of evaluation planning, a program logic model was developed in consultation with a subcommittee of the Executive for the WSCP. A program logic model is simply a diagram which illustrates the primary components of the program, the objectives of each component, and their linkages (Myers, 1999; Rossi, Freeman & Lipsey, 1999; Rush & Ogbourne, 1991). Program logic models assist program planners and providers in visualizing the program, and is a useful tool for clarifying objectives, revealing issues of implementation, and setting priorities in evaluating planning. Figure 1.2 contains the logic model developed for the entire WSCP organization.

Some of the programs that the Executive Committee of the WSCP wanted to offer, namely the Additional Programs (Off-the-Job Safety Program, Safety Groups and Youth Programs), had not yet been implemented. Prior to implementation, and certainly prior to

Figure 1.2 Waterloo Safe Communities Program - Program Logic Model



widescale implementation, it is generally desirable to conduct a needs assessment to determine the need and demand for the program(s) in question. "Needs assessment is the systematic appraisal of the type and scope of an unmet need, the characteristics and preferences of the intended target group, and the nature and scope of existing services directed at this target group" (Myers, 1999; p. 42). The target audience for the WSCP is smaller size business firms (defined as under $90,000 in WSIB premiums) operating in the City of Waterloo. The executive committee was particularly interested in knowing the extent to which their target group was interested in offering various off-the-job safety courses, as well as which factors related to such interest and commitment. Thus, the first study, undertaken as part of the current project, constituted a needs assessment of the level of interest and commitment to off-the-job safety courses on the part of the 78 companies participating in the WSCP at the time. The specific objectives, methods, and findings of this study are presented in Chapter 2 of the thesis.

The Executive Committee of the WSCP also expressed particular interest in the *Back Course* for a number of reasons. As noted earlier, this is one of the few courses that specifically addresses both on-the-job and off-the-job safety. Although the effectiveness of this program has never been formally evaluated in a field setting, there is evidence for the efficacy of the underlying principles based on highly controlled, biomechanical laboratory studies (McGill & Norman, 1993). More recently, a case-control study of auto workers has shown that one of the variables addressed in the Back Course, the moment of force applied to the back and arms, is a significant epidemiological risk factor for musculoskeletal disorders (Neumann et al., 1999). For these reasons, the committee was very interested in evaluating the effectiveness of the *Back Course* delivered by companies in the Waterloo region.

Accordingly, the second part of this thesis involved a systematic evaluation of the *Back Course* delivered in the city of Waterloo. This study incorporated mixed methods, which have five key objectives according to Greene et al. (1989): 1) **triangulation** or the use of multiple methods to obtain convergence of the results of each method, 2) **complementarity** or examining different aspects of the program being studied, 3) **initiation** or exploring new ideas, discrepancies in the results, 4) **development** or using the methods so that the results from one method inform the next method utilized and 5) **expansion** or adding to the scope of the project. Specifically, both an outcome and process evaluation of the *Back Course* were conducted. "Outcome evaluation is the systematic appraisal of the program's impact on clients, in relation to level of program participation and baseline characteristics" (Myers, 1999, p. 49). Process evaluation, meanwhile, is the "systematic appraisal of program usage and delivery under normal or routine operation" (Myers, 1999, p. 47). While outcome evaluation addresses program effectiveness (the extent to which a program has an impact or produces intended client outcomes), an accompanying process evaluation is necessary to determine how and why a program may or may not have the desired effects on clients (Myers, 1999; Rossi et al. 1999). Impact studies alone would constitute a "black box approach", i.e., an inability to interpret the mechanisms and conditions responsible for desired results (Rossi et al., 1999).

Chapter 3 presents the specific objectives, methods and results of the outcome evaluation of the *Back Course* delivered to employees in seven companies operating in the city of Waterloo for the purposes of this study. This chapter begins with a review of the literature on back education programs, followed by a detailed description of the *Back Course*. The outcome evaluation addresses the program's impact on participants' knowledge, self-efficacy, and

behaviour with respect to safe lifting practices (before/after comparisons). Linear and logistic regression analyses were conducted to identify factors that may relate to desired outcomes.

Chapter 4 presents the specific objectives, methods and results of the accompanying process evaluation component of the *Back Course*. Specifically, qualitative methods (focus groups and interviews) were used in order to solicit detailed feedback from employees (both managerial and front-line) who had attended the course, as well as company representatives who had chosen to endorse the course. The overall purpose of this process evaluation was twofold: (1) to assist with interpretation of the outcome evaluation findings: and (2) to examine factors influencing the optimal implementation and delivery of the program, and to recommend subsequent program modifications if necessary.

The final chapter of this thesis, Chapter 5, attempts to tie these studies together. First, the outcome evaluation findings concerning the *Back Course* will be discussed in relation to the accompanying process evaluation findings. Limitations of the methods will be noted and recommendations specified concerning future delivery of this program. Next, the examination of employer interest in off-the-job safety programs, more generally, will be used to develop recommendations for the Waterloo Safe Communities Program and similar programs in other regions. Directions for further program development and evaluation, as well as future research studies, will conclude this final chapter of the thesis.

1.4 Statement of Purpose

The overall purpose of the thesis was to conduct a systematic program evaluation to provide direction to the Executive Committee of the Waterloo Safe Communities Program about the Off-the-Job Safety Component and to the course developers about the *Back and Upper Limb Injury Prevention* course. The evaluation was conducted with small and medium sized companies involved in the Waterloo Safe Communities Program. The evaluation began with a needs assessment to determine the interest and commitment in offering an "Off the Job Safety Program" to employees. The next step of the systematic evaluation was the outcome and process evaluation of the *Back Course*, offered to companies involved in the Waterloo Safe Communities Program. Table 1.1 summarizes the evaluation questions for each step in the systematic program evaluation.

Table 1.1 Summary of Study Purposes

Step in Program Evaluation	**Evaluation Questions**
Needs Assessment - Chapter 2	To examine employers' interest and commitment to offer an off-the-job safety program. To determine the factors that are related to employers' willingness to offer an off-the-job safety program. To examine potential program participants' (i.e., those who participated in the *Back Course*) interest in taking off-the-job safety programs. To determine the factors that are related to program participants' interest in taking off-the-job safety courses.
Outcome Evaluation of *Back Course* - Chapter 3	To explore the degree to which the program increases immediate recall of principles learned in the *Back Course*. To determine the degree to which the program changes self-efficacy with regard to handling materials at work and at home. To determine whether the program changes behaviour with regard to handling materials at work and at home. To determine whether the perception of work changes as a result of taking the *Back Course*. To explore factors that may relate to increased knowledge, self-efficacy and behaviour change.
Process Evaluation of *Back Course* - Chapter 4	To measure the estimated grade levels required to understand the *Back Course* print material. To examine factors influencing the optimal implementation and delivery of the *Back Course*. To examine the impressions of *Back Course* participants. To examine reasons for possible program impact and determine barriers to changing behaviour. To determine the company contact's expectations for the WSCP and the *Back Course* and examine whether these expectations were met.

Chapter 2: Examination of Employer Interest in an Off-the-Job Safety Program

2.1 Introduction

Planning, coordinating and evaluating workplace safety programs may influence the effectiveness of the programs, yet these fundamentals are often overlooked. Based on recent findings from the Canadian National Workplace Survey, of all the companies that offer safety training and accident prevention programs, only 30% base their offerings on the perception of needs for workers and the organization (Craig et al., 1994).

Needs assessment is typically under-utilized as a methodology for program planning (Myers, 1988). Data for needs assessments are collected from key informants and/or potential users of programs. In workplace settings, key informants may be employers and/or health and safety representatives; usually individuals or groups aware of current services and able to identify programs and conditions under which they would offer particular programs. Key informants may also be a group with some control over programs that could be offered in the future. A needs assessment may also involve potential users as a method to determine the groups' potential interest in a program and the conditions for their participation (example, costs, schedules) (Myers, 1999).

Planning the Off-the-Job health and safety program is a necessary first step in the process of program development. This evaluation involved interviewing a number of company contacts from the small and medium sized companies involved in the Waterloo Safe Communities Program to examine the level of interest in the Off-the-Job Health and Safety component and various Off-the-Job health and safety courses (e.g., Bike Safety, Fire Safety, *Back and Upper*

Limb Injury Prevention) and the conditions that they would require in order to offer the courses (i.e. schedule, fee, advertisement, time of day). The purpose of the evaluation was to examine employers' interest and commitment to offer an off-the-job safety program with various course offerings and factors related to willingness to offer such a program. Another purpose was to examine potential program participants' (i.e., those who participated in the *Back Course*) interest in taking off-the-job safety programs and under what conditions they would be interested.

2.2 Methods

2.2.1 Recruitment

Seventy-eight participating companies involved in the Waterloo Safe Communities Program were invited to a Quarterly Meeting where there was a presentation describing a potential Off-the-Job health and safety program including topics such as preventive back care, first aid, fire safety, recreational safety, and other types of safety (Appendix A for a sample list of courses described). Fifty-three companies out of the potential seventy-eight (67.9%) involved in the Waterloo Safe Communities Program expressed an initial interest in the Off-the-Job health and safety program and were subsequently contacted and interviewed in person or over the phone to assess the extent of interest and commitment in such a program.

2.2.2 Data Collection Procedures

A brief survey was distributed to the 28 companies attending the Quarterly Meeting and was also mailed to the 50 company representatives who did not attend. Companies who did not attend were contacted by phone to determine their initial interest in an Off-the-Job health and safety program (Appendix B for the questionnaire). The 53 companies that expressed an initial interest in an Off-the-Job Safety program were subsequently contacted and interviewed in person

or over the phone to determine the conditions under which they would offer the program (i.e., whether the company contact would be: i) willing to offer paid time to take the courses, ii) willing to pay the fee for the courses, iii) what fee they would be willing to pay for the courses, iv) would they be willing to advertise or promote these programs, and v) would they suggest employees take these courses on their own time) (Appendix C for the structured interview script). Notes were taken during each interview. All interviews were conducted by the author.

In addition, participants involved in the outcome evaluation were given a questionnaire six weeks after participating in the *Back Course*. These individuals were asked what types of off-the-job safety courses they would be interested in and under what conditions they would get involved in the courses (e.g., would they attend on their own time, would they pay for the courses). *Back Course* participants will be described in Chapter 3.

Data from the survey and interviews were entered into Excel and analysed using SPSS for Windows (Statistical Package for the Social Sciences for Windows version 10). The analysis included tabulation of frequencies and percentages.

2.3 Results

2.3.1 Sample Characteristics

Overall, 53 of 78 (68%) companies involved in the Waterloo Safe Communities Program expressed an initial interest in the Off-the-Job Safety Program and were interviewed. Forty-three company contacts of the 53 interested companies were interviewed in person (81% of sample), and 10 company contacts were interviewed over the phone (19% of sample) due to scheduling problems (8/10) or due to the preference of the interviewee (2/10). The characteristics of companies surveyed for the needs assessment are shown in Table 2.1. The companies ranged in

size from three to 400 workers; the average company size was 55. The companies were in sales and/or service (34/53) (examples: plumbing, restaurants, fuel sales and distribution, electrician, hotel), manufacturing (14/53) (examples: paintbrush, beer, sausages, chicken processing, stainless steel tubing), construction (4/53) and technical (1/53) sectors. The majority of companies were in sales and/or services (64%) and employed fewer than 49 workers (62%).

Table 2.1 Characteristics of Participating Companies (N=53)

Company Characteristics	%	(n)
Type		
Sales and/or Service	64	(34)
Manufacturing	26	(14)
Construction	7	(4)
Technical	2	(1)
Size of Company (Workers)		
49 or fewer	62	(33)
50-100	23	(12)
101-200	11	(6)
200+	4	(2)
Union (Yes)	4	(2)

2.3.2 Interest in Off-the-Job Health and Safety Topics

Company contacts indicated that they were interested in many of the health and safety topics listed on the survey. As can be seen from Table 2.2, preventive back care was clearly the topic of most interest, followed by recreational safety, stress management and fire safety. There were no significant differences in course interests comparing companies of different sizes and types.

Table 2.2 Interest in off-the-job health and safety topics listed on survey.

Courses	%	(n)
Preventive Back Care	83	(44)
Recreational Safety	53	(28)
Stress Management	41	(22)
Fire Safety	38	(20)
Child Safety	28	(15)
Slips and Falls	26	(14)
Mechanical Safety	26	(7)
Upper Limb Repetitive Strain	23	(12)
First Aid	17	(9)
Use and Disposal of Solvents/Paints	17	(9)
Personal Protective Safety	17	(9)
CPR	15	(8)
Safety with Hazardous Chemicals	15	(8)
Ladder Safety	13	(7)
Electrical Safety	11	(6)
Natural Gas and Propane Tank Safety	4	(2)

Ninety-two percent of company contacts indicated that they would pay worker time for courses only if the courses were related to workplace safety. Only 2% of company contacts were willing to pay for worker time in off-the-job safety courses, and a further 4% indicated that they might be prepared to pay worker time for off-the-job safety courses.

In addition, no more than 28% of company contacts indicated that they would pay the course fee for off-the-job safety courses; whereas 64% of company contacts indicated that they would pay the course fees only for programs related to workplace safety. Of those company contacts who indicated they would pay the course fee, the amount they would pay for courses ranged from $5 - $100, with an average of $63.

All company contacts indicated that they would post information about health and safety courses for advertisement and promotion. Ninety-eight percent of company contacts indicated

that they would suggest/encourage employees to take off-the-job safety courses on their own time.

2.3.3 Response from Impact Questionnaire Respondents

In the post course impact questionnaire (to be described in Chapter 3), participants were asked whether they would be interested in off-the-job safety courses under two conditions: 1) if their company gave them time off work to take the courses and 2) if they were required to take the courses on their own time. If their company gave them time off work to take the courses, the most popular off-the-job safety courses were household hazards (44%, N=45), followed by personal protective safety (42%, N=43), and fire safety (39%, N=40) (Table 2.3).

If participants were required to take courses on their own time, the courses were slightly less popular overall. The most popular off-the-job safety courses individuals might consider on their own time were the same as the most popular courses individuals expressed interest in during work time: household hazards (42%, N=43), personal protection (32%, N=33) and fire safety (32%, N=33) (Table 2.3).

There were differences in interest in off-the-job safety courses by company. For example, 50% of respondents from the plumbing company expressed interest in a recreational safety course when given time off work to take the course compared to 14% of respondents from the hotel. Furthermore, 62% at the chicken processing plant expressed interest in a course on household hazards compared to 20% at the boiler service when given time off work to take the course.

Table 2.3 Interest in Off-the-Job Safety Component Under Various Conditions

Conditions Under which interested	Safety Courses	Hotel (N=21)	Broiler Service (N=5)	Clothing Warehouse (N=7)	Plumbing (N=6)	Chicken Processing (N=16)	Electrical Utilities (N=48)	Overall (N=103) %
Time off Work	**Bike Safety**	9%	20%	0%	0%	6%	21%	14%
	Recreational Safety	14%	20%	43%	50%	25%	29%	27%
	Fire Safety	33%	40%	57%	50%	44%	35%	39%
	Car Seat Safety	14%	20%	28%	17%	12%	17%	16%
	Slips and Falls	33%	20%	57%	50%	50%	31%	37%
	Household Hazards	24%	20%	43%	50%	62%	48%	44%
	Personal Protection	38%	40%	57%	33%	44%	42%	42%
On Own Time	**Bike Safety**	5%	0%	14%	17%	0%	23%	14%
	Recreational Safety	5%	0%	14%	50%	12%	39%	25%
	Fire Safety	28%	0%	43%	33%	37%	33%	32%
	Car Seat Safety	9%	0%	29%	17%	6%	16%	14%
	Slips and Falls	24%	0%	14%	33%	12%	21%	19%
	Household Hazards	33%	20%	29%	50%	50%	46%	42%
	Personal Protection	33%	0%	43%	33%	44%	29%	32%

2.4 Discussion

This study was intended to provide information about the perceived need for an Off-the-Job Safety program, the specific topics of interest and the conditions that would be needed for company contacts to support the initiative. The information was provided to the Waterloo Safe Communities Executive Program in order to plan an Off-the-Job Safety program.

Most company contacts (83%) indicated potential interest in preventive back care. Employers were generally willing to pay for workers' time and course fees, because they perceived a linkage existed between back injury prevention in the home and at work. Many company contacts also expressed interest in several of the other Off-the-Job Safety courses listed. For example, 53% of company contacts expressed interest in recreational safety. However, most employers were demonstrably unwilling to pay for worker time (92%) or for course fees (64%) unless the course was directly related to workplace safety.

Employers of small businesses have been hypothesized to be hard-to-reach because they lack resources (time and money) and motivation to deal with health and injury (Eakin, 1992), and there are few ways for communicating with them since many are not unionized or involved in safety associations. From the needs assessment conducted through this organizational network, employers felt that an off-the-job safety program may be beneficial for employees, but employers would not pay for employees to take part in the programs.

The results of this needs assessment are consistent with the findings of the 1992 Canadian National Workplace Survey. The National Workplace Survey also found that small businesses were more likely to provide information than to offer program activities (Craig et al., 1994). Thus, although the literature indicates that small businesses do not offer enough safety training or education for employees (Heath, 1982), when small business employers are asked if they want to provide additional training and education for workers they may not see the need or have the motivation to offer training. These findings illustrate the importance, as part of a needs assessment, of examining predictive indicators of commitment, in terms of commitment to pay for worker time and expenses and not simply declared interest.

There were company differences reported when comparing the interest and commitment of *Back Course* participants in specific safety courses. These differences may have been due to

factors such as gender and education. For example, 50% of respondents from the plumbing company expressed interest in recreational safety; whereas only 14% of respondents from the hotel expressed interest in this course. In terms of gender, 100% of plumbing company respondents were male (n=6) while 71% of hotel respondents were female (n=15). In addition, all plumbing company respondents had some or completed college, while 85% of hotel respondents had completed high school or less education. This finding is difficult to interpret, since there was a very small sample size and there were extreme differences in both gender and education in these companies.

Employers are "gatekeepers" to offering workplace programs, thus, critical to determine employers' interest and factors that may influence their willingness to offer a program. One limitation of this needs assessment is that only *Back Course* participants (i.e., not employees from all companies involved in the needs assessment) were asked what types of courses they would want and under what conditions that they would want these courses. An important follow-up to this needs assessment may be a periodic needs assessment, which constitutes the systematic appraisal of consumer awareness and an examination of whether other similar services are available and consideration of new markets or target groups (Myers, 1999 p. 45). Employees from all companies involved in the Waterloo Safe Communities Program might be interviewed to see if employees are aware of the Off-the-Job Safety Program, and to determine whether there are other off-the-job safety services available to them in the workplace.

Chapter 3: Outcome Evaluation of the *Back and Upper Limb Injury Prevention* course

3.1 Introduction

Evidence-based prevention of musculoskeletal disorders is critical since back and upper limb injuries affect the majority of adults at some time in their lives (NIOSH, 1997). The cumulative incidence of low back pain (i.e., any back pain between the ribs and top of the leg, from any cause) ranges from 60 to 80% (Deyo et al., 1991). The point prevalence rates of low back pain range from 4.4 to 33.0 % , the one year prevalence rates range from 3.9 to 63% (Loney & Stratford, 1999). There is also strong evidence that musculoskeletal disorders of the upper limb and low back are associated with work-related factors including physical and psychosocial risks (NIOSH, 1997). The duration of nearly 20% of those with work-related low back pain lasts between 3 weeks to 6 months (Cyriax, 1975). In addition, recurrence of musculoskeletal disorders is common in 60 to 85% of patients (Shelerud, 1998). Finally, although the cause of back and upper limb injuries is complex, it is due in part to overexertion, improper body mechanics and lifting techniques (Klein et al., 1984). Thus, the behavioural prevention of back and upper limb injuries is a high priority for many employers.

Based on findings from the Canadian National Workplace Survey, 40% of workplaces offer preventive back care courses to their employees (Craig et al., 1994). The objectives of such courses are to prevent low back injuries in a number of different ways: increasing awareness of back and upper limb injuries (Walsh and Schwartz, 1990); increasing knowledge of course content and handling practices (McCauley, 1990); changing attitudes (Daltroy et al., 1993); increasing exercise compliance (Linton and Kamwendo, 1987); and changing manual handling practices (McCauley, 1990). Results of back injury prevention courses are reported in

section 3.2.3. Some courses have shown increases in knowledge, behaviour and reductions in injury or pain, but others have not shown those positive benefits.

Evaluating the effectiveness of this particular *Back Course* is warranted because the course has never been examined to determine its impacts on course participants before. There is no consensus about the appropriate content of back injury prevention courses (Cohen et al., 1994), and the content varies across courses (such as Versloot., 1992, Daltroy, 1997). Thus, the results of one course evaluation may not be generalizable to another.

3.1.1 Purpose and Overview

The purpose of this study is to evaluate the outcome of the *Back Course* within the context of the *Off-the-Job Safety* component operating within the WSCP. A similar approach was used for the evaluation of a health promotion program delivered to workplaces through a mobile van called the HeartMobile (Gray & Myers, 1997). Focus groups were conducted for the process evaluation in different workplaces and these data were particularly helpful for recommendations to improve the HeartMobile program (Gray & Myers, 1997).

The main objectives of the outcome evaluation in this study were:

- To explore the degree to which the program increases immediate recall of:
  a) biomechanical principles, b) spinal anatomy, c) back injury and d) low back exercises.
- To determine the degree to which the program changes self efficacy (i.e., confidence in one's ability to complete a task) and behaviour with regard to handling materials at work and at home.

Course objectives are critical for governing the type of learning that should result from a program and the techniques that are used to evaluate it. For example, in assessing knowledge resulting from a given education program, the measure itself must be based on the specific educational content. Existing, published knowledge measures are therefore difficult to find. A

literature search yielded no published knowledge measures relevant to prevention of back injuries. Thus, the effort in developing such a knowledge test is justified since the *Back Course* is widespread (i.e., delivered in many workplaces) and the course content does not change substantially over time.

The evaluation of the *Back Course* had a quasi-experimental, one group pre/post design for the knowledge quiz and impact questionnaire. Participants served as reflexive controls for the impact and knowledge questionnaires (Rossi et al., 1999). Although the design is limited because there was no comparison or control group, there were no companies that were interested in being "control" or "comparison" companies. The company contacts agreed to participate in the evaluation after they had previously decided that they would offer the *Back Course* to employees. In comparison, in the evaluation of the Heartmobile program by Gray and Myers (1997), there was an existing lower cost comparison program. Interestingly, however, few companies agreed to receive the comparison program as they perceived it to be an inferior program (Gray and Myers, 1997).

3.2 Background Literature

The review of the literature that follows examined studies identified through: 1) a database search; 2) articles from the reference lists of the initial articles retrieved from the database search; and 3) articles recommended by thesis committee members. The databases searched include Medline, Psychlit, Healthstar, Psychological Abstracts, ERIC and CISTI from the year 1975 to the present. Articles were found using search terms "back and upper limb education", "back school", "program evaluation and back/spine education or back school", "back/spine education", "back injury prevention" and "back program". Only primary prevention articles were selected as studies for this literature review (i.e., interventions aimed to prevent the onset of back injuries). However, review articles on back education programs were identified,

examined and provided insight for this review. These review articles include King (1993); Cohen et al., (1994) on secondary prevention of injuries (i.e., prevent a recurrence of back injury); Frank et al., (1996); Lahad et al., (1994) and Violinn (1999). Cohen et al. (1994) reviewed secondary prevention of injuries, but discussed back injury prevention in general, as well.

Educational programs yielded from the literature search, focussed on preventing back injuries, not on injuries of the upper limb. Thus, the literature review focussed exclusively on back education programs. The *Back Course*, evaluated in this study also focussed primarily on back education with three and a half hours allocated to back education and only approximately ten minutes allocated to upper limb injury prevention.

3.2.1 Overview of Educational Programs to Prevent Back Injuries

Educational programs for workers and management to reduce back injuries have been described in the published literature since the late 1970's (Snook et al., 1978; Mattmiller, 1980; Fitzler, 1983). In the 1990's, educational programs to prevent low back injuries were still being evaluated with contradicting results (Daltroy et al., 1997; Feldstein et al., 1993). Despite the mixed results, "back schools" have become widely introduced for the primary prevention of low back pain and injury. It is difficult to compare studies of back educational programs because of poor program description, different course content for each program, different study methodologies employed and different outcomes of interest in a wide-variety of time frames.

3.2.2 Length, Approach, Content and Delivery of Back Educational Programs

In order to understand evaluation results, it is critical to examine the nature of programs being examined. Back educational programs described in the literature vary considerably in their approach, content, length and delivery. The courses were generally offered by a health professional such as a physiotherapist or occupational therapist. Generally, these programs

included discussions of musculoskeletal anatomy, physiology of the lower back, body mechanics and posture. The programs may have also incorporated physical fitness, stress management and nutrition. If the program was targeted to participants with injuries, the programs may have incorporated coping with pain, relaxation, activities of daily living and vocational guidance. For those with low back pain, an Australian programme (Kennedy, 1980), the Swedish Back School (Forssell, 1980), the Canadian Back Education Units (Hall, 1980) and the California Back School (Mattmiller, 1980) were developed, implemented in a wide number of settings and outlined in detail.

3.2.2.1 Length of Course

Appendix D summarizes the studies of 22 back educational courses. As can be seen, the course length ranged from one hour (Carlton, 1987; McCauley, 1990; Walsh and Schwartz, 1990; Wood, 1987) to 40 hours (Videman et al., 1989); consisting of anywhere from one session (Carlton, 1987, Chaffin et al., 1986, Feldstein et al., 1993, McCauley, 1990, Schenk et al., 1996, Walsh and Schwartz, 1990, Wood, 1987) to ten sessions (Engels et al., 1998, Engels et al., 1997). The course with 40 sessions took place over 2.5 years (Videman et al., 1989).

3.2.2.2 Content and Approach

Although back educational courses often incorporated discussions of biomechanics, anatomy, physiology of the lower back, and posture (Carlton, 1987; Chaffin et al., 1986; Daltroy et al., 1993; Daltroy et al., 1997; Weber et al., 1996; Woodruff et al., 1994; McCauley, 1990; Feldstein et al., 1993), there was tremendous variability in the topic coverage. Some courses incorporated strengthening exercises (Daltroy et al., 1993; Daltroy et al., 1997; Woodruff et al., 1994; Shi, 1993), stress management (Versloot et al., 1992; Weber et al., 1996) and management of other risk factors such as smoking and weight loss (Shi, 1993). It is not possible to grasp the full range of content covered across these courses because some authors did not provide a

detailed description (Engels et al.,1997; Engels et al., 1998; Schenk et al., 1996; Videman et al., 1989; Walsh and Schwartz, 1990; Wickstrom et al., 1993).

3.2.2.3 Biomechanical Approaches

The biomechanical approaches also varied across studies. Some courses advised lifting with a flexed lumbar spine so that the posterior ligamentous system is tightened and intra-abdominal pressure increased (as cited in Schenk et al., 1996). Other courses recommended lifting with the lumbar spine in the extended or lordotic position to reduce pressure on the intervertebral disc (Schenk et al., 1996). It is difficult to know the full variability in biomechanical approaches used in the studies to date, since they are often not fully described.

3.2.2.4 Delivery

Number of participants was not specified in several articles (e.g., Shi, 1993, Feldstein et al., 1993; Engels et al., 1998; Videman et al., 1989; McCauley, 1990), but most courses reportedly included between seven and 15 participants per class (Daltroy et al., 1993; Daltroy et al., 1997; Weber et al., 1996; Versloot et al., 1992, Schenk et al., 1996). In the U.S. Navy's Healthy Back Program there were 300 participants per class (Woodruff et al., 1994) which was much higher than any of the other courses.

Most commonly, the instructor for the back educational courses was a physical therapist (Daltroy et al., 1993; Daltroy et al., 1997, Weber et al., 1996; Woodruff et al., 1994; Videman et al., 1989; Schenk et al., 1996; Wood, 1987) or an occupational therapist (McCauley, 1990; Feldstein et al., 1993; Carlton, 1987). One educational course was taught by a consulting company, but the instructor's training was not specified (Chaffin et al., 1986). In many of the studies, instructors were not described (Walsh and Schwartz, 1990; Versloot et al., 1992; Engels et al., 1998; Engels et al., 1997).

Most courses were offered as an interactive session with an instructor (e.g. Daltroy et al., 1993; Feldstein et al., 1993; Weber et al., 1996; Engels et al., 1996; Woodruff et al., 1994), but the amount of interaction was likely influenced by the number of participants in each class. For example, the U.S. Navy Healthy Back Program had classes of 300 participants with one instructor (Woodruff and Conway, 1994) which would allow for less interaction than a class of seven with one instructor (Weber et al., 1996).

3.2.2.5 Summary of Back Educational Courses

Overall, the content and quality of back injury prevention courses were not uniform across the intervention studies reported to date in the literature. In a review by Cohen et al. (1994) of secondary prevention back education, the authors indicated that there was inconsistency in the content and duration of all types of education programs and that the interventions reviewed were not all high in quality. Currently, there is no consensus regarding the essential and effective components of back education. The authors of this review also suggested that interventions were often not adequately described, and recommended explicit description of program objectives in intervention studies (Cohen et al., 1994). Course objectives are critical for governing the type of learning that should result from a program, and the techniques that are used to evaluate the program. The findings of Cohen et al. (1994) for secondary prevention educational programs were consistent with the findings in this literature review of primary prevention educational courses.

3.2.3 Effectiveness of Back Education Programs

Back education interventions are intended to reduce workplace costs and prevent low back injuries in a number of different ways: increasing awareness of back and upper limb injuries (e.g., Walsh and Schwartz, 1990), increasing knowledge of course content and handling practices (e.g., McCauley, 1990), changing attitudes (e.g., Daltroy et al., 1993), increasing exercise

compliance (e.g., Linton and Kamwendo, 1987) and changing manual handling practices (e.g., McCauley, 1990). However, establishing the effectiveness of a back education program is not an easy task. Effectiveness is dependant on a number of factors: whether the course works under real world conditions, whether the course is delivered well, whether the course is complied with and whether the outcome of interest was accurately documented.

Although the outcomes described are important for program effectiveness, they are influenced not only by the intervention, but by other factors such as individual characteristics of the intervention participants and the course environment (Sidani and Braden, 1998). However, the evaluation of back education has rarely reported the impressions of program participants to explore course delivery, experiences of participants and participants' impressions of the course (Zwerling et al., 1997). None of the studies reviewed reported systematically collecting impressions of program participants. One study reported, anecdotally, that the education intervention was well-received (Wood, 1987).

Appendix D summarizes the findings from the 22 studies examining back education programs. Studies examined a broad range of outcomes (e.g., knowledge, attitudes, behaviours, costs, pain) at different follow-up times (immediate post course to seven years post course). In the next section, the results of the 22 journal articles will be described as they related to the specific outcomes of interest.

3.2.3.1 Changes in Knowledge

Follow-up times for assessing change in knowledge ranged from immediate post course (e.g., Schenk et al., 1996) to 2.5 years (Daltroy et al., 1993) and was examined in four studies (Walsh and Schwartz, 1990; Daltroy et al., 1993; Woodruff et al., 1994; Schenk et al., 1996). Knowledge was usually measured by a knowledge test through written or oral assessment. Increases in knowledge were shown across all studies, even after 2.5 years (Daltroy et al., 1993).

Woodruff et al. (1994) indicated that short term knowledge increased in U.S. Navy recruits after receiving the Healthy Back Program compared with an immediate post-course control with no education. Schenk et al. (1996) showed that an interactive program was more effective than a video program or no intervention in changing knowledge immediately following the course.

In six months follow-up, Walsh and Schwartz (1990) showed that knowledge of back pain increased significantly in both experimental groups (education and education plus orthosis) compared to a control, absenteeism was reduced (although not statistically significant) in both groups compared to a control and there was significantly less lost time in the education with orthosis group compared to a control group.

3.2.3.2 Changes in Behaviour

The follow-up for studies involving behaviour change ranged from immediate post test (Schenk et al., 1996) to 2.5 years (Videman et al., 1989; Daltroy et al., 1993) and behaviour was examined in nine studies. Behaviour was measured in a variety of ways including indirect methods like self-report (Daltroy et al., 1993) or direct methods like behavioural observation following a checklist or pre-specified criteria for safe or "correct" lifting or the number and percentage of harmful postures (Engels et al., 1998). Behaviour was observed for a specified task (patient transfer) (Feldstein et al., 1993) or for general handling practices observed in the work setting (Carlton, 1987). Behaviour was observed in person (e.g., Carlton, 1987) or through the use of videotape (e.g., Chaffin et al., 1986). In addition to measuring behaviour, some researchers measured lumbar lordosis (Schenk et al., 1996) flexibility, strength and anthropometric measures (Videman et al., 1989). Six of the nine studies that examined behaviour as an outcome showed changes in lifting techniques after the back program (Carlton, 1987 (outside laboratory); Videman, 1989; McCauley, 1990; Feldstein, 1993; Shi, 1993; Engels et al., 1998).

Schenk et al. (1996) showed that there were significant differences in lifting techniques in the intervention group compared to video or control groups examined immediately post course compared to a video program and control group. In two weeks follow-up, there was a significant difference in safe lifting practices in a laboratory for the participant group compared to a control group, but this difference was not shown in the workplace (i.e., when the participant was observed working on the job) (Carlton, 1987). Feldstein et al. (1993) showed that in four weeks, nurse participants improved their quality transfer of patients by 19% compared to no improvement in controls. However, there was a low program participation rate among nurses. Chaffin et al. (1986) showed that in 3 months safe lifting behaviours increased for two of the five principles taught in the course in participants post course compared to baseline. They also showed that the type of lifting behaviours most likely to be changed were the ones that were simple to learn. Data from the study indicated that there may have been ceiling effects for keeping the load close to the body before the course.

Engels et al. (1998) indicated that in 15 months, trained nurses in a hospital setting showed a significant improvement for a variety of tasks involving a patient examining the number and percentage of harmful postures and errors (i.e., using a checklist), but controls did not. They also found that the change in postures and errors did not result in a change in perceived physical exertion, but they did require more time for their tasks than controls (e.g., more likely to use a lifting device).

Videman et al. (1989) showed in 2.5 years that trained nurses scored significantly higher in skill assessment than controls, but that the patient handling skills were still rated below the midpoint of the 7-point scale. The authors indicated that if the work environment is ergonomically unsatisfactory, it may not be possible to change handling practices at work.

3.2.3.3 Changes in Injury Status

The follow-up for studies involving injuries as the outcome of interest ranged in length from eight months (Weber et al., 1996) to seven years (Wickstrom et al., 1993). Injuries were examined in 6 of 23 studies (Fitzler, 1983; Wood, 1989; Wickstrom et al., 1993; Weber et al., 1996; Daltroy et al., 1997; Shi, 1993). Injuries were measured by asking respondents to report back pain prevalence (Shi, 1993), through occupational records of the number of consultations with physicians (Wood, 1989), number of musculoskeletal injuries (Daltroy et al., 1997), lost time injuries and compensation costs (Fitzler, 1983), the rate of repeated injury after return to work or sick leave from work (Wickstrom et al., 1993). The articles examined in this review showed variable results for changes in injury status depending on a number of factors including the way injuries were measured.

In eight months follow-up, Weber et al. (1996) found that the number of consultations with physicians was reduced significantly in the participant group compared to a control group. Weber et al. (1996) also found that those who volunteer for back programs have often experienced back pain or injury in the past. In one year of follow-up, Shi (1993) indicated that compared to controls, self-reported back pain prevalence was reduced. Fitzler (1983) found after one year that there was an increased rate of incident reporting, but a 50% reduction in the frequency of lost time in participants of an educational course compared with baseline. Worker's Compensation costs were also reduced by a factor of 10.

3.2.3.4 Changes in Work Attendance

Only one study included in this review examined changes in work attendance (i.e., absenteeism) as an outcome of interest. In six years, Versloot et al (1992) found that there was a significant decrease in absenteeism in the intervention group compared to the control, an annual

savings of $900 per employee. Overall, the reduction in personnel costs to the company were calculated to be between $70,000 and $103,400 (Versloot et al., 1992).

3.2.4 Methodological Issues Related to the Evaluation of Back Education Programs

The published articles included in this review comprise the bulk of the literature related to back educational courses. Other reviews have evaluated the quality of studies, and excluded articles that do not meet a pre-determined methodological standard (e.g., Cohen et al., 1994 or Lahad et al., 1994). Studies in Appendix D were not selected on the basis of methodological quality, but were organized by study design. Of the 22 studies in Appendix D, five articles selected were randomized control trials, eight were non-randomized control trials, six were pre/post designs and three were post only designs. All the studies were included in this literature review to show the range of educational interventions, outcomes examined and the methodologies employed.

Although randomized control trials are important for determining the net effects of an intervention through random assignment, control of contextual factors and manipulation of treatment, the focus on the causal connection does not explain the intervention or program effects, why, how and under what conditions the intervention is effective. This focus on the causal connection ignores the mediating intervention effects which makes interpretation difficult (Sidani and Braden, 1998). That being said, methodological issues are still of central importance for understanding how the findings contribute to the body of knowledge as a whole.

In a review by Violinn (1999) on workplace interventions to prevent low-back disorders, the author distinguished between pragmatic and explanatory approaches to evaluation. The author referred to pragmatic evaluation studies as "more immediately responsive to the demand to evaluate worksite interventions" (p. 268) and as "useful in deciding whether an intervention is suited to a given worksite" (p. 268). Pragmatic studies deal with methodological obstacles (such

as a control group, randomization and placebo) efficiently (e.g., by not utilizing a control group) and are characterized as practical in intent. Violinn (1999) suggested that pragmatic studies are important for generating hypotheses that workplace interventions *may* prevent low back disorders. The author referred to explanatory evaluation studies as the opposite end of the spectrum as pragmatic studies, and indicated that they are more scientifically rigorous and include methodological features such as a pre/post design, control group, randomization and placebo control. These features will be considered in the next section.

3.2.4.1 Quasi-experimental Post Test Only Designs

Studies that evaluate interventions with a post test only design are limited because the outcomes are not assessed prior to study participation, there may be group differences at baseline and the extent of change cannot be measured (pre to post). If there is a ceiling effect for a particular measure (e.g., the participants and control group may have known a great deal about handling practices prior to the intervention so there may not be great differences after the intervention), it will not be possible to understand why an intervention may not show differences between groups. In this literature review, there were three post test only designs with a control group (Carlton, 1987; Schenk et al., 1996 and Woodruff et al., 1994).

3.2.4.2 Quasi-experimental One Group Pre/Post Design

Extraneous variables that influence the results of a study are difficult to control in a field setting such as a workplace intervention. Studies that examine one group prior to intervention and the same group after the intervention may be confounded by extraneous variables in the workplace or the community as a whole (e.g. the economy or government policy may change over the course of the intervention). One way to assess the potential effect of extraneous variables is to examine general workplace trends that occur independent of an intervention (e.g., examine injuries reported in the intervention workplaces, in addition to other workplaces).

Chaffin et al., (1986); Fitzler (1982, 1983); Lepore (1983); Wickstrom et al. (1993) and Wollenberg (1989) conducted pre/post studies without the use of a control group. These studies may be useful for generating hypotheses about the potential effectiveness of an educational program, but may not account for all extraneous variables because no control group was utilized. In some instances, a sequential approach, doing a one group pre/post comparison, before a randomized approach (or a comparison if randomization is not feasible) might be warranted (Myers, 1999). In cases when there is no previous evidence of program impact it is important to determine whether participants change and the extent to which they change prior to conducting more rigorous evaluation studies.

3.2.4.3 Randomization

Randomization balances the characteristics of participants in an intervention and control group that may be known or unknown to a researcher. These characteristics may influence adherence to an intervention and may influence the outcomes measured in the study. In community field settings, it may not be possible to randomize individuals, but may be possible to randomize work units or workplaces to either an intervention or control group (Daltroy et al., 1997). Five studies in this literature review employed some form of randomization (Daltroy et al., 1993; Daltroy et al., 1997; McCauley, 1990; Shi, 1993; Walsh and Schwartz, 1990). Daltroy et al. (1993) conducted a randomized clinical trial and found that behaviour did not change and injuries were not reduced. This study is often cited to indicate that education courses are not effective. However, the power to detect effects in this randomized control trial was reduced to 30% due to the small numbers of workers assigned to the education group who were actually trained and contamination of the control group by including trained workers in the control group.

3.2.4.4 Non-equivalence of Intervention and Control Groups

A sham (or placebo) intervention is given to those in a control group to determine whether an intervention is effective because of an intervention or because of a sham intervention. McCauley (1990) conducted a randomized trial with a back educational course for the intervention group and a general safety course for the alternative intervention (placebo) to determine the effect of the back educational course. In this study there were significant improvements in pulling and transferring behaviours comparing intervention and sham intervention groups of custodial helpers and groundskeeper assistants.

3.2.4.5 Summary

Methodological rigour in the form of control groups, randomization and placebo (alternative intervention) groups is important for determining the causal connection between an intervention and outcome of interest, but if this degree of rigour is not practical or possible in the community field setting, alternative strategies for conducting studies while not as methodologically strict, may inform best practice for an intervention. In addition, alternative methodological designs to the randomized control trial may help to characterize an intervention beyond simply relating variables to outcomes to better understand an intervention's mediating variables, and how and why an intervention may be effective.

3.2.5 Conclusions

This literature review has shown that educational interventions vary in terms of their approach, content, length and delivery. The content and delivery of many educational courses are not adequately described so it is difficult to determine how the course may influence outcomes. The outcomes of interest also vary across studies depending on the study follow-up time. The studies have shown mixed results depending on the outcomes of interest. Generally the studies have reported increases in knowledge (e.g., Daltroy et al., 1993), and may (e.g.,

McCauley, 1990) or may not (e.g., Daltroy et al., 1993) have shown a change in behaviour. Costs, productivity, absenteeism, lost time at work for injuries and injury rates may (e.g., Shi, 1993; Walsh and Schwartz, 1990) or may not (e.g., Daltroy et al., 1997) have changed to favour the educational program. Furthermore, the methodological rigour across studies varied from post-test only with control group design to randomized control trials. No studies included in this review reported results of process evaluation to determine how or why the intervention may be effective.

Schenk et al. (1996) found an interactive back program was more effective than a video or no intervention in changing knowledge. The *Back Course* to be evaluated in this study also has an interactive format, although the course content of Schenk et al. (1996)'s intervention is not specified and thus, may be different than the *Back Course*.

It is difficult to determine how similar the back education courses examined in this review are to the *Back Course* being evaluated since course descriptions in studies are not detailed or specific. However, none of the education courses studied to date appear to be identical to the *Back Course* in this evaluation so the findings of these studies cannot be generalized to this evaluation.

The study described in this chapter is the outcome evaluation of the *Back Course* using a one group pre/post design. A sequential approach to program evaluation has been used to devise the design of the *Back Course* evaluation (Myers, 1999). Since this program has never been evaluated before in a field setting and is offered in numerous companies, the first step in the evaluation is determining whether the course has impacts on course participants and the extent of these impacts using a one group pre/post design. If the course does show impacts on course

participants, it may be worthwhile to pursue a more rigorous evaluation using a control group and/or randomization. The outcome evaluation presented in this chapter will help to determine the program's impact on course participants in relation to program participation and baseline characteristics. The process evaluation presented in Chapter 4 is also necessary to determine how and why the program may or may not have had the desired effects on participants, and helps to explain the findings of the outcome evaluation.

3.3 Description of the *Back Course*

The four hour *Back Course* aims to provide participants with new, practical principles that can be used at work and at home to: prevent a first time back injury, prevent recurrence of a previous back injury and minimize disability from an existing back injury. The objectives of the *Back Course* are to:

1) To increase awareness and knowledge of the anatomy of the normal and injured spine, of how back injuries occur and what to expect if a back injury occurs, of five biomechanical principles and of strategies to reduce risk when handling materials at home and work.
2) To change lifting practices at home and work utilizing the biomechanical principles from the course.

The *Back Course* is composed of five main components including: 1) biomechanical principles, 2) spinal anatomy, 3) biomechanics of how back injuries occur 4) practice using principles 5) practice analysing a video of program participants handling materials on the job 6) practice improving back fitness. Overheads are used during the course; a handout of each overhead is given to participants to follow. The practical examples are shown on slides using both home and relevant work examples (specific for each company). Some generic examples

are also demonstrated by the instructor. Participants also have the opportunity to practice, under instructor supervision, the biomechanical principles learned in the workshop. In the final part of the course, participants rehearse and practice four strengthening exercises to improve back muscle endurance. An information sheet describing the four exercises to improve back fitness (flexibility and strength) is given to participants as they leave the session (including a diagram and written instructions for each exercise). Upon completion of the course, participants also receive a "Certificate of Achievement" and a checklist for evaluating the ergonomics of their job. Figure 3.1 shows a flow chart of the course activities and provides a brief description of each course component.

1. Introduction

Participants are introduced to the instructor, the course purpose and objectives and asked to complete the knowledge pre course quiz. Some injury statistics are provided to course participants during this section in order to describe the magnitude of the problem.

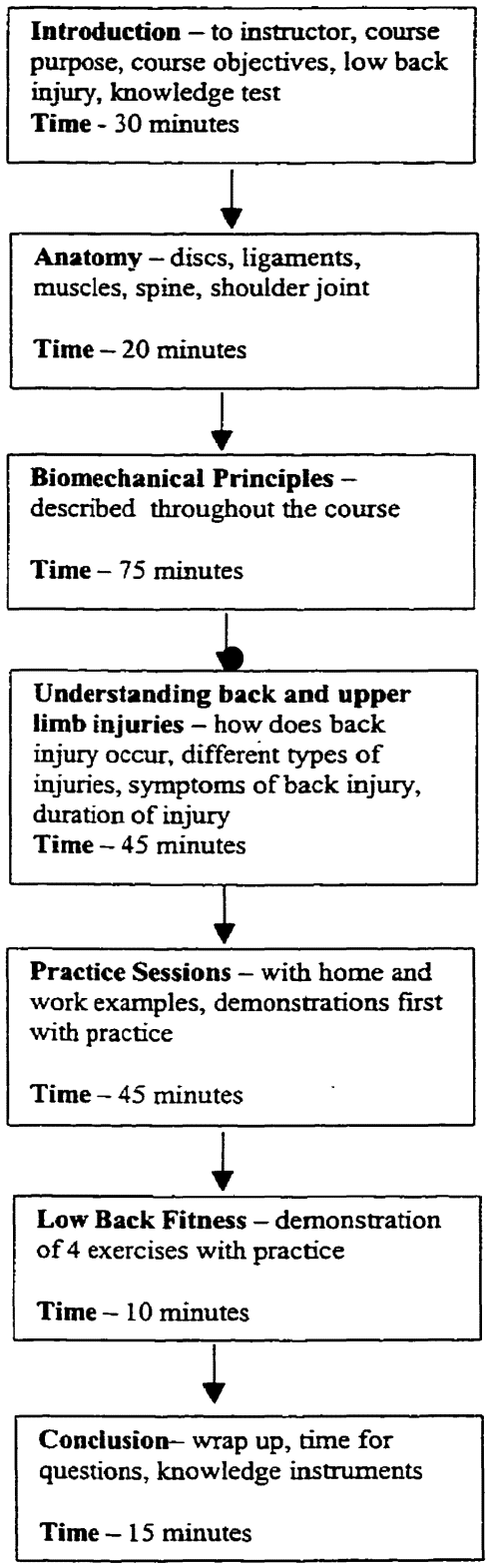
2. Spinal Anatomy

Participants are taught about the spine, spine movements, muscles, ligaments and discs. A model of a healthy spine is passed around to course participants and slides of ligaments and facets are shown. To demonstrate the use of the back muscles, an electromyograph is hooked up to the course instructor to show participants when the back muscles are contracting.

3. Understanding back and upper limb injuries

Participants are taught that most people recover from a back injury, the most common reasons for back injury, different types of back injuries, and how to analyse injury risk in different situations. Slides of examples of potential low back injuries are shown depicting the change to the back

Figure 3.1 Components of the *Back and Upper Limb Injury Prevention Course*



anatomy after injury (e.g., muscle strain, ligament damage). Symptoms of back pain and how back injuries occur is also described for course participants.

4. Biomechanical principles

The main principles include: 1) moving around after prolonged immobility and 2) lightly tensing torso muscles before handling materials. As well, 3) keeping the moment low at all joints, 4) keeping the normal curve in the spine and 5) avoiding twisting the spine to extremes are the principles highlighted when material is being handled. These principles are described in detail and examples are shown of each principle. For example, a torque wrench is used to describe the importance of keeping the moment low at all joints.

5. Practice Using Principles

The participants are asked to apply the biomechanical principles taught in the lecture by lifting a recycling container, a 6-pack of beer and an example specific to the work of participants. Each participant has a turn to lift and receives feedback from the instructor and others in the group.

6. Back Fitness

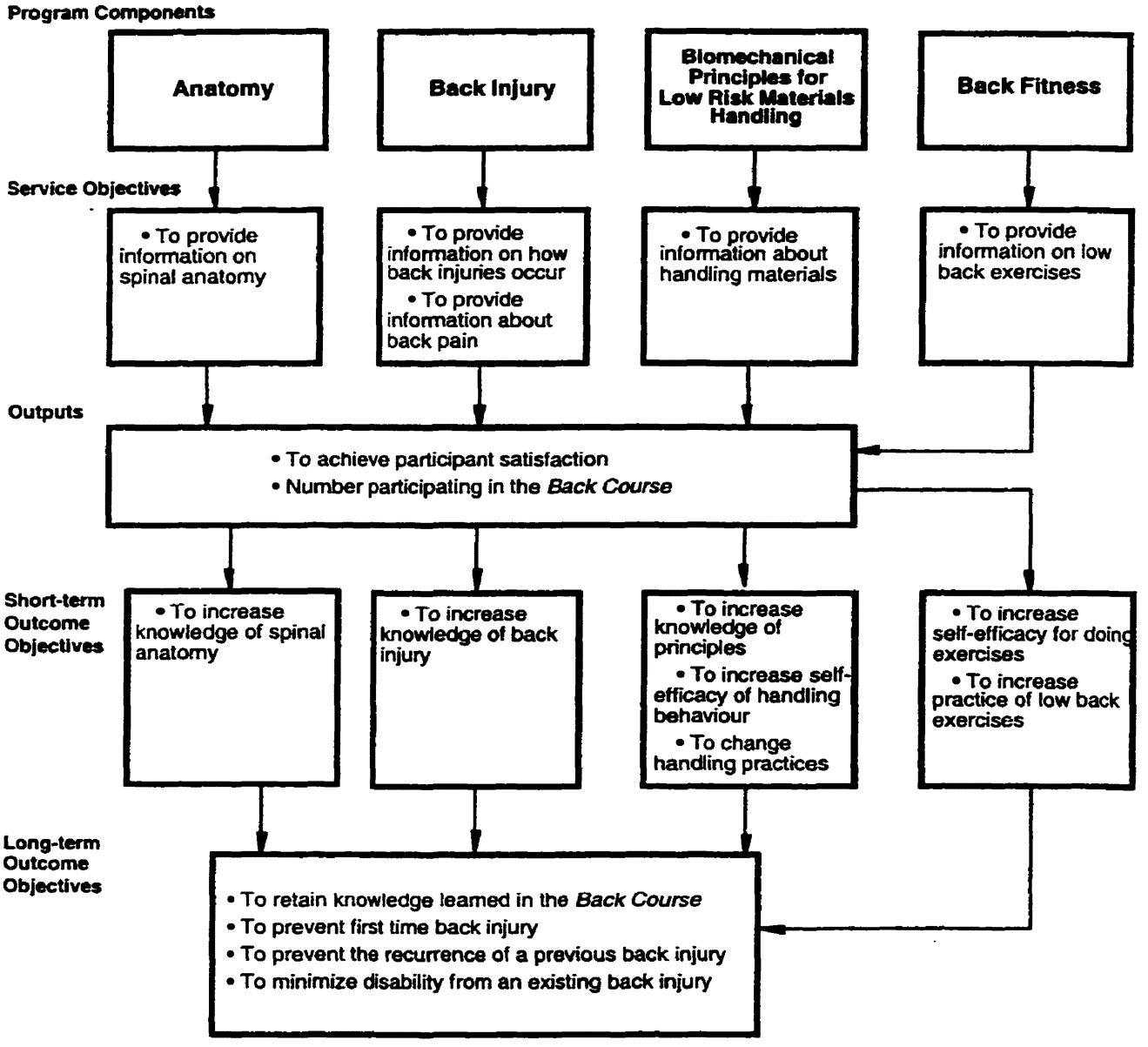
The presenter demonstrates four exercises to improve back fitness. In addition, participants practice exercises to improve their back fitness on mats with the help of the presenter.

7. Conclusion

The conclusion includes wrap up time, time for questions and completion of the knowledge post course quiz.

A program logic model was developed for the *Back Course* in collaboration with the program instructor (Figure 3.2). The main course components include the back anatomy, back injury, biomechanical principles and back fitness. In this logic model, short term objectives

Figure 3.2 Back Course Program Logic Model



included increasing knowledge, self-efficacy and behaviour and long term objectives included prevention of back injuries.

3.3.1 Funding

The WSCP partially supports the *Back Course* by contributing $15 per attendee for member companies up to a total of $10,000. Each company is required to pay $5 per attendee for the four hour course. The number of participants per class ranged from 8 to 17. Most commonly there were 15 participants in each class. This reduction in fees by the WSCP was meant to encourage companies to offer the course in their companies.

3.3.2 Course Instructor

The *Back Course* was delivered by a graduate of the Bachelor of Science in Kinesiology with the Ergonomics option, under the supervision of Dr. Mardy Frazer. The instructor received training from Dr. Mardy Frazer and Dr. Robert Norman and practiced with three pilot tests of the program before teaching the course to companies involved in the WSCP.

3.3.3 Course Marketing

The *Back Course* is generally advertised at the University of Waterloo through the Ergonomics and Safety Consulting Service's promotional materials. For the WSCP, the advertising and marketing of this course was conducted with the help of a Kinesiology undergraduate student hired with an Ontario Works Grant, under the supervision of the graduate student researcher. A pamphlet was developed by the undergraduate student to advertise the course to companies involved in the Waterloo Safe Communities Program. The pamphlet describes the program and gives information about the course developers.

The marketing included calling all company contact people to inform them about the opportunity to take this course. This often required calling the company contact people more than once (often more than two times as well) to get a response about their interest. The student also asked company contacts about the day and times the employees would be able to participate in the program. Dr. Bob Norman "made a pitch" to company contacts about the *Back Course* at the February 1999 Quarterly Meeting to recruit participants. The newly developed pamphlet was distributed at this February 1999 Quarterly Meeting. Information about the marketing process (example: number of calls made, number of times the company contact people were faxed) was tracked on ACT software by Symantec.

3.3.4 Target Audience

The *Back Course* has been delivered to employees of many companies in Southern Ontario such as General Motors in Oshawa. Currently, attendance and course offerings are not tracked systematically by those offering the *Back Course*. Participants in the *Back Course* routinely complete a knowledge assessment prior to taking the course and immediately following the course. (The knowledge assessment was revised for this evaluation.) The course evaluated in this study is offered as it is normally delivered to other companies with one modification. Ten minutes of application of the biomechanical principles to the upper limb was added to the course as a request of the WSCP just prior to offering the course to WSCP companies. This addition is now a permanent modification to the *Back Course*.

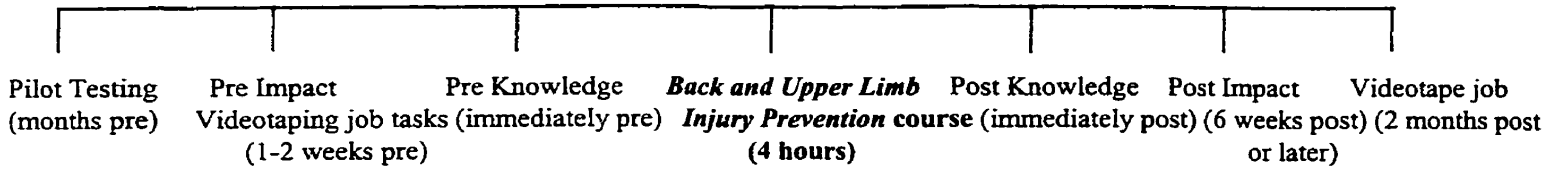
For this evaluation study, the *Back Course* was offered as part of the WSCP's additional course offerings, and was targeted to employees of the participating companies. The course was offered on the days and times preferred by the participating companies (weekdays, weekends,

one four hour session or two two hour sessions). The course was offered at the University of Waterloo or at the individual companies, if preferred. Employers were given paid time to workers to participate in the course.

3.4 Methods

The outcome evaluation of the *Back Course* consisted of the following components in chronological order: 1) development of evaluation materials; 2) pilot testing of evaluation materials; 3) administration of knowledge quiz (immediately pre course and immediately post course); 4) impact questionnaire (two weeks pre course and six weeks post course); and 5) videotaped job task analysis (pre course and 6-8 months post course). Figure 3.3 shows the timeline of data collection methods.

Figure 3.3 Timeline of Data Collection Methods for Outcome Study.



3.4.1 Company and Participant Recruitment

Seven of fifty-three companies involved in the WSCP expressed interest in the *Back Course* and volunteered to participate in the evaluation of the *Back Course*. As shown in the Table 3.1, the companies ranged in size from 18 to 150 employees.

Two hundred thirty workers from these seven companies attended the *Back Course* during the study period held either at their worksite or at the University of Waterloo. The most common number of participants per session was 15 (as stated in section 3.3.1), but the number ranged from 8-17 course participants per session. The course was offered at three workplaces.

When the course was offered at the workplace only employees from one workplace attended the course, but when the course was offered at the university, employees from different companies participated in the same session. Overall, there were 18 *Back Course* sessions offered for the purposes of this evaluation.

Table 3.1 Participant Rate by Company

Company	**Number of Employees**	**Number of Course Participants (Percentage)**	**Location Course was Offered**
Hotel	200	37 (18.5%)	Hotel
Clothing Warehouse Operation	26	9 (34.6%)	University of Waterloo
Paintbrush Manufacturing Plant	70	56 (80%)	Paintbrush Manufacturing Plant
Boiler Service, Repair and Installation Company	22	8 (36.4%)	University of Waterloo
Chicken Packaging Plant	145	21 (14.5%)	University of Waterloo
Plumbing	18	12 (66.7%)	University of Waterloo
Electrical Utilities	134	87 (64.9%)	Electrical Utilities Company

The evaluation of the *Back Course* involved a knowledge quiz, impact questionnaire and videotaped job task analysis, each with a varying number of participants. All 230 employees who participated in the *Back Course* were asked to complete the knowledge quiz and the impact questionnaire. A sample of employees were selected for the videotaped job task analysis. Appendix E presents the methods, results and discussion of the videotaping of job tasks before and after the course.

Knowledge Quiz and Impact Questionnaire. Eligibility criteria for the knowledge quiz and impact questionnaire was the ability to read and comprehend the questionnaires. This was determined by talking to the company contacts to include only those who could understand English (written) in the evaluation, and by letting people know that if they didn't understand the questionnaire, they were not to complete it.

3.4.2 Study Personnel

All design, measurement and analysis aspects of the study were coordinated by the evaluator (the author of this thesis). The author developed/adapted and administered all questionnaires, facilitated all focus groups, interviewed company contacts and helped videotape the job tasks with a staff member from the Ergonomics Safety and Consulting Service. A trained recorder was hired to help with all the focus groups. The focus groups and interviews were fully transcribed by a paid transcriber.

3.4.3 Procedure

Knowledge Quiz. The knowledge quiz was administered to course participants immediately before the course started and immediately upon completion of the course. The course instructor forwarded all knowledge quizzes to the evaluator in labelled and sealed envelopes immediately after the course was completed.

Impact Questionnaire. The questionnaire battery was given to course participants two weeks before and six weeks after participating in the course and was coded with unique identifiers to link the pre and post course questionnaire. Course participants were asked to return completed pre questionnaires in sealed confidential envelopes to the course instructor, or to their company health and safety representative. After the course, questionnaires were returned to their

company representatives in a sealed confidential envelope. Three cash prizes ($100, $50, and $50) were also promoted in the second questionnaire follow-up letter for those who completed both questionnaires to increase the response rate.

3.4.4 Measures

Knowledge Quiz. A knowledge quiz was developed by course developers for use in the *Back Course*. This quiz was revised substantially for this evaluation with regard to format and content in collaboration with the program developers. The knowledge quiz consisted of 27 items, as well as two items for each of the five video clips viewed by participants (Refer to Appendix F for knowledge quiz). The response alternative "I'm not sure" was given to participants in all questions to reduce guessing and to differentiate between lack of information and misinformation. From these items, eight subscales were developed including each of the five biomechanical principles, anatomy, exercises and video clips (Appendix F for a table of items pertaining to each subscale). The knowledge quiz was used for two primary purposes:

- To provide an indicator of baseline level of knowledge related to the course content (both overall and regarding specific areas).
- To provide an indicator of change in knowledge from pre to post.

Impact Questionnaire. The impact questionnaire consisted of a battery of survey items and instruments in five main sections: 1) background including sociodemographics, risk factors for musculoskeletal disease and job tasks 2) expectations of the course, 3) Job Content Questionnaire, 4) Job Satisfaction 5) job influence, 6) Workplace organization, and 7) Spinal Function Sort (tool to measure self-efficacy). Both the pre and post impact questionnaire are found in Appendix G. The pre course questionnaire included background questions, risk factors

and questions about job tasks, in addition to expectations of the course, the Job Content Questionnaire, job satisfaction, job influence, workplace organization and Spinal Function Sort. The post course questionnaire was almost identical to the pre course questionnaire, but did not include demographic or risk factor questions, and did ask about injuries history since the course was taken and questions related specifically to the *Back Course*.

1. Background Questions: Background questions included sociodemographics, risk factors for musculoskeletal disease, job tasks, previous injuries and previous injury prevention courses taken. *i) Sociodemographics (pre).* The background questions were used for descriptive purposes. All questions were developed by the Institute for Work and Health, with the exception of the education question. The level of education item was taken from the National Population Health Survey (Statistics Canada, 1994).

Risk Factors (pre). The risk factor questions were developed for descriptive purposes in order to better understand the participants' risk factors for back injuries.

Job Tasks (pre). Participants reported their current job title and the main tasks in their current job. These two items were developed by the Institute for Work and Health to identify the main requirements of a person's job in a survey of newspaper workers (Beaton et al., 1998). Participants were also asked to report prior courses they have taken related to injury prevention at work and the course(s) content if they had. These items were developed by the author to determine prior experience with injury prevention courses. Participants also reported on 6 items from a list of 33 discrete physical requirements of work (e.g. lifting, bending or stooping, pulling or pushing and crouching or kneeling) identified by the U.S. Department of Labor Employment and Training Administration (1977, 1981) to identify physical capabilities a worker must have to

complete their job. These six items were based on Fishbain et al.'s (1994) measurement of residual functional capacity in chronic low back pain patients. For this study, the items were selected to better characterize the loads on the back and upper limb. No psychometrics were associated with these descriptive items.

Injuries (post). Six items were included in the post impact questionnaire to determine whether participants had experienced injuries over the previous six weeks. These items were included for comparison to the pre questionnaire, and were developed by the author.

Program (post). Eight items, developed by the author asked participants to remember the *Back Course* and whether it resulted in any changes in their handling practices. In addition, two items, developed by the author asked participants to check any off-the-job safety courses of interest to them. These items were developed for descriptive purposes for comparison to the pre impact questionnaire.

2. Expectations of the Back Course: Participants rated their expectations of the *Back Course*. Low scores indicated that the course was not helpful and high scores indicate that the course was helpful for that particular item (Refer to Appendix G, items B1-B6). After the course was offered the participants rated their impressions after having taken the course.

3. Job Content Questionnaire. Twenty-six items were taken from the original 42-item Job Content Questionnaire (Karasek & Theorell, 1994). This measure includes four scales: *decision latitude* and *psychological job demands*, *physical job demands*, and *social support*. Based on the criticisms that this measure is unable to distinguish between psychological and physical demands, the Institute for Work and Health modified the Psychological Demands scale to separate psychological from physical work demands (Kasl, 1996). The scale included two

items that were slightly revised from the Job Content Questionnaire and three items related to psychological demands from the original Job Content Questionnaire. In addition, three of five items from the original Job Content Questionnaire's physical job demand scale were included in the impact questionnaire. Internal consistency has been reported for all the subscales of the Job Content Questionnaire and the Cronbach's alpha coefficients are generally above .70 for most subscales (Schnall et al., 1994; Landsbergis et al., 1994).

4. Job Satisfaction. Job satisfaction was measured with one item from the National Population Health Survey (Statistics Canada, 1994). (Refer to Appendix G, item C33)

5. Job Influence. Eleven items measuring perceived influence or control on the job were measured using a five point Likert scale developed by Greenberger (1982) starting from very little (1), little (2), a moderate amount (3), much (4), to very much (5). (Refer to Appendix G, items D1-D10)

6. Workplace Organization. Workplace organization was measured with five items using a five-point Likert scale from strongly agree to strongly disagree (i.e. strongly agree, agree, neither agree nor disagree, disagree, strongly disagree). The questions were developed by Hunt et al. (1993) for the Upjohn Institute for Employment Research's study of Disability Prevention among Michigan employers in collaboration with researchers, labour and government representatives (Refer to Appendix G, items F1-F5).

7. Spinal Function Sort. The Spinal Function Sort is a 50-item scale (Matheson & Matheson, 1989) designed to measure perceived confidence in handling tasks for activities of daily living. Each item also has a drawing with a simple task description that covers a range of spinal demands which progress from light to heavy, and follow the United States Department of

Labour Physical Demand Characteristics of Work system (Matheson et al., 1993) (Refer to Appendix G, items G1-G50). Gibson and Strong (1996) reported that the Spinal Function Sort had good internal consistency (alpha=.97), test-retest reliability (ICC=0.89) and construct validity for perceived capacity of individuals with chronic pain in work-related activities. The tool was originally developed for disabled adults. Using the Spinal Function sort originally intended, respondents are asked to read a short description of each work task and to look at each drawing. They are then asked to indicate their current level of ability to perform each task on a 5-point scale from able (1) to restricted (3) to unable (5)

For this study, the wording of each item was modified slightly in order to use the self-efficacy scale recommended by Maibach & Murphy (1995). Furthermore, wording was modified given study participants do not necessarily have a pre-existing injury.

Pilot Testing

Two groups were assembled to pilot test the battery of survey questionnaires used in this study. First, a convenience sample of housekeeping staff at the University of Waterloo, who took the *Back Course* was administered the knowledge quiz immediately before and after the course. One week after the course was taken, two focus groups were conducted to administer the impact questionnaire. Response burden was considered in the pilot test of measures. Thus, the length of time it took to complete each instrument in the impact questionnaire was recorded with a minimum, maximum, and average time. The knowledge quiz took from 5 - 17 minutes (average 10), while the remaining battery took from 10 - 28 (average 20) minutes. The focus group participants then gave their impressions of the battery of surveys for item difficulty, clarity of instructions, relevance to the course and general feedback. Participants in the first pilot test,

suggested changes to the knowledge quiz and the impact questionnaire which were made to the survey instruments before the second pilot such as using true and false questions rather than multiple choice for the knowledge quiz and changing the format for responding to the Spinal Function Sort.

Once the tools were modified, another convenience sample of graphics and library staff assembled from the University of Waterloo to participate in the course and the pilot test of measures. Additional changes were made to both the knowledge quiz and impact questionnaire after the second pilot test.

3.4.5 Data Analysis

Knowledge Quiz. Prior to analysis, data were examined for accuracy of data entry, missing values and fit between their distributions and assumptions of multivariate analysis. The data were then analysed using SPSS (Statistical Package for the Social Sciences for Windows version 10).

Individual items were assessed for difficulty using an item difficulty index which is the proportion of respondents that got a particular item correct. An item difficulty index of .20 to .80 is desirable and indicates that an item can be correctly answered by some, but not all participants (Pratt et al., 1992). If most answers are known prior to training, ceiling effects may occur since the results may not be able to be improved upon post course.

Individual items of the knowledge quiz were examined using the pre and post differences index (PPDI) which is the difference between an item's difficulty index before the course and after the course. A negative or small change in a single item (or in the overall quiz) may indicate that an item is not effective in assessing knowledge change or that it is ineffectively

communicated in the course.

Pre and post course scores were also assessed to determine the difference between the number of "I'm not sure" responses for each item. A positive or small change in the number of "I'm not sure" responses for a single item may indicate that an item is not effective in assessing knowledge change or that it is ineffectively communicated in the course.

Individual items were also assessed by comparing the responses of participants with the highest scores with those with the lowest scores. Positive item discrimination over .20 is desirable and indicates that a high scorer generally gets the item correct, and a low scorer tends to get the item incorrect (Ailinger, 1998). Item discrimination indices were determined by subtracting the proportion of respondents who scored in the 75th percentile and got the item correct from the proportion of respondents who scored in the 25th percentile and got the item correct.

Impact Questionnaire. Prior to analysis, data were examined for accuracy of data entry, missing values and fit between their distributions and assumptions of multivariate analysis. Differences among study participants (course participants completing pre and post impact questionnaires) and those course participants completing the pre questionnaire only, were tested using independent *t* tests for continuous variables, Mann-Whitney U test for an ordinal variable and the chi-square test for categorical variables. The data were then analysed using SPSS for Windows (Statistical Package for the Social Sciences for Windows version 10).

The questionnaire was scored by adding responses to the subscales and calculating means and standard deviations for each scale or individual item, if there was no subscale for the item. Knowledge, self-efficacy and psychosocial subscales were examined before and after the course

using repeated measures ANOVA to determine if there were any pre/post changes. In addition, linear and logistic regression analyses were conducted to explore factors that may relate to improved knowledge, self-efficacy and behaviour.

3.4.6 Ethical Considerations

The Office of Research Ethics at the University of Waterloo reviewed and provided ethics clearance for this study. All companies and individuals received written information about the details of the evaluation prior to participating. For the knowledge quiz, informed consent was implied by respondents completing the quiz. Informed consent was obtained for participation in the impact questionnaire (Appendix G) and this form was distributed with the pre impact questionnaire.

3.5 Results

3.5.1 Response Rates

Knowledge Quiz. Figure 3.4 shows the completion rate for the knowledge quiz. Of the 230 people who participated in the *Back Course*, eight people could not complete the quiz due to language. The overall response rate was 99% for participants who responded to both the pre and post course quiz. The response rate ranged from 87 to 100% depending on the company (Table 3.2).

Figure 3.4 Response Rates for Knowledge and Impact Questionnaire

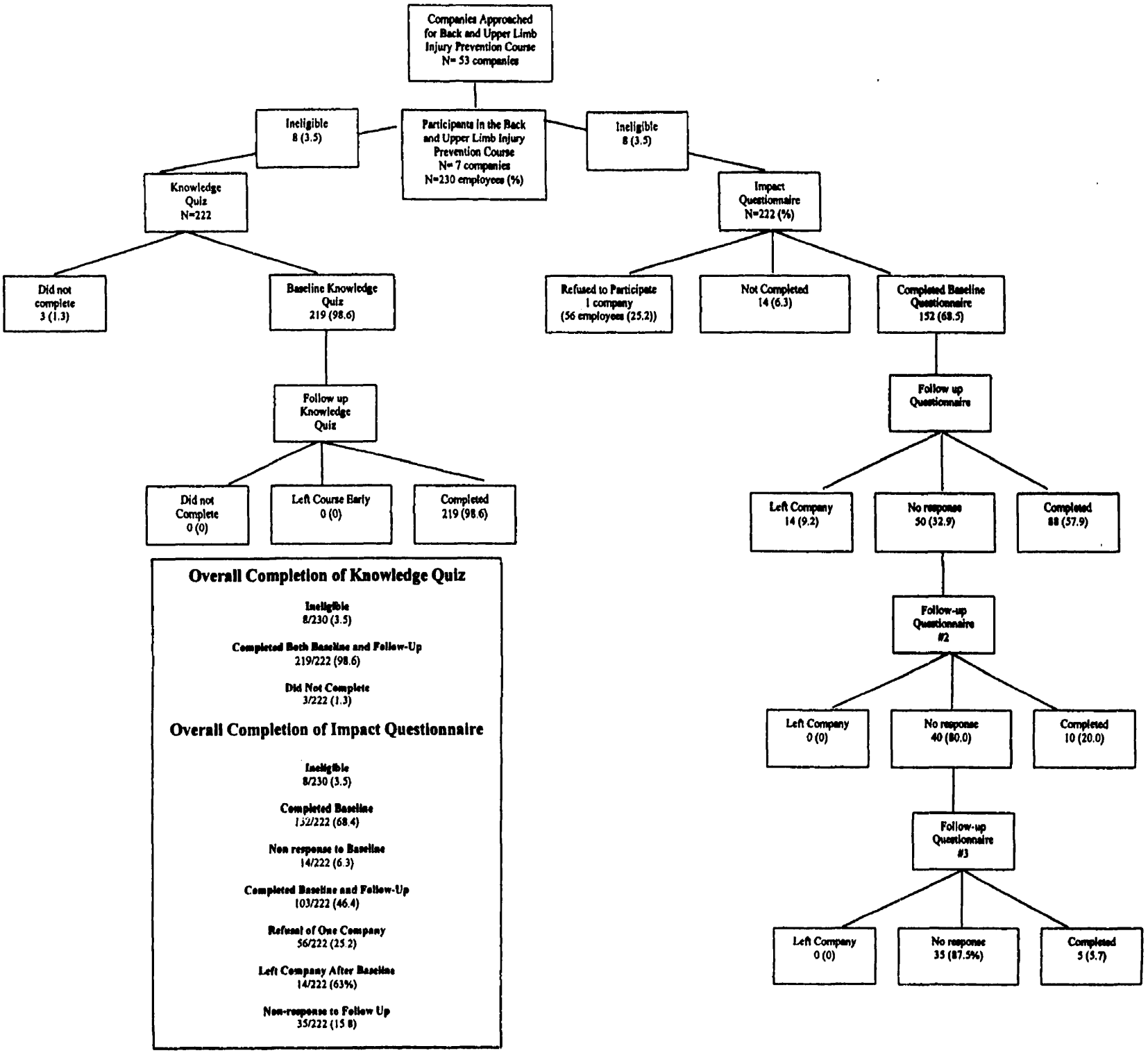


Table 3.2 Completion Rate of Knowledge Quiz for Course Participants

Company	Completion Baseline	Completion Follow-up
Clothing Warehouse	9/9 (100%)	9/9 (100%)
Paintbrush Manufacturing	56/56 (100%)	56/56 (100%)
Hydro Company	86/87 (98.9%)	86/86 (100%)
Chicken Packaging Plant	20/20 (100%) 1 ineligible	20/20 (100%)
Plumbing Company	11/12 (92%)	11/11 (100%)
Boiler service, repair & installation Company	7/8 (87%)	7/7 (100%)
Hotel	30/30 (100%) (7 ineligible)	30/30 (100%)
Totals	219/222 (98.6%)	219/222 (98.6.0%)

Impact Questionnaire. Figure 3.4 shows the completion rate of the impact questionnaire. Of the 230 people who participated in the course, eight people could not complete the quiz due to language. In addition, at the paintbrush manufacturing company, the management of the company received complaints about the questionnaires prior to the course and then refused to complete the questionnaires as a company. Examples of the complaints received included its length, repetitiveness and relevance to the course (questions about perceptions of work and supervisors). Therefore, of the eligible participants, the overall completion rate for the pre questionnaire was 68% and the overall response rate for completing both the pre and post questionnaire was 46%. Fourteen course participants left their company after the course and were not able to be followed-up. The response rates ranged from 0 (company that rejected the questionnaires) to 80% depending on the company (Table 3.3).

Table 3.3 Completion Rate of Impact Questionnaire

Company	Completion Baseline	Completion Follow-up	Left Company after Pre
Clothing Warehouse	9/9 (100%)	7/9 (77.8%)	2/9 (22.2%)
Electrical Utilities Company	77/87 (88.5%)	48/87 (55.2%)	0 (0%)
Chicken Packaging Plant	20/20 (100%) 1 ineligible	16/20 (80.0%)	3/20 (15%)
Plumbing Company	10/12 (83.3%)	6/12 (50.0%)	2/12 (16.7%)
Boiler service, repair & installation Company	6/8 (75.0%)	5/8 (62.5%)	0/8 (0%)
Hotel	30/30 (100%) 7 ineligible	21/30 (70.0%)	7/30 (23.3%)
Totals excluding Paintbrush Manufacturing	152/166 (91.6%)		
Paintbrush Manufacturing	0/56 (0%)	0/56 (0%)	N.A.
Totals	152/222 (68.5%)	103/222 (46.4%)	14/222 (6.3%)

3.5.2 Evaluation Participants

Two hundred and thirty participants were eligible to complete the knowledge quiz and the impact questionnaires. Those participants who completed the baseline knowledge quiz were compared to those who completed both the baseline and follow-up knowledge quiz using Chi-Square test to test the statistical associations. Table 3.4 shows the characteristics of participants who completed the pre course quiz and those who completed the pre and post course quiz. No statistically significant differences were found.

Table 3.4 Characteristics of Participants (N=103) and Dropouts (N=49)

Variable	Study Participants N = 103	Study Dropouts N = 49
Female	34%	35%
Age (M ± SD) in years	40.9±10.5	38.5±10.1
Height (M ±SD) in cm	173.0±10.4	174.0±10.4
Weight (M ± SD) in kg	80.4±16.2	79.5±18.4
Language Comfortable Speaking (English)	93%	98%
Language Comfortable Reading/Writing(English)	91%	100%
Education % (n)		
Less than High School	11%	11%
Completed High School	30%	37%
Some or Completed College	42%	44%
Some or Completed University	15%	15%
Young Children - Yes	35%	43%
Physical Care for People - Yes	21%	28%
Physically Active		
Very Much So	34%	33%
Moderately	63%	72%
Not at all	0%	2%
Do you take formal exercise classes Yes	51%	43%
Had a Injury Before - Yes	56%	59%
Had low back pain before - Yes	74%	88%
Missed Work because of Back, neck or shoulder injury	27%	31%
Taken WSIB rehabilitation classes	0.04%	6%
Taken prior courses in injury prevention	25%	26%

Those who completed both impact questionnaires (N=103) were compared to the rest of the sample who completed the knowledge quiz but not both impact questionnaires (N=116) for differences in knowledge quiz scores (Table 3.5). Comparing the mean of overall post course knowledge scores, there were statistically significant differences ($p<0.0001$) between those who completed both impact questionnaires and the rest of the sample. Although the post course knowledge quiz scores were higher in the group that completed the impact questionnaire than those who did not, their change in score from pre to post course quiz was similar to the group that did not complete the impact questionnaire. This finding suggests differences exist between the groups such as differences in education level. It is possible that the group that completed the

impact questionnaires had a higher average education level than the group that did not complete the impact questionnaires (but this could not be examined because those who did not complete the impact questionnaire did not complete the education question).

Table 3.5 Comparison of those who completed both impact questionnaires to the rest of the sample.

	Completed Impact Post Course Quiz mean ± s.e.m.	**Did Not Complete Impact** Post Course Quiz mean ± s.e.m.
Post Course Knowledge Quiz Score (Quiz + Videoclips) Overall	*83.08 ± 1.48	*51.68 ± 1.99
i) hotel	64.86 ± 4.54	38.38 ± 5.99
ii) plumbing	86.49 ± 3.72	63.96 ± 6.80
iii) chicken processing	83.61 ± 3.88	56.31 ± 9.65
iv) paintbrush manufacturing		42.31 ± 2.68
v) clothing manufacturing	84.94 ± 2.35	55.40 ± 6.76
vi) boiler service	85.95 ± 4.79	55.40 ± 1.35
vii) electrical utilities	89.19 ± 0.90	66.64 ± 2.57
Difference Between Pre and Post Course Knowledge Quiz (Overall)	31.17 ± 1.63	33.49 ± 2.03
i) hotel	34.63 ± 4.50	32.22 ± 7.00
ii) plumbing	34.81 ± 6.69	30.86 ± 12.53
iii) chicken processing	34.95 ± 4.30	23.46 ± 6.80
iv) paintbrush manufacturing		37.37 ± 3.28
v) clothing manufacturing	30.69 ± 6.55	25.92 ± 11.11
vi) boiler service	28.89 ± 2.87	31.48 ± 1.85
vii) electrical utilities	28.39 ± 1.97	30.51 ± 3.18

*Statistically Significant Difference F=152.48, P=<0.0001

Sample Description

Descriptive statistics will be reported for those who completed the impact questionnaire in this section of the thesis (N=103). Data were analysed using SPSS statistical software (Statistical Package for the Social Sciences for Windows version 10). For continuous variables, a one-way between subjects analysis of variance (ANOVA) was used to determine if there was a significant difference between the means of different groups (e.g., differences between companies). For discrete variables, tables were constructed and Chi Square (χ^2) tests were performed to determine if the observed data were different from the expected. A χ^2 significance level below 0.05 indicates that the data differ significantly from the expected null hypothesis (Tabachnick and Fidell, 1996). However, when the expected count of a cell is less than five, the Chi-square test is not valid. Since company was significant in the repeated measures ANOVA of the knowledge quiz, the results will be reported by company. However, the Chi-square test is not valid because the expected count for cells is less than five when comparing companies. Therefore, the data are presented by company for descriptive purposes only.

Charactistics of Respondents

Gender

There were more male (N=68, 66%) participants than female (N=35, 34%) overall. Table 3.6, shows that there were two companies (boiler service and plumbing companies) with only males who participated in the course (and completed both impact questionnaires) and two other companies (chicken processing and electrical utilities) with more males than females; whereas at two companies (hotel and clothing warehouse companies) there were more females than males.

Table 3.6 Gender of those who completed both the pre and post impact questionnaire by company.

	Hotel (N=21)	Boiler Service (N=5)	Clothing Warehouse (N=7)	Plumbing (N=6)	Chicken Processing (N=16)	Electrical Utilities (N=48)	Overall (N=103)
Males N (%)	6 (29%)	5 (100%)	2 (29%)	6 (100%)	11(69%)	38 (79%)	68 (66%)
Females N (%)	15(71%)	0 (0%)	5 (71%)	0 (0%)	5 (31%)	10 (21%)	35 (34%)

Age

The average age of respondents was 41 and the range was 21 to 65 years of age across all companies. The hotel had the oldest average age of 47 and the clothing warehouse had the youngest average age of 29 (and the smallest age range). The chicken processing and electrical utilities company had the largest range of ages with 36 years each.

Table 3.7 Age of those who completed both the pre and post impact questionnaire by company.

	Hotel (N=21)	Boiler Service (N=5)	Clothing Warehouse (N=7)	Plumbing (N=6)	Chicken Processing (N=16)	Electrical Utilities (N=48)	Overall (N=103)
Mean Age in years	47	34	29	37	33	44	41
Min./Maximum	32-65	29-41	23-32	23-54	21-57	23-59	21-65

Language Comfortable Speaking and Reading/Writing

There were eight participants who did not understand English well enough to respond to the impact questionnaire. Most respondents (N=98, 95%) were comfortable speaking and reading or writing English. Of those who were not as comfortable with English, three respondents from the hotel indicated that they would prefer to speak, read and write Spanish, Hindi or Turkish. One respondent from the clothing warehouse and one from the electrical

utilities indicated that they would prefer to speak, read and write Polish. Since the correlation between the two language variables (i.e., 1.speaking and 2. reading or writing) is high (0.465, $p<.0001$) only the reading/writing variable will be used for the regression analysis.

Education

Overall, 11% of respondents (N=11) had less than high school, 31% (N=31) had completed high school, 43% (N=44) had college or completed college and 15% (N=15) had university or completed university. However, there were differences seen in education levels across companies. These differences may have been due to the education requirements for the jobs at each company. For example, at the broiler service company all the participants had some or completed college which is likely a requirement for their trade. At the electrical utilities almost 90% of the sample had some type of post-secondary education. On-the-other-hand, at the hotel and chicken processing plant 85% and 93% of the respondents had completed high school or less education. Refer to Table 3.8 for more details about education by company.

Table 3.8 Education of those who completed both the pre and post impact questionnaire by company.

	Hotel (N=21)	Boiler Service (N=5)	Clothing Warehouse (N=7)	Plumbing (N=6)	Chicken Processing (N=16)	Electrical Utilities (N=48)	Overall (N=103)
Less than High School N (%)	5 (28%)	0 (0%)	1 (14%)	0 (0%)	5 (31%)	0 (0%)	11 (11%)
Completed High School N (%)	12 (57%)	0 (0%)	2 (29%)	1 (17%)	10 (62%)	6 (13%)	31 (31%)
Some or Completed College N (%)	3 (14%)	5 (100%)	3 (43%)	5 (83%)	1 (6%)	27 (59%)	44 (43%)
Some or Completed University N (%)	1 (5%)	0 (0%)	1 (14%)	0 (0%)	0 (0%)	13 (28%)	15 (15%)

*not all participants completed the education question.

Young Children, Care for Older Adults or Disabled People

Overall, 37% of respondents (N=36) cared for young children, older adults or disabled people; and 62% (N=64) did not have young children or care for older adults or disabled people. The differences between companies varied, ranging from 18% to 83% of the respondents in different companies caring for young children, older adults or disabled people (Table 3.9).

Table 3.9 Respondents who care and provide physical care for children, older adults or disabled people by company.

	*Hotel (N=21)	*Boiler Service (N=5)	Clothing Warehouse (N=7)	*Plumbing (N=6)	Chicken Processing (N=16)	*Electrical Utilities (N=48)	*Overall (N=103)
Care for children, older adults or disabled people.	3 (18%)	3 (75%)	4 (57%)	5 (83%)	4 (25%)	17 (37%)	36 (37%)

Physical Activity and Participation in Exercise

Respondents were asked their perceptions of how physically active they consider themselves. No respondents indicated "not at all", 65% (n=65) indicated "moderately" and 35% (n=35) indicated "very much so". This trend was common across all companies except the broiler service where there were 50% (n=2) who indicated they consider themselves moderately physically active and 50% (n=2) indicated very much so, and the clothing warehouse where 86% (n=6) indicated they consider themselves moderately physically active and 14% (n=1) indicated they consider themselves very much so. Respondents were also asked whether they currently take part in any organized exercise classes, sports or exercises. Overall, 53% (n=53) of respondents indicated they currently take part in organized exercise classes, sports or exercises. Across companies, participants in organized exercise classes ranged from 29% (n=2) to 75% (n=3) of respondents. The types of exercises mentioned by different participants included aerobics, hockey, bowling, dancing, baseball, biking and running (Table 3.10).

Table 3.10 Physical Activity and Participation in Organized Exercise Class by company.

	Hotel (N=21)	Boiler Service (N=5)	Clothing Warehouse (N=7)	Plumbing (N=6)	Chicken Processing (N=16)	Electrical Utilities (N=48)	Overall (N=103)
Consider themselves physically active							
Very Much So	9(43%)	2 (50%)	1 (14%)	2 (33%)	6 (37%)	15 (33%)	35 (35%)
Moderately	12(57%)	2 (50%)	6 (86%)	4 (67%)	10 (62%)	31 (67%)	65(65%)
Organized Exercise Class							
Yes	8 (38%)	3 (75%)	2 (29%)	4 (67%)	10 (62%)	26 (56%)	53 (53%)
No	12(57%)	1 (25%)	5 (71%)	2 (33%)	6 (37%)	18 (39%)	44 (44%)
Sample of types of exercise	Aerobics Biking Weight training Bowling Dancing	Hockey Softball Tennis Swim Bowling Golf	Walking Cycling Weight training Badminton	Biking Baseball Hockey Swim Fishing Hunting	Baseball Soccer Hockey Fishing Biking Golf	Aerobics Biking Dancing Hockey Golf Running	

*not all participants completed the question.

Previous Back, Shoulder or Neck Injury

The lifetime prevalence of back, shoulder or neck injury of all respondents was 58% (N=58) ranging from 43-63% across companies (Table 3.11). Seventy-seven percent (N=76) of respondents had experienced low back pain ranging from 50-80% across companies (Table 3.11) The most recent episode of low back pain ranged from 20 years ago to a chronic, daily experience. Overall, 29% (N=28) of respondents had missed work due to a back, shoulder or neck injury, ranging from 0% to 50% by company. Of those who missed work due to an injury, only 14% (N=4) of respondents had ever taken any Workplace Safety and Insurance Board rehabilitation programs (of any kind) ranging from 0% to 33% by companies.

Table 3.11 Previous Back, Shoulder or Neck Injury by company.

	Hotel (N=21)	**Boiler Service (N=5)**	**Clothing Warehouse (N=7)**	**Plumbing (N=6)**	**Chicken Processing (N=16)**	**Electrical Utilities (N=48)**	**Overall (N=103)**
Back, shoulder/neck injury ever?							
Yes	12(57%)	2(50%)	3(43%)	3(50%)	9(56%)	29(63%)	58(58%)
No	7(33%)	2(50%)	4(57%)	3(50%)	5(36%)	16(35%)	37(37%)
Unsure	2(9%)	0(0%)	0(0%)	0(0%)	0(0%)	1(2%)	5(5%)
Ever experienced low back pain?							
Yes	15(71%)	2 (50%)	6 (86%)	4 (67%)	12 (75%)	37 (80%)	76 (77%)
No	6(29%)	2 (50%)	1 (14%)	2 (33%)	4 (25%)	9 (20%)	22 (22%)
Most recent episode (range)	1.5 years ago-on a daily basis	4 months ago	2 years ago-every morning, yesterday	5 years ago-today	2 years ago - daily	20 years ago - chronic, presently	
Ever missed work for injury?							
Yes	4(25%)	1(25%)	0(0%)	3(50%)	5(31%)	15(33%)	28 (29%)
No	14(78)	3(75%)	6(100%)	3(50%)	11(69%)	31(67%)	68 (71%)
Ever taken WSIB rehab programs?							
Yes	1(25%)	0(0%)	0(0%)	1(33%)	1(20%)	1(7%)	4(14%)
No	3(75%)	1(100%)	0(0%)	2(67%)	4(80%)	14(93%)	24(86%)

*not all participants completed the question due to skip patterns

Characteristics of the Job

The job titles of respondents varied depending on their company. The boiler service and plumbing company respondents were skilled trades people or apprentices. The respondents of the chicken processing plant were mainly supervisory staff of the factory lines, while the hotel respondents included housekeepers, maintenance, banquet set up and laundry employees. At the clothing warehouse respondents were involved in shipping and receiving at the warehouse, and their job titles reflected this type of work. The job titles of the electrical utilities varied from upper management to lineman, meter readers and clerks.

Respondents characterized their jobs based on a number of physical demands (Table 3.12). Only 3%, 7%, and 28% of respondents indicated that they did not lift light (maximum five pounds), medium (between 10 and 25 pounds) and heavy (50 pounds or more) loads at all respectively, and 41%, 45% and 43% indicated that they lift light, medium and heavy loads to some extent respectively, and 45%, 35% and 13% indicated that they lift light, medium and heavy loads to a great extent respectively. By company, the differences were similar with most of the respondents indicating that they lift light and medium loads to some or a great extent. With regard to heavy loads by company, a smaller proportion of respondents indicated that they lift heavy loads to a great extent compared to the light and medium loads, and a larger proportion of respondents indicated that they do not lift heavy loads at all compared to the light and medium loads.

Only 2%, 7% and 7% of respondents indicated that their jobs did not entail the physical demands of a) bending or stooping, b) pulling or pushing and c) crouching or kneeling respectively, while 43%, 28% and 33% of respondents indicated that their jobs included a) bending or stooping, b) pulling or pushing and c) crouching or kneeling to a great extent. Across companies, the trends of physical demands were viewed similarly by respondents.

Table 3.12 Physical Demands at Work by company.

To what extent does your job include these physical demands?	Hotel (N=21)	Boiler Service (N=5)	Clothing Warehouse (N=7)	Plumbing (N=6)	Chicken Processing (N=16)	Electrical Utilities (N=48)	Overall (N=103)
Lifting light loads							
Not at all							
To some extent	1(5%)	0(0%)	0(0%)	0(0%)	0(0%)	2(4%)	3(3%)
To a great extent	7(33%)	2(40%)	2(29%)	2(33%)	7(44%)	22(46%)	42(41%)
	10(48%)	3(60%)	4(57%)	4(67%)	9(56%)	15(31%)	46(45%)
Lifting medium loads							
Not at all	1(5%)	0(0%)	0(0%)	0(0%)	0(0%)	8(17%)	9(69%)
To some extent	13(62%)	1(20%)	4(57%)	2(33%)	8(50%)	18(37%)	46(45%)
To a great extent	4(19%)	4(80%)	3(43%)	4(67%)	8(50%)	12(25%)	36(35%)
Lifting heavy loads							
Not at all	8(38%)	0(0%)	1(14%)	0(0%)	3(19%)	16(33%)	28(27%)
To some extent	9(43%)	5(100%)	5(71%)	3(43%)	8(50%)	18(37%)	48(47%)
To a great extent	1(5%)	0(0%)	0(0%)	3(43%)	5(31%)	4(8%)	13(13%)
Bending or Stooping							
Not at all	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	2(4%)	2(2%)
To some extent	9(43%)	4(80%)	3(43%)	2(33%)	6(60%)	20(42%)	44(43%)
To a great extent	9(43%)	1(20%)	3(43%)	4(67%)	10(62%)	16(33%)	44(43%)
Pulling or pushing objects							
Not at all	0(0%)	0(0%)	0(0%)	0(0%)	1(6%)	6(12%)	7(7%)
To some extent	9(43%)	3 (60%)	3(43%)	3(43%)	3(19%)	23(48%)	44(43%)
To a great extent	9(43%)	2(40%)	3(43%)	3(43%)	12(75%)	9(19%)	29(28%)
Crouching or kneeling							
Not at all	0(0%)	0(0%)	1(14%)	0(0%)	3(19%)	3(6%)	7(7%)
To some extent	9(43%)	2(40%)	2(29%)	0(0%)	10(62%)	26(54%)	49(47%)
To a great extent	9(43%)	3(60%)	3(43%)	6(100%)	3(19%)	9(19%)	34(33%)

*not all participants completed the question.

Prior Injury Prevention Courses at Work

Overall, only 26% of respondents reported taking prior courses in injury prevention. By company, this trend was fairly consistent with the exception of the electrical utilities company where a larger proportion (44%, N=20) of respondents reported taking prior courses in injury prevention. The content of the prior courses included ergonomics, Workplace Hazardous Information Systems (WHMIS), toxic chemicals, confine space, anatomy, range of motion exercises, fire extinguisher safety, general safety topics from the Industrial Accident Prevention Association (IAPA), and exercises and back strengthening (Table 3.13).

Table 3.13 Prior Courses in Injury Prevention at Work by Company.

	Hotel (N=21)	**Boiler Service (N=5)**	**Clothing Warehouse (N=7)**	**Plumbing (N=6)**	**Chicken Processing (N=16)**	**Electrical Utilities (N=48)**	**Overall (N=103)**
Ever taken Injury Prevention at work? Yes No	 1(5%) 18(95%)	 1(20%) 4(80%)	 1(14%) 6(86%)	 0(0%) 6(100%)	 3(20%) 12(80%)	 20(44%) 25(55%)	 26(26%) 72(73%)
Injury Prevention Courses Reported	-Ergonomics	-Confine Space	-WHMIS -Toxic Chemicals		-IAPA courses -Anatomy seminar -Range of motion exercises	-Ergonomics at work station -Fire extinguishers -General Back Posture - general safety courses -Exercise and back strengthening	

*not all participants completed the question.

Expectations

Respondents were asked to provide their expectations for the course outcomes and their impressions about the course outcomes after having taken the course. The mean for each item was calculated by company (Table 3.14). For all items, there were fairly high course expectations that ranged from 6.54 to 7.55. After having taken the course, across all companies, the respondents felt that the course taught them something new, responding with a higher score than when asked about their expectations. After having taken the course, respondents felt that the course was of use at home and work, responding with a slightly higher average score of 7.57 than when asked about their expectations. However, four of the six companies responded with slightly lower scores after having taken the course compared to their expectations pre course. After having taken the course, the respondents felt that the course made a slight change to the way they handle materials at work and at home. In addition, after having taken the course, the respondents felt that the course resulted in a slight increase in communication at their company with an average score of 6.21, slightly lower than the pre course score. Only two of the six companies responded with slightly higher scores after having taken the course. Finally, after having taken the course, the respondents felt that the course would made a slight improvement to their company's safety record with an average score of 6.54, slightly lower than the pre course score. Four of the six companies responded with slightly higher scores after having taken the course.

Table 3.14 Mean Value for the Expectations and Impressions of the *Back and Upper Limb Injury Prevention* Course by Company

Scale: 1-9 The *Back and Upper Limb Injury Prevention* course will		**Hotel N=21**	**Boiler Service N=5**	**Clothing Warehouse N=7**	**Plumbing N=6**	**Chicken Processing N=16**	**Electrical Utilities N=48**	**Overall N=103**
1- Teach Me Nothing New 9 -Teach Me Something New	Pre	7.14 (2.39)	7.50 (1.73)	6.57 (1.40)	7.33 (1.51)	6.88 (1.26)	7.20 (1.22)	7.11 (1.56)
	Post	7.48 (1.72)	7.80 (1.30)	7.43 (2.15)	8.00 (1.10)	7.06 (1.73)	7.48 (1.34)	7.46 (1.51)
1- Will not be of use 9 - Taught me useful principles	Pre	7.33 (1.93)	8.25 (0.96)	8.00 (1.15)	7.67 (1.51)	7.25 (1.34)	7.61 (1.26)	7.55 (1.42)
	Post	7.14 (1.82)	8.00 (1.00)	7.86 (1.46)	8.83 (0.41)	7.06 (1.73)	7.69 (1.26)	7.57 (1.48)
1-Make no difference to work behaviour 9 - change the way work material is handled	Pre	6.80 (2.40)	7.50 (1.73)	6.71 (1.50)	7.33 (1.63)	6.31 (1.74)	6.89 (1.74)	6.82 (1.85)
	Post	7.00 (2.32)	7.60 (1.52)	7.29 (1.38)	7.50 (1.05)	6.75 (1.34)	6.65 (1.73)	6.87 (1.75)
1-Make no difference to home behaviour 9 -Result in a change in the way material is handled at home	Pre	6.95 (2.11)	7.25 (2.36)	6.00 (2.16)	6.33 (2.94)	6.06 (1.77)	7.04 (1.62)	6.76 (1.91)
	Post	6.52 (2.44)	6.80 (1.92)	7.00 (1.15)	7.83 (0.75)	6.13 (1.82)	6.81 (1.78)	6.72 (1.78)
1- Decrease company communicatio n 9 -Increase company communicatio n	Pre	7.10 (1.97)	7.25 (1.71)	5.71 (0.95)	7.67 (1.63)	6.25 (1.18)	6.83 (1.29)	6.78 (1.49)
	Post	5.71 (1.31)	7.40 (1.67)	6.00 (1.15)	7.00 (1.79)	6.06 (1.06)	6.29 (1.01)	6.21 (1.22)
1-Make no difference to safety record 9 -Greatly improve the safety record	Pre	6.55 (2.74)	7.75 (0.96)	4.86 (2.12)	6.83 (1.60)	5.88 (2.36)	6.87 (1.48)	6.54 (1.48)
	Post	6.67 (2.01)	6.20 (1.92)	5.29 (1.70)	4.00 (2.83)	6.25 (1.53)	6.63 (1.44)	6.33 (1.78)

*not all participants completed the question. Each includes: Mean (Standard Deviation)

3.5.3 Course Outcomes

The *Back Course* was evaluated to see whether measures of knowledge, self-efficacy and behaviour changed after the *Back Course* intervention. Measurement tools included the knowledge quiz and the impact questionnaires given to participants pre and post course. Other data collection methods included videotaped job task analysis pre and post course (see Appendix E). The results of the analysis of the knowledge quiz and impact questionnaires will be reported in this section of the thesis.

3.5.3.1 Knowledge Quiz

The responses to the knowledge quiz were examined for overall and subscale scores and individual item scores. Comparison of pre and post course quiz responses to subscales were examined using repeated measures analysis of variance (ANOVA). The purpose of repeated measures ANOVA is to control for individual differences that may affect the within-group variance (Hair et al., 1998).

Overall Scores

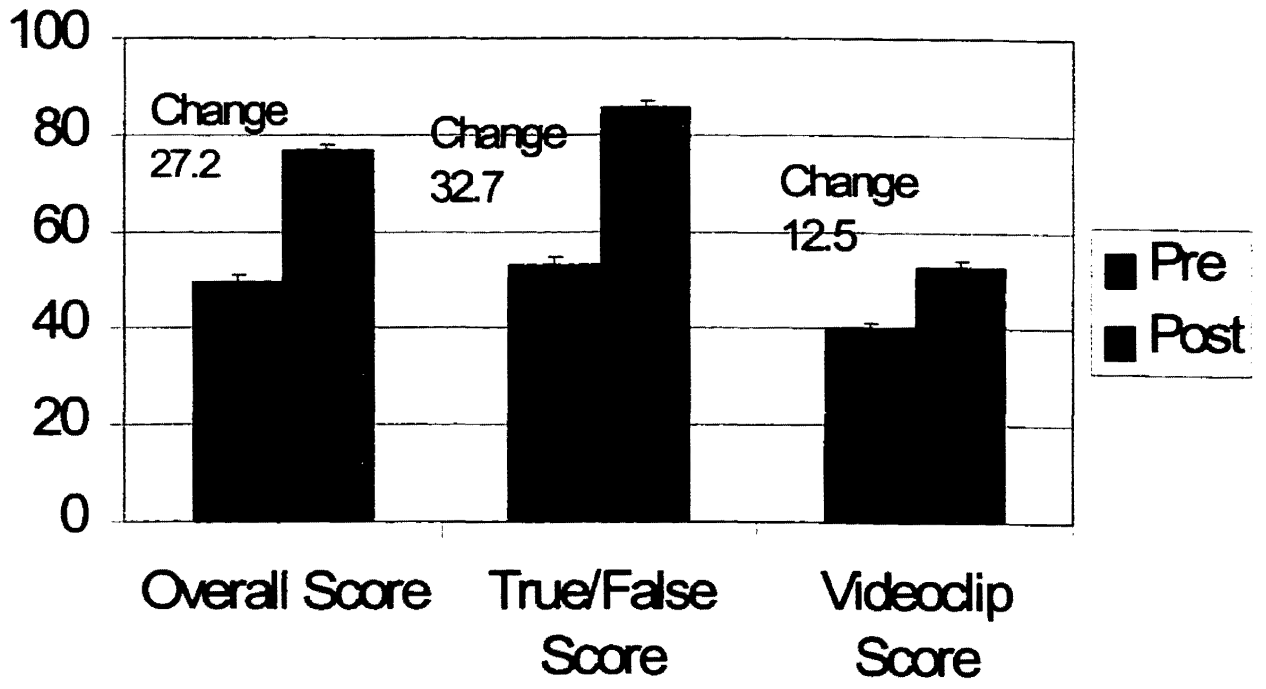
A total of 219 knowledge quizzes (219 pre course and 219 post course) were analysed for change in knowledge scores from pre to post course. Items were grouped by conceptual principle to form subscales and were analysed by subscale. Subscale scores were calculated by determining the average score for the items in the subscale (Refer to Appendix H to results by company).

Repeated measures ANOVA was conducted for the overall quiz, the true/false quiz and the videoclip section by company. There was a statistically significant increase of the difference between the true/false quiz and the videoclip scores from pre to post ($F(2, 420)=65.6$, $p<0.0001$).

As can be seen in Figure 3.5, there was a greater increase in the true/false portion than the videoclip portion of the knowledge quiz. When overall scores were analysed there were no differences between scores from pre to post course.

Repeated measures ANOVA was then conducted within subjects for each knowledge subscale, the total videoclip score, the true/false quiz, and the overall score for the pre and post course quiz between companies. Using the Greenhouse-Geisser adjustment method for the analysis of repeated measures, there was a significant interaction between subscales and company ($F(5.495, 1154.25)=1.60$, $p=0.018$). There were increases for the subscales from pre to post, but the change depended on company and subscale. The smallest increase from pre to post course was shown for videoclips (Figure 3.5) and the largest differences were found for the tensing the torso muscles, keeping the moment low and keeping the normal curve in the spine subscales. LSD post-hoc tests indicated that the boiler service had significantly larger increases from pre to post course knowledge quiz than the paintbrush manufacturing company. Also, the increases in scores of the clothing manufacturing warehouse, plumbing company, chicken processing and electrical utilities were significantly higher from pre to post course than the paintbrush manufacturing and the hotel.

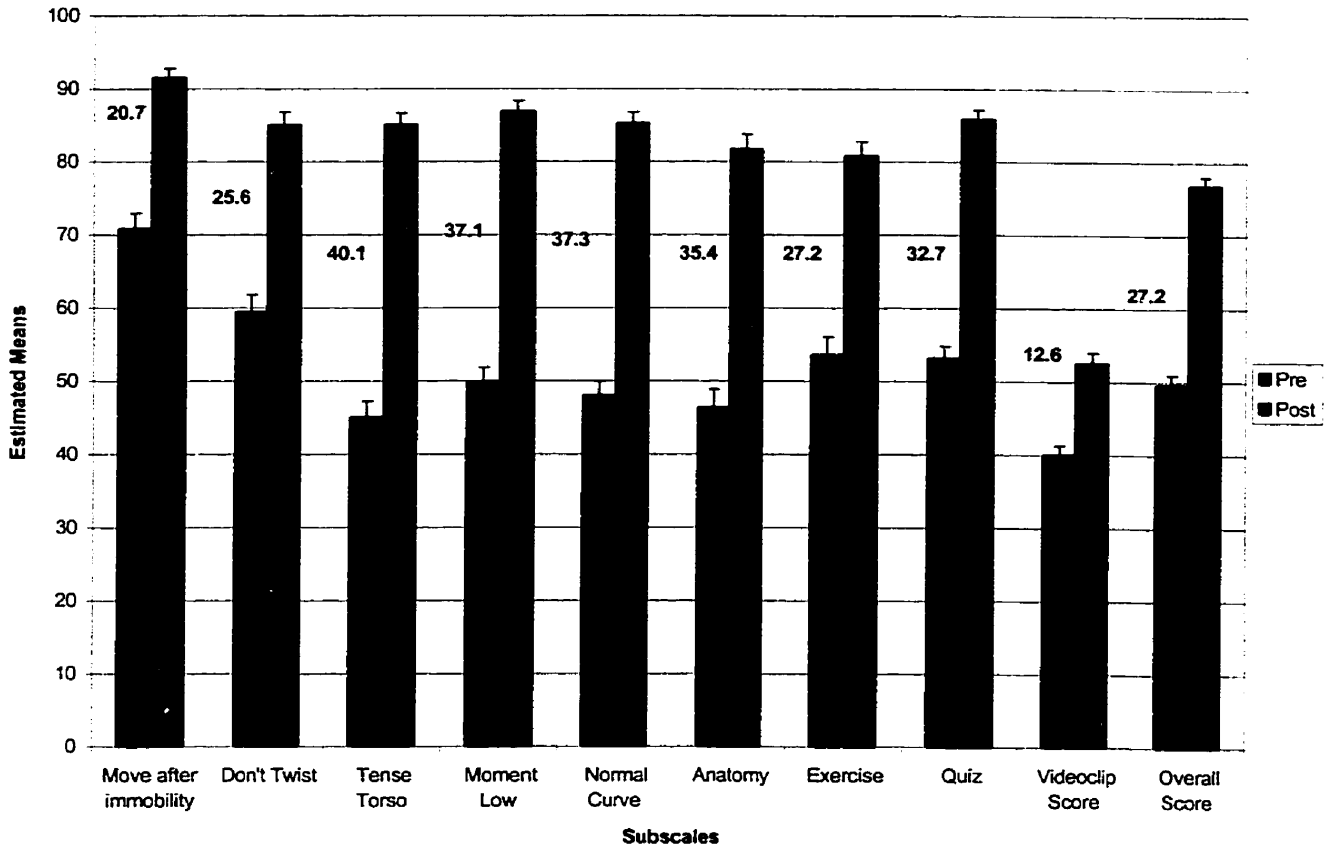
Figure 3.5 Pre and post mean scores overall, for true/false quiz and videoclip section.*



*Mean +/-Standard Error of the Mean (SEM)

**After examining the residual plots of studentized residuals by the predicted value, the variance did not appear to be homogeneous so repeated measures ANOVA was conducted on the ratio of the differences of "Post - Pre" values for the total videoclip score, the true/false quiz, and the overall score for both pre and post course quiz

Figure 3.6 Pre and post mean scores for each subscale.



*Bars represent mean+/- SEM, number above bars represent the mean change between post and pre course**Results of evaluation of the assumptions of normality of sampling distributions were satisfactory. After examining the residual plots of studentized residuals by the predicted value, the variance of some of the subscales did not appear to be homogeneous so repeated measures ANOVAs were conducted on the ratio of the differences of "Post - Pre" values for each subscale, the total for videoclips and the quiz, and the overall total for both pre and post course quiz. After examining the residual plots of studentized residuals by the predicted value, the variance of the subscales did appear to be homogeneous, but the presence of outliers led to transformation of all of the ratio of the differences for subscales, the total for videoclips and the quiz and overall total. Outliers did not remain after transformation.

"I'm Not Sure" Responses

A total of 219 knowledge quizzes (219 pre course and 219 post course) were analysed for overall responses of "true" or "false" to the quiz, or whether respondents were "not sure". Repeated measures ANOVA was conducted for the overall quiz, the true/false quiz and the videoclip section by company. There was a statistically significant increase in those who responded with either true or false from those who were "not sure" from pre to post on the overall quiz, the true/false portion and the videoclip portion of the knowledge quiz ($F(2,288)=84.55=p<0.0001$), but no difference between companies was found. Figure 3.7 shows that there was a greater increase in those who responded "true" or "false" from those who responded that they were "not sure" for the true/false portion than for the videoclip portion of the knowledge quiz.

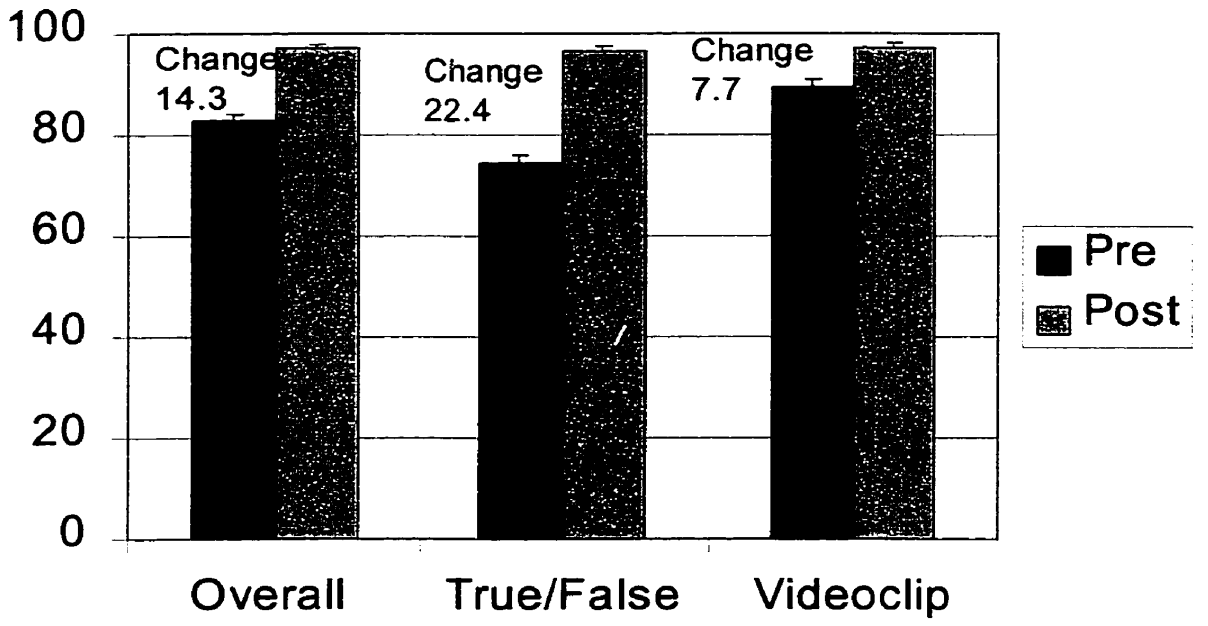
Repeated measures ANOVA was then conducted across companies with each knowledge subscale, the total for videoclips and the quiz, and the overall total for both the pre and post course quiz. There was a significant effect of time (pre and post), by whether a respondent answered with "true" or "false" or "I'm not sure" by company ($F(54, 1242)=1.54$, $p=0.008$. A graphical display of the time by those who respond with true or false and those who are unsure by subscale is shown in Figure 3.8. As can be seen in Figure 3.8, there were increases in true or false responses from pre to post, but the increases depended on the subscale. The smallest increases were shown for the "videoclips", "move after prolonged immobility", "exercises" and "don't twist to extremes" and the largest increases were shown for "keep the moment low", "anatomy" and "tensing the torso muscles" subscales. Appendix I shows the mean number of respondents who indicated they were not sure and standard deviation for each subscale by

company. In terms of company differences, LSD post-hoc tests indicated that the employees from the hotel were significantly more unsure than employees from all the other companies.

For the pre course quiz, 44 to 100 percent of participants, responded with "True" or "False" rather than "Not Sure" depending on the subscale and the company. However, for the post course quiz, 87 to 100 percent of participants responded with "True" or "False" rather than "not sure" depending on the subscale and the company (Appendix I) and this finding was fairly consistent across companies.

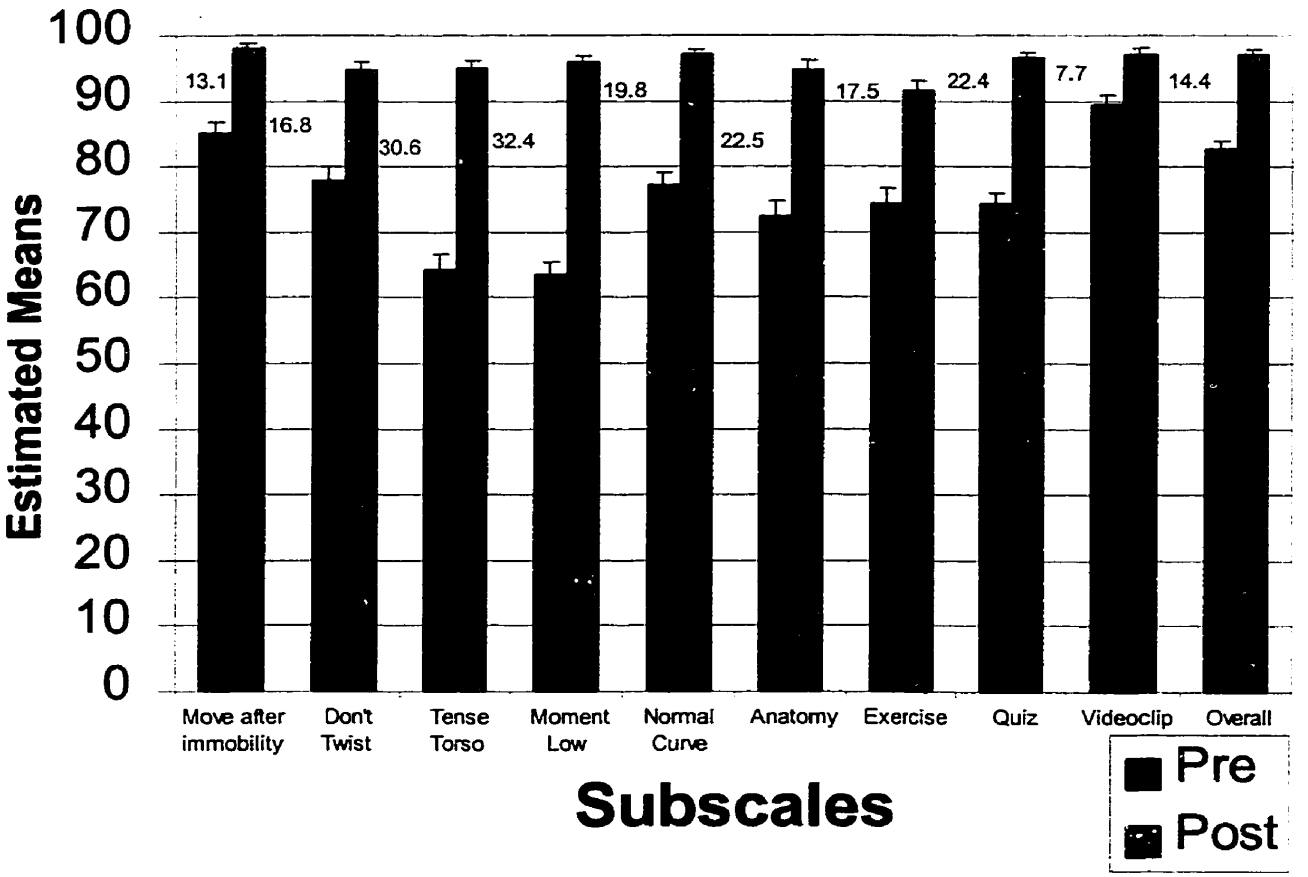
Even if the percent of respondents who were "sure" about their responses in the post course quiz increased, their responses may not have been correct. Table 3.15 show an example of the responses from one item on the knowledge quiz both pre and post course by company. Ninety-five (86%) participants who responded "I'm not sure" to question 26, answered the question correctly on the post course quiz, while of the others, nine (8%) still responded "I'm not sure" and six (5%) responded incorrectly.

Figure 3.7 Pre and post responses of "True" or "False" rather than "I'm Not Sure" Overall*.



*Bars represent mean score +/- SEM.
**Results of evaluation of the assumptions of normality of sampling distributions were satisfactory.

Figure 3.8 **Pre and post responses of "True" or "False" rather than "I'm Not Sure" for each subscale.***



* Bars represent mean +/- SEM, number above bars represents the change between post and pre course
**Results of evaluation of the assumptions of normality of sampling distributions were satisfactory.

Table 3.15 Participant Responses to Question 26:Disc Compression Increases When the Low Back Moment is High. (Subscale: Keep the Moment Low)

Company	Pre Course Quiz	Post Course Quiz			
		True*	False	I'm Not Sure	Blank
Hotel	True*	5	1		
	False	2			
	I'm Not Sure	14		2	
	Blank	2		2	2
Plumbing	True*	2			
	False	2			
	I'm Not Sure	5			
	Blank				
Chicken Processing	True*	8			
	False		1		
	I'm Not Sure	10	2		
	Blank				
Paintbrush Manufacturing	True*	11		2	
	False	2			
	I'm Not Sure	16	2	3	
	Blank	15		3	2
Clothing Warehouse	True*	1			
	False				
	I'm Not Sure	5		3	
	Blank				
Boiler Service	True*	2		1	
	False	1			
	I'm Not Sure	3			
	Blank				
Electrical Utilities	True*	36			
	False	5			
	I'm Not Sure	4	2		
	Blank	2			

*represent correct answers

Item Analysis Results

Each item was analysed for item difficulty index, for pre and post differences index (PPDI) and for item discrimination index. Item difficulty and item discrimination indices are not recommended as the final basis for item selection, but they can help to identify items that need to be changed (Dieckmann et al., 1988). Reported results are summarized across all companies since very few differences were seen between companies.

True/False/Not Sure Questions

The range of item difficulty indices conducted on the 27 true/false/not sure items is shown on Table 3.16 for all companies (Appendix J for more details). Pratt et al. (1992) recommended that in order that an item can be answered correctly by some but not all participants, items should range between 0.20 to 0.80 on the item difficulty indices. Examining all companies together, 26 of 27 items on the pre course quiz were within Pratt et al. (1992)'s recommended range of 0.20 to 0.80. On the post course quiz, a large proportion of the participants answered the items correctly, therefore only six of 27 items on the post course quiz were within Pratt et al. (1992)'s recommended range of 0.20 to 0.80.

The range and mean PPDI for pre and post course quiz is shown on Table 3.16 for all companies together. The mean PPDI across all companies indicated that there was moderate to high improvement from pre to post course quiz for all companies. For all companies combined, the items are ranked from the most sensitive to change to the least sensitive to change in Appendix J.

Item discrimination indices were calculated by subtracting the proportion of respondents who scored in the 75th percentile and got the item correct from the proportion of respondents who

scored in the 25th percentile and got the item correct. Item discrimination indices indicates how well a question discriminates between those who performed well on a test and those who did poorly on the test. The index values range from +1.00 to -1.00 with +1.00 indicating the highest discrimination. The discrimination index is also affected by the item difficulty index for the question. Questions with item difficulty indices less than .50 have lower maximum discrimination indices. Questions with a discrimination index over 0.20 are considered to be desirable (Ailinger et al., 1991). Items with a discrimination index greater than or equal to 0.50 is generally considered to be a strong item, items with a discrimination index above 0.30 but less than 0.50 is considered to be moderately strong. Items with a discrimination index above 0.20 and less than 0.30 are considered to be adequate discriminators (Ailinger et al., 1998). The discrimination indices are shown in Table 3.16 for all companies. For all companies together, only two items had discrimination indices under 0.20 on both the pre and post course quiz.

Table 3.16 Summary of Item Difficulty, Pre/Post Differences and Item Discrimination Indices Across All Companies for True/False Items and Video Clips.

		Item Difficulty Index		**Pre/Post Differences Index**		**Item Discrimination Index**			
		Range	**Between 0.20-0.80**	**Range**	**Mean**	**<.2**	**.2-.29**	**.3-.49**	**<.5**
True/False Items	Pre	0.31-0.84	26/27	0.10-0.60	0.33	2	6	12	7
	Post	0.68-0.98	6/26			2	6	13	6
Video Clips	Pre	0.05-0.76	8/10	0.06-0.31	0.14	6	0	3	1
	Post	0.11-0.84	5/10			6	0	3	1

Videoclips

The range of item difficulty indices conducted on the 10 videoclip items is shown on Table 3.16 for all companies together. In general across all companies, the questions relating to the videoclips were not answered as well as the quiz, and generally there was not as large or as consistent of a change between pre and post course quiz for the videoclips compared to the quiz. For all companies together, eight of 10 items on the pre course quiz were within Pratt et al. (1992)'s recommended range of 0.20 to 0.80 on the pre course quiz, and five of ten items on the post course quiz were within Pratt et al. (1992)'s recommended range of 0.20 to 0.80.

The range and mean PPDI for pre and post course quiz is shown on Table 3.16 for all companies together. The range of PPDI varied greatly and indicated that the sensitivity of items to change varied. The mean PPDI for all companies indicated that there was a relatively small improvement from pre to post course quiz in analysis of the video clips.

The discrimination indices are shown in Table 3.16 for all companies. For all companies together, six of ten items had discrimination indices under 0.20 on both the pre and post course quiz.

Non-Parametric Tests of Association by Item

McNemar's test for concordance was used, item by item, to test the null hypothesis that the proportion of correct responses to that item did not change significantly from pre to post test. McNemar's test was used since the (pre - post) scores for individual items are not normally distributed. In the McNemar test for the significance of changes, the test statistic is based on the frequencies in the off-diagonal cells of the 2x2 frequency table in which the two

variables cross-classified are pre-test score (Correct or Incorrect) and post-test score (Correct or Incorrect) for each person. The χ^2 distribution is used to examine the statistical significance of the pre/post changes when the off-diagonal frequencies are large, but when they are small (i.e., if the sum of the off-diagonal entries is less than 30) the binomial distribution is used since the χ^2 approximation is poor. The significance levels of the McNemar's Test for all companies together by item are reported in Appendix K. When all companies were considered together, the proportion of respondents responding correctly to a post course knowledge item was significantly increased for all items compared to pre course knowledge quiz items. Even though item responses examined by company, showed that respondents changed from incorrect to correct on pre to post course quiz, the small sample sizes in some companies did not result in statistically significant changes. For example, for question one: all the companies with statistically non-significant results showed that all respondents moved from incorrect on the pre course quiz to correct on the post course quiz, but had a small number so the results were not statistically significant.

With all companies together, the proportion of post course videoclip item correct responses for all items except one were statistically higher than the pre course correct responses. However, these questions were not done as well as the true/false item responses. For all items there were numerous participants who correctly answered the question in the pre course quiz, and incorrectly answered the item in the post course quiz.

Internal Consistency

Kuder-Richardson Formula 20 (equivalent to Cronbach's alpha for dichotomous variables) was used to assess the quiz's internal consistency. The internal consistency for the true/false items was 0.9148 and the internal consistency for the videoclips was 0.7313. Furthermore, the internal consistency for each subscale is shown in Table 3.17. The anatomy subscale had the lowest internal consistency of 0.3810.

Table 3.17 Internal Consistency for Each Subscale

Subscale	Internal Consistency
Move around after prolonged immobility	0.5679
Avoid Twisting the Spine to Extremes	0.7579
Lightly Tense the Torso Muscles	0.6922
Keep the Moment Low	0.7246
Keep the Normal Curve in the Spine	0.7074
Anatomy	0.381
Exercise	0.4377
Total Quiz	0.9148
Videoclips	0.7313

3.5.3.2 Impact Questionnaire Results

Over 400 variables were measured on the Impact Questionnaire. A number of items were included for descriptive purposes. Although it is beyond the scope of this thesis to report the findings from all variables, to describe the study sample, a number of variables of particular interest are reported in this section of the thesis. Multivariate analyses were also performed on the data and are reported in section.

Multivariate Analyses

The primary purpose of this study was to determine if the *Back Course* improved knowledge, self-efficacy, changed behaviour and changed perceptions of their job by comparing the pre and post course knowledge quiz and impact questionnaires. Linear and logistic regression analyses were conducted to explore factors that may relate to desired outcomes of knowledge, self-efficacy and changed behaviour.

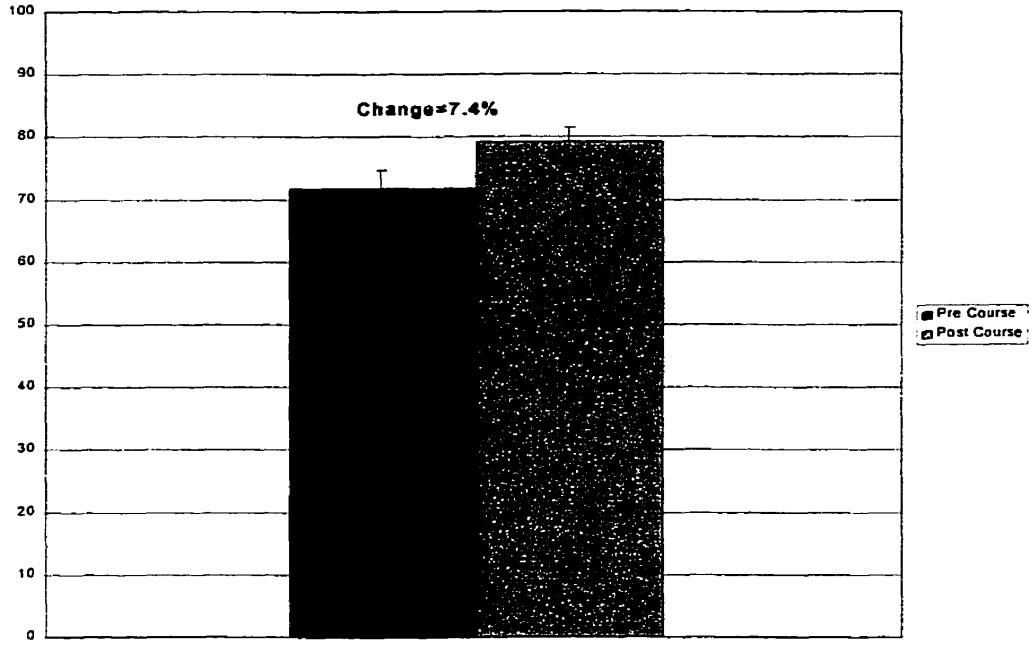
Change in Self-Efficacy

Overall, respondents reported an increase in self-efficacy from pre to post course across all items. On average across all companies, there was an increase in self-efficacy from 71.79 pre course to 79.19 post course. However, there were high pre course scores for each item on the Spinal Function Sort. The high pre course scores on each individual item with the exception of four items, resulted in pre course ceiling effects demonstrated by frequency histograms and negative skewness values. Thus, overall, there were ceiling effects for self-efficacy.

Repeated measures ANOVA was conducted within subjects for each item on the Spinal Function Sort for both the pre and post course impact questionnaires between companies to determine whether the participants' self-efficacy (i.e., confidence in their ability to minimize the risk of back, shoulder and neck injury) improved from pre to post course. Prior to conducting the repeated measures ANOVA, a check of reliability was done examining the correlations of highly similar items on the Spinal Function Sort. While the drawings of items 17 and 49 are not identical, both have the same task description. Similarly items 6 and 50 are

nearly identical. The scores on items 17 and 49 were highly correlated at 0.9537 and items 6 and 50 were highly correlated at 0.9050. Since the reliability between these two sets of items

Figure 3.9 Pre and Post Course Responses for Self-Efficacy on the Spinal Function Sort



*Bars represent mean score +/- SEM.
**Results of evaluation of the assumptions of normality of sampling distributions were satisfactory.

was so high, the Repeated Measures ANOVA with Spinal Function Sort items was performed. Results of evaluation of the assumptions of normality of sampling distributions were negatively skewed so the data were transformed using the SQRROOT(101-X). The repeated measures ANOVA was conducted again with the transformed variables. As a result, the F test was adjusted with new degrees of freedom based on an adjustment value called epsilon using new criteria, the Greenhouse-Geisser. Using the Greenhouse-Geisser, there was a significant

interaction of time (i.e., pre and post) by the sort category (F (10.233, 767.512)=9.842, $p<0.0001$ (Results are shown in Appendix L. Item by item the pre course self-efficacy scores were high (from 40.07% confident to 83.33% confident) which may have resulted in a pre course ceiling effect.

There are overall improvements in self-efficacy for each item on the Spinal Function Sort from pre to post course across companies. Although company was not found to interact with the Spinal Function Sort items and time, there were some differences noted between companies. For nearly 30 of the 50 items, respondents from the hotel did not show improvements in self-efficacy from pre to post course. At most of the other companies, there was an improvement in self-efficacy from pre to post course.

Change in Job Content, Job Influence and Job Satisfaction

Repeated measures ANOVA was also conducted within subjects for each subscale on the Job Content Questionnaire, the Job Influence scale and the job satisfaction item for both the pre and post course impact questionnaires between companies to determine whether the participants' perceptions of their job (i.e., psychosocial aspects of their job) improved from pre to post course. Table 3.18 shows the scores from the pre and post course impact questionnaire for all of the Job Content Questionnaire scales, the Job Influence scale and the job satisfaction item. As can be seen in the table, the scores did not change from pre to post course. It should also be noted that for the job satisfaction item, respondents were fairly satisfied prior to taking the course which may have resulted in a ceiling effect.

Table 3.18 Scores of Job Content, Job Influence and Job Satisfaction Scales

Items/Scales		**Pre Course Scores (Standard Deviation)**	**Post Course Scores (Standard Deviation)**
Job Content Questionnaire	Skill Discretion	26.76 (6.42)	27.14 (6.25)
	Decision Authority	23.46 (8.56)	24.15 (8.04)
	Supervisor Support	9.26 (2.81)	9.20 (2.69)
	Co-worker Support	9.17 (2.67)	9.02 (2.00)
	Social Support	18.47 (5.06)	18.22 (4.02)
	Psychological Support	28.28 (5.45)	28.22 (4.97)
	Physical Exertion	2.33 (1.26)	2.44 (4.97)
Job Satisfaction (1=Very Satisfied to 4 Not at all Satisfied)		1.93 (0.89)	1.77 (0.70)
Job Influence Scale (11 items summed)		32.82 (9.36)	33.83 (9.02)

None of the results of the repeated measures ANOVA were found to be significant so they will not be presented further. Since there was no significant difference between pre and post course for the Job Content Questionnaire subscales, the Job Influence subscale, and the job satisfaction item, the pre course score of each was used for the regression analysis.

Regression Analyses

Regression analysis was performed using SPSS Regression and SPSS Frequencies for evaluation of the assumptions of Multiple Regression (Statistical Package for the Social Sciences for Windows Version 10). Since some variables were highly correlated such as the language people are most comfortable reading and writing, and the language people are most comfortable speaking, only one variable, the language people are most comfortable speaking was selected for inclusion in the models. In addition, whether respondents "have young

children, care for older adults or disabled people" was highly correlated with whether respondents "provide physical care for these people", so the former variable was included in the models. The Job Content Questionnaire has a number of scales (Decision Latitude, Social Support) and subscales (Skill Discretion, Decision Authority, Co-worker Support and Supervisor Support). The subscales were included in the analysis rather than the umbrella scales.

For analysis and reporting purposes, variables were grouped into the following six categories:

1. Background including sociodemographic, risk factors for musculoskeletal disease, and job tasks.
2. Expectations of the course before the course was offered
3. Job Content Questionnaire Subscale Variables (psychosocial questions related to work)
4. Job Satisfaction Variable
5. Job Influence Subscale
6. Workplace Organization Variables

Each variable was individually fit in a linear regression model to determine the variable's significance in the absence of all other variables. Only significant variables have been reported in this analysis.

Multiple Regression With Differences Between Post and Pre Course Knowledge Quizzes as Dependent Variable

Univariate Statistics

Regression was used to examine the individual and joint effects of the independent (i.e., explanatory) variables on the difference in the pre and post course knowledge quiz scores. The difference in knowledge quiz scores comparing post and pre course scores was calculated

subtracting the post scores from the pre scores. The scores ranged from -5.41 to 67.57 with an average of 26.38.

Category 1: Background Information

Table 3.19 shows that gender was related to increases in knowledge quiz between post and pre course scores. Females had a higher mean increase in the post course knowledge quiz scores than males from the pre course scores.

Table 3.19 The Relationship of Background Variables on Differences between Post and Pre Knowledge Quiz Scores

Variable		Mean Differences Between Pre and Post	β Coefficient	Standard Error	t value	P Value
Gender R^2=0.040	Male (n=68)	24.81	-5.405	2.69	-2.01	0.05
	Female (n=35)	30.22				

Category 2: Expectations of the Course

Table 3.20 shows that two of the expectation variables were associated with increases in post knowledge quiz scores from the pre knowledge quiz scores. Generally, those who felt that the course would of little use to them at home or work had smaller increases in post course scores compared to pre course scores than those who felt the course would be of use to them at work. In general, respondents who did not expect the course to change the way they handle materials at work had smaller increases between post and pre course scores than those who felt the course would change the way they handled materials at work.

Table 3.20 The Relationship of Expectation Variables on Differences between Post and Pre Knowledge Quiz Scores

Variable		Mean Differences Between Pre and Post	β Coefficient	Standard Error	t value	P Value
Expectations : of use R^2=0.057	1-3 No Use (n=1)	21.62	2.183	0.913	2.392	0.02
	4 (n=2)	21.62				
	5 (n=6)	18.92				
	6 (n=11)	20.15				
	7 (n=23)	26.55				
	8 (n=22)	28.5				
	9 Useful (n=32)	28.97				
Expectations : handle work R^2=0.051	1-2 No difference(n=3)	23.42	1.585	0.704	2.251	0.03
	3 (n=3)	22.52				
	4 (n=5)	17.83				
	5 (n=12)	25.9				
	6 (n=13)	25.57				
	7 (n=20)	22.43				
	8 (n=21)	28.06				
	9 Change in handling (n=19)	32.57				

Multivariate Statistics

The multiple regression model was constructed using two strategies, both of which produced the same results. Table 3.21 presents the results of the initial model prior to backward elimination.

Table 3.21 Multiple Regression Model examining the Relationship of Variables on Differences between Post and Pre Knowledge Quiz Scores*

Variable	β Coefficient	Standard Error	t value	Significance	R Square
Expectations that course will be of use at home and work	4.524	2.703	1.673	0.108	
Management committed to keeping workers employed when injured	1.563	2.795	0.559	0.582	
Rehab courses	4.543	7.619	0.596	0.557	
Gender	3.005	5.447	0.552	0.587	
Expectations that course will change the way material is handled at home	-5.636	3.479	-1.62	0.12	
Expectations that course will change the way material is handled at work	3.392	2.953	1.149	0.263	
Overall					0.31
Intercept	-3.199				

***Strategies for Selecting Final Model**

1. Table 3.21 shows the variables entered into the multivariate model (the variables with a significance level of at least 0.10). The variables were then eliminated using backward elimination which included all the independent variables entered, with each step consisting of the removal of the variables that change the R^2 the least, provided that the change was small enough so that the null hypothesis was not rejected, using a preset significance level of .10. Background variables (such as age) which were not significant in the univariate analysis were inserted into the multiple regression model to investigate their significance when controlling for other variables in the model.
2. In the second strategy, statistically significant variables from each category were fit into initial models using a hierarchical analysis approach. The variables from each category were then eliminated using backward elimination. The final variables in each category were then entered into a final model. Variables in this model were eliminated using backward elimination.

In both strategies, interactions between variables were also examined with their main effects in both strategies. No interactions were found with a P Value less than 0.10. Thus, the interaction terms were not investigated further. Table 3.22 presents the best fitting model using both of these two strategies.

Table 3.22 Multiple Regression Model examining the Relationship of Variables on Differences between Post and Pre Knowledge Quiz Scores

Variable	β Coefficient	Standard Error	t value	Significance	R Square
Expectations that the course will be of use at home and work	3.703	1.679	2.206	0.036	
Overall					0.15
Intercept	1.91				

The best fitting model includes only the variable of expectations that the course will be of use at home and work. This variable accounted for 15% of the variance.

Given the regression equation is the following: $y_i = \beta_0 + \beta_1 x_{i1}$

y_i=difference in post and pre knowledge quiz scores,
$\beta_0 = 1.91$
$\beta_1 = 3.70$, x_{i1}= expectations that the course will be of use at home and work

For every one unit increase in the expectation that the course will be of use at home or work, there is a 3.703 unit increase in the differences between post and pre course score.

Linear Regression With Post Course Knowledge Quiz Score as Dependent Variable

Univariate Statistics

Linear regression was used to examine the individual and joint effects of the independent (i.e., explanatory) variables on the post course knowledge quiz score. The scores ranged from 21.62 to 100.00 with an average of 83.08. The variables used in the previous linear regression were also used in this analysis.

Category 1: Background Information

Table 3.23 shows that company, language, and education were highly significant. Those from the hotel had a lower mean score on the post course knowledge quiz than other companies and the electrical utilities company had the highest mean score on the post course knowledge quiz than other companies. Respondents who speak a language other than English had a lower mean post knowledge quiz score than respondents who speak English. Respondents with less than high school or with high school had lower mean scores than those with some or completed college or university.

Table 3.23 The Relationship of Background Variables on Post Course Knowledge Quiz Scores

Variable		Mean Post Course Knowledge Score	β Coefficient	Standard Error	t value	P Value
Company R^2=0.379	Hotel (n=21)	64.86				
	Boiler Service (n=5)	85.95	21.08	6.02	3.5	0.001
	Clothing Warehouse (n=7)	84.94	20.08	5.29	3.79	0.0001
	Plumbing (n=6)	86.49	21.62	6.02	3.59	0.001
	Chicken Processing (n=16)	83.61	18.75	4.06	4.61	0.0001
	Electrical Utilities (n=48)	89.19	24.32	3.25	7.49	0.0001
Language R^2=0.138	English (n=98)	84.19	-31.934	8.175	-3.907	<0.0001
	No English (n=5)	52.25				
Education R^2=0.160	Less than High School (n=11)	68.06	6.779	1.593	4.256	<0.0001
	High School (n=31)	79.68				
	Some or Completed College (n=44)	87.9				
	Some or completed University (n=15)	87.93				

Category 3. Job Content Questionnaire Subscales

Table 3.24 shows that Decision Authority (3 items) and Co-worker Support (4 items) were associated with post course knowledge quiz scores. In general, those with higher scores on the decision authority and co-worker support subscales had lower scores on the post course knowledge quiz than those with lower scores on the three subscales.

Table 3.24 The Relationship of Job Content Questionnaire Subscales on Post Course Knowledge Quiz Scores

Variable	Mean Subscale Score	β Coefficient	Standard Error	t value	P Value
Decision Authority R^2=0.051	23.46	-0.407	0.185	-2.201	0.03
Co-worker Support R^2=0.082	9.17	-1.516	0.548	-2.766	0.01

Category 6. Workplace Organization Variables

Table 3.25 shows that management encouraging supervisors to provide light duties to those with injuries was highly associated with the post knowledge course quiz scores. For this workplace organization variable, in general those who strongly agreed or agreed tended to have higher scores on average than the balance of respondents.

Table 3.25 The Relationship of Workplace Organization on Post Course Knowledge Quiz Scores

Variable		Mean Post Course Score	β Coefficient	Standard Error	t value	P Value
Management encourages supervisors to provide light duties to those with injuries. R^2=0.082	Strongly Agree (n=36)	88.54	-5.154	1.813	-2.84	0.006
	Agree (n=52)	82.65				
	Neither agree or disagree (n=9)	77.48				
	Disagree (n=4)	86.49				
	Strongly disagree (n=1)	35.13				

Multivariate Statistics

The multiple regression model was constructed using two strategies, both of which produced the same results. The initial model entered for the multiple regression is presented in Table 3.26.

Table 3.26 Multiple Regression Model examining the Relationship of Variables Post Course Knowledge Quiz Scores*

Variable		β Coefficient	Standard Error	t value	Significance	R Square
Gender		-0.169	3.666	0	0.963	
Language		-25.11	7.404	-3.39	0.001	
Education		2.453	1.974	1.243	0.218	
Company	Hotel	0				
	Boiler Service	14.42	7.725	1.867	0.066	
	Clothing Warehouse	12.419	6.747	1.841	0.07	
	Plumbing	12.158	7.646	1.59	0.116	
	Chicken Processing	9.913	4.957	2	0.049	
	Electrical Utilities	10.877	5.559	1.957	0.054	
Job Satisfaction		-1.74	2.196	-0.79	0.431	
Decision Authority		-0.169	0.184	-0.92	0.362	
Supervisor Support		0.312	0.745	0.419	0.676	
Co-worker Support		-0.313	0.735	-0.43	0.672	
Physical Exertion		1.162	1.256	0.925	0.358	
Management encourages employees to shut down an unsafe machine		-0.191	2.455	-0.1	0.938	
Management encourages employees to report physical symptoms arising from job tasks		2.145	2.908	0.738	0.463	
Management encourages supervisors to provide light duties to those with injuries.		-2.902	2.533	-1.15	0.256	
Overall						0.46
Intercept		76.155				

***Strategies for Selecting Final Models**

1. Table 3.26 shows the variables entered into the multivariate model (variables with p value of .1 or less). The variables were then eliminated using backward elimination which included all the independent variables entered, with each step consisting of the removal of the variables that change the R^2 the least, provided that the change was small enough so that the null hypothesis was not rejected, using a preset significance level of .10. Background variables which were not significant in the univariate analysis were inserted into the multiple regression model to investigate their significance when controlling for other variables in the model.
2. In the second strategy, statistically significant variables from each category were fit into initial models. The variables from each category were then eliminated using backward elimination. The final variables in each category were then entered into a final model. Variables in this model were eliminated using backward elimination.

In both strategies, interactions between variables were also examined with their main effects in both strategies. No interactions were found with a P Value less than 0.10. Thus, the interaction terms were not investigated further. Table 3.27 presents the best fitting model using both of these two strategies.

Table 3.27 Final Multiple Regression Model examining the Relationship of Variables Post Course Knowledge Quiz Scores

Variable		Coefficient	Standard Error	t value	Significance	R Square
Company	Hotel	0				
	Boiler	19.168	6.439	2.977	0.004	
	Clothing	13.763	5.564	2.473	0.016	
	Plumbing	16.466	6.439	2.557	0.012	
	Chicken	12.243	4.223	2.899	0.005	
	Electric	18.483	3.559	5.194	<0.0001	
Language		-25.281	6.844	-3.694	<0.0001	
Overall		Intercept 71.372				0.406

The initial best fitting model included company and language. This model accounted for 41% of the variance.

Given the regression equation is the following:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \beta_4 x_{i4} + \beta_5 x_{i5} + \beta_6 x_{i6}$$

y_i= post knowledge quiz scores, $\beta_0 = 71.37$
$\beta_1 = 19.17$, x_{i1}= boiler service
$\beta_2 = 13.76$, x_{i2}= clothing warehouse
$\beta_3 = 16.47$, x_{i3}= plumbing
$\beta_4 = 12.24$, x_{i4}= chicken packaging
$\beta_5 = 18.48$, x_{i5}= electrical utilities
$\beta_6 = -25.28$, x_{i6}= language

Adjusting for other variables in the model, respondents from the boiler service, clothing warehouse, plumbing company, chicken processing and electrical utilities had higher post course scores than respondents from the hotel. In addition, respondents from the electrical utilities had higher post course scores than respondents from any other company. Respondents who read or write a language other than English scored lower post course than respondents who speak English.

When this model was considered by comparing all companies to the hotel, it was recognized that the hotel was dominating the relationship found for the company variable. Those in the hotel were associated with lower post course scores than any other company. The company variable was taken out of the final model and backward elimination was performed to see how the final model may be influenced by this manipulation. The final model that resulted included: education, language and management providing light duties for employees when they are injured.

Table 3.28 Second Final Multiple Regression Model examining the Relationship of Variables Post Course Knowledge Quiz Scores

Variable	Coefficient	Standard Error	t value	Significance	R Square
Language	-30.018	6.8	-4.414	<0.0001	
Education	4.617	1.433	3.222	0.002	
Management providing light duties for injured workers	-4.152	1.495	-2.777	0.007	
Overall					0.353
Intercept	81.185				

The second best fitting model (excluding company) included language, education and management providing light duties for injured workers. This model accounts for 35% of the variance.

Given the regression equation is the following:

$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3}$

y_i= post knowledge quiz scores, $\beta_0 = 81.18$
$\beta_1 = -30.01$, x_{i1}= language
$\beta_2 = 4.617$, x_{i2}= education
$\beta_3 = -4.152$, x_{i3}= management providing light duties for injured workers

Adjusting for other variables in the model, those with some or completed college were associated with a 4.627 unit increase in knowledge quiz post score than those with only a high school education. Also those with difficulties with the English language were associated with a 30 unit decrease in the knowledge quiz post score. Those who reported that management provided light duties for injured employees were associated with a 4 unit increase in knowledge quiz post score.

Logistic Regression with Self Efficacy Change Score as Dependent Variable

Logistic regression was used to examine the individual and joint effects of the independent (i.e., explanatory) variables on the spinal function sort outcome variable. The dependent variable is change in confidence of the respondents' ability to minimize risk of back, shoulder or neck injury. In this study, Y=0 denotes that respondents were less confident in their ability to minimize risk of back, shoulder or neck injury post course compared to pre course and Y=1 denotes that respondents were more confident in their ability to minimize risk of back,

shoulder or neck injury post course compared to pre course. The logistic function relates the dependent variable (the confidence in ability to minimize risk of back, shoulder or neck injury) to the explanatory (independent) variables which may be discrete or continuous (Tabachnick and Fidell, 1996). The dependent variable was created by adding together all 50 of the individual item scores for the pre course impact questionnaire. These scores represented the respondents' pre course confidence in their ability to complete each task minimizing risk of injury to their back, shoulder or neck. All 50 of the individual item scores for the post course impact questionnaire were then added together. These scores represented the respondents' post course confidence in their ability to complete each task minimizing risk of injury to their back, shoulder or neck. It was hypothesized that after taking the *Back Course*, individuals would be more confident in their ability to minimize risk of back, shoulder or neck injury. The post scores for each individual were then subtracted from the pre scores for each individual to create a continuous outcome variable. A categorical variable was then created indicating whether there was positive change, negative change or no change from pre to post course. There was positive change with 72 (70%) cases indicating that they were more confident that they could minimize risk of back, shoulder, or neck injury and 29 (28%) indicating that they were less confident that they could minimize risk of back, shoulder or neck injury. (There were two that did not complete the questions.)

Category 1: Background Information

Table 3.29 shows that gender, and a respondents' perception of their activity level were significant. A higher proportion of females reported more confidence in their ability to minimize risk of back, shoulder and neck injury from post to pre course than males. A higher proportion of people who considered themselves moderately active were more confident in their ability to minimize risk of back, shoulder and neck injury from post to pre course compared to those who considered themselves very active.

Table 3.29 The Relationship of Background Variables on Change in Self Efficacy from post to pre course quiz

Variable		Frequency	Outcome		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
			Positive	Negative					
Gender	Female	35/103	30/35	5/35	1.256	0.547	5.268	0.02	3.51
	Male	68/103	42/68	26/68					
Active	Moderately	65/103	50/65	15/65	0.965	0.457	4.467	0.035	2.62
	Very Much So	35/103	20/35	15/35					

Category 3. Job Content Questionnaire Subscales

Table 3.30 shows that a higher mean score on the co-worker support subscale was associated with confidence in the ability to minimize risk of back, shoulder and neck injury.

Table 3.30 The Relationship of Job Content Questionnaire Subscales on Change in Self Efficacy from post to pre course quiz

Variable	Mean or Frequency	Outcome		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
		Positive	Negative					
Co-worker Support Subscale	9.18	9.62	8.19	0.261	0.118	4.868	0.03	1.298

Multivariate Analyses

The logistic regression model was constructed using the two strategies, both of which produced the same results. Table 3.31 shows the variables entered into the multivariate model.

Table 3.31 Initial Multivariate Model with Change in Self Efficacy from post to pre course quiz as Dependent Variable*

Variable	β Coefficient	Standard Error	Wald	Significance	Odds Ratio
Gender	0.722	0.675	1.145	0.285	2.059
Active	-1.06	0.55	3.722	0.054	0.346
Expect: Course would teach something new	-0.355	0.204	3.013	0.083	0.701
Coworker Support	-0.361	0.151	5.697	0.017	0.697
Post Course Tense Torso Muscles	-0.035	0.017	4.112	0.043	0.965
Constant	7.99	3.167	6.367	0.012	2952.43

-2Log Likelihood = 85.036

*Strategies for Selecting Final Models

1. In the first strategy, variables with a p value of 0.1 or less from the above categories were combined into a model. The variables were then eliminated using backward elimination which included all the independent variables entered, with each step consisting of the removal of the variables that change the R^2 the least, provided that the change was small enough so that the null hypothesis was not rejected, using a preset significance level of .10. Background variables which were not significant in the univariate analysis were inserted into the multiple regression model to investigate their significance when controlling for other variables in the model.
2. In the second strategy, statistically significant variables from each category were fit into initial models. The variables from each category were then eliminated using backward elimination. The final variables in each category were then entered into a final model. Variables in this model were eliminated using backward elimination.

Using both strategies, interactions between variables were also examined with their main effects in both strategies. No interactions were found with a P Value less than 0.10. Thus, the interaction terms were not investigated further. Table 3.32 presents the best fitting model using both of these two strategies.

Table 3.32 Final Model with Change in Self Efficacy from post to pre course quiz as Dependent Variable

Variable	β Coefficient	Standard Error	Wald	Significance	Odds Ratio
Active	1.178	0.511	5.311	0.021	3.249
Coworker Support	0.243	0.119	3.783	0.05	1.275
Constant	-1.929	1.122	2.959	0.085	0.145

-2Log Likelihood = 110.47

The best fitting model includes perception of activity level and the coworker support subscale of the Job Content Questionnaire.

Given the logistic regression equation is the following:

Ln (prob Y=1)/prob (Y=0) $= \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2}$

ln (probability that respondent is more confident in ability to minimize risk of injury)/ln (probability that respondent is less confident in ability to minimize risk of injury)
$\beta_0 = -1.93$
$\beta_1 = 1.18$, x_{i1}= perception of activity
$\beta_2 = 0.24$, x_{i2}= co-worker support

Perception of level of physical activity was associated with an increase in the reporting of confidence in ability to minimize risk of injury. For example, a respondent who reported that he/she was moderately active had 3.25 greater odds of reporting confidence in ability to minimize risk of injury than a respondent who reported he/she was very active. As well, a greater level of co-worker support was associated with an increase in the reports of confidence in the ability to minimize risk of injury. For example, respondents scores ranged from 4-19 on co-worker support. Assuming linearity throughout the distribution, a respondent with 10 on the co-worker support subscale, would have 1.62 times greater odds of reporting confidence in

ability to minimize risk of injury compared to a respondent with a 8 on the co-worker support subscale; whereas a respondent with a score of 12 on the co-worker support subscale had 2.64 times the odds of reporting confidence in ability to minimize risk of injury compared to a respondent with a score of 8 on the co-worker support subscale.

Logistic Regression with Self-Reported Behaviour as the Dependent Variable

Logistic regression was used to examine the individual and joint effects of the independent (i.e., explanatory) variables on three separate self-reported behaviour dependent variables. Since these measures of self-reported behaviour are each based on one item in the post item questionnaire and have not been psychometrically assessed, the analysis is exploratory in nature.

Exercise

The first dependent variable is doing the exercises taught in the *Back Course.* In this study, Y=0 denotes that respondents did not do the exercises taught in the *Back Course* and Y=1 denotes that respondents did do the exercises taught in the *Back Course.* Ninety-seven respondents (94%) reported remembering the exercises taught in the *Back Course.* Sixty-eight respondents (66%) reported doing the exercises taught in the *Back Course.* Of those respondents, 39 (57%) reported doing the exercises a few times, 16 (23%) reported doing the exercises several times and 13 (19%) reported doing the exercises regularly at six weeks follow-up. Thirty-five respondents (34%) reported that they did not do the exercises taught in the *Back Course.* Fifty-nine respondents (57%) reported referring to the handout received in the *Back Course.*

Category 1: Background Information

Table 3.33 shows that a higher proportion of those who reported low back pain over the past 6 weeks reported doing the exercises than those who did not report low back pain.

Table 3.33 The Relationship of Background Information on Reports of Doing Exercises Learned in Course

Variable		Frequency	Exercises		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
			Yes	No					
Low back pain over past 6 weeks	Yes	20/103	18/20	2/30	-1.383	0.653	4.48	0.034	0.251
	No	82/103	49/82	33/82					

Category 3. Job Content Questionnaire Subscales

Table 3.34 shows that those who reported a higher level of co-worker support also reported doing the exercises learned in the course more than those who reported a lower level of co-worker support.

Table 3.34 The Relationship of Job Content Questionnaire Subscales on Reports of Doing Exercises Learned in Course

Variable	Mean	Exercises		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
		Yes	No					
Co-worker Support Subscale	9.18	9.59	8.33	0.222	0.109	4.172	0.04	1.249

Category 6. Workplace Organization Variables

Table 3.35 shows that a higher average score (i.e. a higher average score indicates a less agreement on the statement) on two workplace organization variables was associated with reports of doing the exercises learned in the course. For example, the mean score of "management encourages employees to shut down an unsafe machine or stop the work process

when an unsafe condition arises" was 2.09 for those who reported doing the exercises compared to 1.59 for those who do not do the exercises. A score of 1 indicates that the respondent strongly agreed, a score of 2 indicates the respondent agreed and a score of 3 indicates that the respondent neither agreed or disagreed with the statement.

Table 3.35 The Relationship of Workplace OrganizationVariables on Reports of Doing Exercises Learned in Course

Variable	Mean	Exercises		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
		Yes	No					
Management encourages employees to shut down an unsafe machine	1.93	2.09	1.59	0.753	0.305	6.077	0.014	2.12
Management encourages supervisors to provide light duties to those with injuries.	1.97	2.14	1.63	0.811	0.328	6.125	0.013	2.25

Category 7. Knowledge Quiz Subscales

Table 3.36 shows that those who had a greater increase between post and pre course on the subscale don't twist the spine to extremes, a greater post quiz score on the tense the torso muscles and exercise subscales also reported doing the exercises more than those who had a smaller increase on the don't twist the spine to extremes subscale or lower post quiz score on the tense the torso muscles and exercise subscales.

Table 3.36 The Relationship of Knowledge Variables on Reports of Doing Exercises Learned in Course

Variable	Mean	Outcome		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
		Positive	Negative					
Post-Pre Change Don't Twist to extremes	27.47	23.11	35.71	-0.016	0.008	4.307	0.038	0.98
Post Course Tense the torso muscles·	90.49	93.03	85.71	0.026	0.013	4.065	0.044	1.03
Post course Exercise	84.16	88.63	75.71	0.021	0.009	6.116	0.013	1.02

Category 8. Self Efficacy

Table 3.37 shows those who reported more confidence in their ability to minimize risk of back, shoulder and neck injury post compared to pre course also reported doing the exercises learned in the course.

Table 3.37 The Relationship of Self Efficacy on Reports of Doing Exercises Learned in Course

Variable	Frequency	Exercises		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
		Yes	No					
Spinal Function Sort (more confident pos-pre)	72/103	52/72	20/72	0.887	0.455	3.791	0.050	2.43

Multivariate Analyses

The logistic regression model was constructed using two strategies, both of which produced the same results. Table 3.38 shows the variables entered into the multivariate model.

Table 3.38 Initial Multivariate Model with Exercise Learned in Course as Dependent Variable*

Variable	β Coefficient	Standard Error	Wald	Significance	Odds Ratio
Tense Post Course	0.037	0.021	3.079	0.079	1.038
Coworker Support	0.087	0.145	0.361	0.548	1.091
Management encourages supervisors to provide light duties to those with injuries.	0.898	0.62	2.095	0.148	2.455
Spinal Function Sort	-0.837	0.677	1.527	0.217	0.433
Low back pain	-2.11	0.951	4.926	0.026	0.121
Exercise Post Course	0.019	0.012	2.469	0.116	1.02
Management encourages employees to shut down an unsafe machine	0.91	0.592	2.362	0.124	2.485
Management encourages employees to report physical symptoms arising from job tasks	-0.262	0.694	0.143	0.706	0.769
Injury that disrupted life	-0.467	0.991	0.222	0.638	0.627
Twist Diff. Post and Pre	-0.019	0.011	2.868	0.09	0.981
Constant	-2.176	3.43	0.526	0.114	

-2Log Likelihood = 77.783

Strategies for Selecting Final Model

1. In the first strategy, all statistically variables with a p value of greater than .1 or less from the above categories were combined into a model. The variables were then eliminated using backward elimination which included all the independent variables entered, with each step consisting of the removal of the variables that change the R^2 the least, provided that the change was small enough so that the null hypothesis was not rejected, using a preset significance level of .10. Background variables (such as age and gender) which were not significant in the univariate analysis were inserted into the multiple regression model to investigate their significance.
2. In the second strategy, statistically significant variables from each category were fit into initial models. The variables from each category were then eliminated using backward elimination. The final variables in each category were then entered into a final model and eliminated using backward elimination.

Using both strategies, interactions between variables were also examined with their main effects in both strategies. No interactions were found with a P Value less than 0.10. Thus, the interaction terms were not investigated further. Table 3.39 presents the best fitting model using both of these two strategies.

Table 3.39 Multivariate Model Using Reports of Doing Exercise Learned in Course as Dependent Variable

Variable	Coefficient	Standard Error	Wald	Significance	Odds
Management encourages supervisors to provide light duties to those with injuries.	1.112	0.397	7.852	0.005	3.04
Low back pain over past 6 weeks	-1.733	0.728	5.659	0.017	0.177
Knowledge Quiz Post Course Quiz: Score on Exercise Subscale	0.033	0.01	9.691	0.002	1.033
Constant	-0.841	1.642	0.263	0.608	0.431

-2Log Likelihood = 97.218

Given the logistic regression equation is the following:

$$\text{Ln (prob Y=1)/prob (Y=0)} = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3}$$

ln (probability that respondent did exercises learned in course)/ln (probability that respondent did not do exercises learned in course)

$\beta_0 = -0.841$

$\beta_1 = 1.112$, x_{i1}=Management encourages supervisors to provide light duties to those with injuries

$\beta_2 = -1.733$, x_{i2}= low back pain over past 6 months

$\beta_3 = 0.033$, x_{i3}=knowledge quiz post course quiz score on exercise subscale

Management encouraging supervisors to provide light duties to those with injuries was negatively associated with an increase in reporting doing the exercises learned in the course. For example, a respondent who reported that he/she disagreed with the statement had a 3 times greater odds of reporting confidence in ability to minimize risk of injury than a respondent who reported he/she neither agreed nor disagreed with the statement. As well, reporting pain in the last six months was associated with an increase in the reports of doing the exercises learned in the course. For example, a respondent with no reported pain would have 0.18 times smaller odds of reporting doing the exercises learned in the course. Finally, a high score on the exercise

subscale of the post knowledge quiz was associated with an increase in reports of doing exercises learned in the course. For example, those with 85% on the exercise subscale had 1.39 greater odds of doing exercises learned in the course than those with 75% on the exercise subscale.

Behaviour Change at Work

The second dependent variable is behaviour change at work. In this study, Y=0 denotes that respondents did not change they way they physically do their job (e.g., how they lift things) and Y=1 denotes that respondents did change the way they physically do their job. Eighty-two respondents (79%) reported changing the way they physically do their job at six weeks follow-up. Twenty-one respondents (20%) reported that they did not change the way they physically do their job at six weeks follow-up.

Category 1: Background Information

Table 3.40 shows that females and those who had not taken injury prevention courses previously were associated with increased reports of behaviour change at work.

Table 3.40 The Relationship of Background Information on Reports of Behaviour Change at Work

Variable		Mean or Freq	Job Behaviour Change		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
			Yes	No					
Gender	Female	35/103	33/35	2/35	-1.801	0.778	5.35	0.021	0.165
	Male	68/103	50/67	18/67					
Prior injury prev. courses	Yes	26/103	17/26	36794	1.14	0.534	4.55	0.033	3.125
	No	69/103	59/69	10/69					

Category 2: Course Expectations

Table 3.41 shows that higher mean expectations (of the course teaching useful principles, to be of use, and to change the way materials are handled at home and work) for the *Back Course* were associated with an increase in reports of changing behaviour on the job. The expectation that the course would improve the company's safety record was not related to reports of changing behaviour on the job.

Table 3.41 The Relationship of Expectations on Reports of Behaviour Change at Work

Variable	Mean	Job Behaviour Change		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
		Yes	No					
Expectations: teach	7.11	7.37	6.15	0.5	0.171	8.593	0.0001	1.649
Expectations: of use	7.55	7.78	6.58	0.566	0.185	9.372	0.0001	1.76
Expectations: handle work	6.82	7.1	5.63	0.416	0.142	8.579	0.0001	1.515
Expectations: handle home	6.76	7.06	5.47	0.422	0.138	9.31	0.0001	1.525

Category 8. Knowledge Quiz Subscales

Table 3.42 shows that those who reported changing the way they do their job had a greater increase between post and pre course on the overall quiz, the "don't twist the spine to extremes" "anatomy", and "exercises" subscales compared to those who reported not changing the way they do their job. For the multivariate analysis, since the overall quiz difference between post and pre course scores was significant, it will be included in the multivariate modelling rather than the subscales to limit the number of variables included in the multivariate modelling.

Table 3.42 The Relationship of Knowledge Scores on Reports of Behaviour Change at Work

Variable	Mean or Frequency	Job Behaviour Change		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
		Yes	No					
Post-Pre Change Don't Twist to extremes	27.47	31.17	12.5	0.027	0.011	6.285	0	1.03
Post-Pre Change Anatomy	33.66	39.51	10	0.019	0.007	7.47	0	1.02
Post-Pre Change Quiz Total	31.17	33.2	23	0.044	0.018	5.913	0	1.05

Multivariate Statistics

The logistic regression model was constructed using two strategies, both of which produced the same results. Table 3.43 shows the variables entered into the multivariate model.

Table 3.43 Initial Multivariate Model with Reports of Behaviour Change at Work as Dependent Variable

Variable	β Coefficient	Standard Error	Wald	Significance	Odds Ratio
Expectation: teach	1.447	0.57	6.438	0.011	4.251
Expectation: Use	-1.125	0.569	3.902	0.048	0.325
Expectation: Handle at Work	-0.062	0.327	0.036	0.849	0.94
Expectation: Handle at Home	0.449	0.276	2.639	0.104	1.566
Expectation: Communication	0.451	0.33	1.873	0.171	1.57
Gender	-4.377	1.798	5.926	0.015	0.013
Age	-0.129	0.047	7.67	0.006	0.879
Perception of Activity Level	1.298	0.788	2.71	0.887	0.893
Prior Courses in Inj. Prevention	-0.113	0.796	0.02	0.887	0.893
Differences between pre/post Knowledge	0.048	0.03	2.518	0.113	1.049
Constant	2.102	3.439	0.374	0.541	8.18

-2Log Likelihood = 53.705

Strategies for Selecting Final Model

1. In the first strategy, all variables with a p value of .1 or less from the above categories were combined into a model. The variables were then eliminated using backward elimination which included all the independent variables entered, with each step consisting of the removal of the variables that change the R^2 the least, provided that the change was small enough so that the null hypothesis was not rejected, using a preset significance level of .10. Background variables which were not significant in the univariate analysis were inserted into the multiple regression model to investigate their significance when controlling for other variables.
2. In the second strategy, statistically significant variables from each category were fit into initial models. The variables from each category were then eliminated using backward elimination. The final variables in each category were then entered into a final model and eliminated using backward elimination.

Using both strategies, interactions between variables were also examined with their main effects in both strategies. No interactions were found with a P Value less than 0.10. Thus, the interaction terms were not investigated further. Table 3.44 presents the best fitting model using both of these two strategies.

Table 3.44 Multivariate Model Using Reports of Behaviour Change at Work as Dependent Variable

Variable	Coefficient	Standard Error	Wald	Significance	Odds Ratio
Gender	-3.193	1.273	6.287	0.012	0.041
Age	-0.095	0.036	6.854	0.009	0.909
Expectations: Teach	0.739	0.236	9.799	0.002	2.094
Constant	-3.216	2.215	2.108	0.147	0.04

-2Log Likelihood = 66.889

Given the logistic regression equation is the following:

Ln (prob Y=1)/prob (Y=0) $= \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3}$

ln (probability that respondent changed behaviour at work)/ln (probability that respondent did not change behaviour at work)
$\beta_0 = -3.216$
$\beta_1 = -3.193$, x_{i1}=Gender
$\beta_2 = -0.095$, x_{i2}= Age
$\beta_3 = 0.739$, x_{i3}=Expectations that the course may teach something new

Being male was negatively associated with reporting behaviour changes at work. For example, a male had 0.041 the odds of reporting a behaviour change at work than a female. As well, age was negatively associated with reports of behaviour change at work. For example, a respondent who was 45 had 0.62 odds of reporting a behaviour change at work compared to a 40 year old respondent. Finally, expectations that the course would teach something new was positively associated with reports of changing behaviour at work. For example, those who responded with an 8 (out of 9, high scores indicating the course taught something new) had 4.3 the odds of reporting a behaviour change at work compared to a respondent who responded with a 6 on the item.

Changing Behaviour at Home

The third dependent variable is changing behaviour at home. In this study, Y=0 denotes the respondents who did not change the way they do things around the house and Y=1 denotes that respondents did change the way they do things around the house. Seventy-seven respondents (75%) reported changing the way they do things at home and twenty-five respondents (25%) reported that they did not change the way they do things at home at six weeks follow-up.

Category 1: Background Information

Table 3.45 shows that female gender was positively associated with reports of behaviour change at home.

Table 3.45 The Relationship of Background Variables on Reports of Behaviour Change at Home

Variable		Frequency	Change Behaviour at Home		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
			Yes	No					
Gender	Female	35/103 (34%)	33/35	2/35	-2.019	0.774	6.8	<.0001	0.133
	Male	68/103 (66%)	22/68	46/68					

Category 2: Expectations

Table 3.46 shows that higher mean expectations (of the course teaching useful principles, that the course would be of use, would change the way materials are handled at home and work and would increase company communication) for the *Back Course* were associated with an increase in reports of changing behaviour at home.

Table 3.46 The Relationship of Expectations on Reports of Behaviour Change at Home

Variable	Mean or Frequency	Change Behaviour at Home		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
		Yes	No					
Expectations: teach	7.11	7.47	6.04	0.622	0.176	12.48	<.0001	1.863
Expectations: of use	7.55	7.82	6.65	0.567	0.177	10.23	<.0001	1.763
Expectations: handle work	6.82	7.24	5.43	0.546	0.148	13.675	<.0001	1.727
Expectations: handle home	6.76	7.25	5.13	0.623	0.152	16.804	<.0001	1.865
Expectations: communication	6.78	6.96	6.17	0.388	0.178	4.725	<.0001	1.474

Category 6. Knowledge Quiz Subscales

Table 3.47 shows greater increases between pre and post course scores on the overall quiz scores and several other subscales were positively associated with reporting behaviour change at home. In the multivariate analysis the difference between pre and post course overall quiz will be used to reduce the number of variables in the model.

Table 3.47 The Relationship of Knowledge Scores on Reports of Behaviour Change at Home

Variable	Mean or Frequency	Behaviour Change at Home		β Coefficient	Standard Error	Wald	P Value	Odds Ratio
		Yes	No					
Post-Pre Change Tense torso muscles	40.59	44.36	27.8	0.017	0.008	4.443	0.035	1.02
Post-Pre Change Anatomy	33.66	39.1	15.2	0.015	0.006	5.619	0.018	1.02
Post-Pre Change Quiz Total	31.17	33.1	24.6	0.035	0.016	4.549	0.033	1.04

Multivariate Analyses

The logistic regression model was constructed using two strategies, both of which produced the same results. Table 3.48 shows the variables entered into the multivariate model.

Table 3.48 Initial Multivariate Model with Reports of Behaviour Change at Home as Dependent Variable

Variable	β Coefficient	Standard Error	Wald	Significance	Odds Ratio
Gender	-2.616	1.148	5.194	0.023	0.073
Difference between pre and post course	0.009	0.024	0.141	0.708	1.009
Expectation: Teach	1.027	0.427	5.792	0.016	2.793
Expectation: Use	-0.572	0.391	2.138	0.144	0.565
Expectation: Handle at work	0.038	0.291	0.017	0.896	1.039
Expectation: Handle at home	0.543	0.228	5.654	0.017	1.721
Expectation: Communication Increase	-0.039	0.294	0.017	0.895	0.962
Expectation: Improved Safety	0.027	0.185	0.021	0.884	1.027
Constant	-3.038	2.192	1.92	0.166	0.048

-2Log Likelihood = 67.158

Strategies for Selecting Final Model

1. In the first strategy, all variables with a p value of .1 or less from the above categories were combined into a model. The variables were then eliminated using backward elimination which included all the independent variables entered, with each step consisting of the removal of the variables that change the R^2 the least, provided that the change was small enough so that the null hypothesis was not rejected, using a preset significance level of .10. Background variables which were not significant in the univariate analysis were inserted into the multiple regression model to investigate their significance when controlling for other variables in the model.
2. In the second strategy, statistically significant variables from each category were fit into initial models. The variables from each category were then eliminated using backward elimination. The final variables in each category were then entered into a final model. Variables in this model were eliminated using backward elimination.

Using both strategies, interactions between variables were also examined with their main effects in both strategies. No interactions were found with a P Value less than 0.10. Thus, the interaction terms were not investigated further. Table 3.49 presents the best fitting model using both of these two strategies.

Table 3.49 Multivariate Model Using Reports of Behaviour Change at Home as Dependent Variable

Variable	Coefficient	Standard Error	Wald	Significance	Odds
Gender	-2.037	0.871	5.467	0.019	0.073
Expectations: Teach	0.61	0.171	10.094	0.001	1.724
Expectations: handle things at home	0.545	0.171	10.094	0.001	1.724
Constant	-8.647	2.247	14.813	0.0001	0.0001

-2Log Likelihood = 70.489

Given the logistic regression equation is the following:

$$\text{Ln (prob Y=1)/prob (Y=0)} = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3}$$

ln (probability that respondent changed behaviour at work)/ln (probability that respondent did not change behaviour at work)
$\beta_0 = -8.647$
$\beta_1 = -2.037$, x_{i1}=Gender
$\beta_2 = 0.610$, x_{i2}= Expectations that the course may teach something new
$\beta_3 = 0.545$, x_{i3}=Expectations that the course will result in a change in the way material is handled at home

Being male was negatively associated with reporting behaviour changes at home. For example, a male had 0.073 the odds of reporting a behaviour change at home than a female. On-the-other hand, expectations that the course may teach something new was positively associated with reports of behaviour change at home. For example, those who responded with an 8 (out of 9, high scores indicating the course taught something new) had 3.4 the odds of

reporting a behaviour change at home compared to a respondent who responded with a 6 on the item. Finally, expectations that the course would result in a change in the way material is handled at home was positively associated with reports of behaviour change at home. For example, those who responded with an 8 (out of 9, high scores indicating the course taught something new) had 3.0 the odds of reporting a behaviour change at home compared to a respondent who responded with a 6 on the item.

3.6 Discussion

3.6.1 Response Rates

Knowledge Quiz. Overall, the response rate of the knowledge quiz was very high (99%). Only three participants were unable to complete both the pre and post knowledge quiz since they had to leave the course before the knowledge quiz was completed. The pre course scores of those who left early were well within the range of other respondents (40 - 70%) to the pre course quiz.

Impact Questionnaire. The response rate of both pre and post impact questionnaires was much lower at 46% (including the paintbrush manufacturing company that did not respond to the impact questionnaire). If the paintbrush manufacturing company was not included in the response rate calculations, the response rate of the impact questionnaire was 68%. Comparing those who responded to the pre course impact questionnaire and those who responded to both the pre and post course impact questionnaire showed no significant differences in background variables such as gender, education, and perception of activity level.

In contrast, those who responded to either of the impact questionnaires scored significantly higher on the post course knowledge quiz than those who only responded to only the knowledge quiz. (This relationship remained even when the paintbrush manufacturing company was removed.) However, the increase from pre to post course quiz scores were similar between these two groups. This finding suggests that there may be differences between those who responded to the impact questionnaire and those who did not respond to the impact questionnaire (e.g., education level). It is difficult to know how this may have influenced the results, but this will be discussed further in section 3.6.3.1.

3.6.2 Knowledge Quiz

3.6.2.1 Overall Knowledge Quiz Scores

Overall for the *Back Course*, there was a significant increase in immediate recall from pre to post course for participants from all companies and for all subscales using the knowledge quiz as the measurement tool. This increase in immediate recall is consistent with the literature for other back injury prevention programs (Woodruff, 1994; Schenk et al., 1996; Walsh and Schwartz, 1990; Daltroy et al., 1993).

3.6.2.2 Knowledge Quiz Subscales

The knowledge quiz analysis also provided information about the level of knowledge related to specific concepts of back injury prevention. There was a greater increase from pre to post course for the subscales: "tense the torso muscles", "keep the moment low", "keep the normal curve in the spine" and "anatomy" compared to the other subscales (i.e., "move after immobility", "don't twist to extremes", "exercise" and "videoclips"). This is mainly due to

lower scores on the pre course quiz. For example, the average pre course score on the "tense the torso muscles" subscale was 45%. On the subscales where more improvement was seen (i.e., "tense the torso muscles", "keep the moment low", "keep the normal curve in the spine" and "anatomy"), there was more room to improve since respondents did not know as much about the topics prior to the course. In contrast, the average score on a subscale that did not improve as much, "move after prolonged immobility" was 71%. For the subscales that did not improve as much (i.e., "move after immobility", "don't twist to extremes", "exercise"), there was less room to improve after the course because of high pre course scores.

The questions related to the videoclips had the smallest increase from pre to post course, and the lowest average pre and post course scores (40% and 53% respectively). The questions related to videoclips were more difficult than the true/false items because they required participants to apply more than one theoretical principle learned in the course to a practical example. In the course, participants were given the opportunity to evaluate risk in a variety of home and work situations. Perhaps more opportunities to evaluate risk should be given to course participants, or perhaps a follow-up course should focus on handling materials in the workplace setting.

3.6.2.3 Company Effects

Overall for the total score, videoclip score and quiz score, there were no differences found by company. When looking across all subscales, the paintbrush manufacturing company and the hotel had significantly lower scores than the clothing warehouse, plumbing company, chicken processing and electrical utilities. The paintbrush manufacturing company had

significantly lower scores than the boiler service company. This effect in scores by company may be related to extraneous differences in the companies such as education level. Unfortunately data related to socioeconomic status are not available for the paintbrush manufacturing company. The background questions from the impact questionnaire will be discussed in greater detail in section 3.6.3.

3.6.2.4 I'm Not Sure Responses

The "I'm not sure" alternative was included on the knowledge quiz to differentiate between misinformation and lack of information. Lack of information appeared to be more widespread than common misconceptions on the pre course knowledge quiz for the majority of the items on the knowledge quiz. As expected, course participants responded with "true" or "false" rather than "I'm not sure" more in the post than the pre course quiz. There was a greater increase in responses of "true" or "false" rather than "I'm not sure" overall for the true/false items than for the videoclip portion of the knowledge instrument. There were significant differences seen by subscale that were similar to the differences in average scores by subscale discussed in section 3.6.2.2. As well, although the "I'm not sure" responses were fairly consistent across companies for the post course quiz, the hotel was significantly more unsure than all the other companies (particularly for the pre course quiz).

Although participants who answered with true or false were not necessarily correct, when the questions were examined, if participants responded with "I'm not sure" on the pre course quiz, it was correct on the post course quiz the majority of the time.

3.6.2.5 Item analysis

The item analysis conducted on the knowledge quiz showed that most of the items in the true/false quiz were within recommended ranges for item difficulty, item discrimination and pre and post differences index. Although the videoclip items were within item difficulty ranges, they generally did not discriminate well between high and low scorers and they had very small improvement on the pre and post differences index.

The findings related to the videoclips in the item analysis showed problems in responding to those particular questions. Perhaps if this part of the knowledge quiz is maintained, the examples shown in the videoclip part of the knowledge quiz should be easier for course participants to answer.

3.6.3 Impact Questionnaire

3.6.3.1 Descriptive Statistics

The companies that participated in the *Back Course* varied in terms of the work they do (e.g., plumbing, serving people in the hotel, warehouse operations, manufacturing, electrical utilities). The physical demands of all of the participants' work generally required some lifting, bending or stooping and crouching or kneeling. Unfortunately, comparisons between companies were difficult because of the small numbers of participants from some companies. Generally, the gender varied from company to company depending on the industry (e.g., boiler service and plumbing had all male participants). Overall, there were more males than females who participated in the course. The level of education varied by company, likely due to the different job requirements at each company.

The proportion of respondents who have ever had a back, shoulder and neck injury was 58% which is similar to published findings in the literature (Loney & Stratford, 1999). Cumulative incidence or lifetime incidence refers to the total number of people who have had a back, shoulder or neck injury in their lifetime. (Deyo and Tsui-Wu (1987) have also called this cumulative lifetime prevalence). In a recent review of prevalence rates in 18 primary journal articles, the cumulative lifetime prevalence (or cumulative incidence) ranged from 31-72% (Loney and Stratford, 1999).

Expectations and impressions of the *Back Course* were generally very high for all items. Respondents reported the highest expectations and impressions for items related to the course teaching something new and being of use to them. Respondents reported the lowest expectations and impressions for the course making a difference to their safety record. Significantly, it appears from the analysis of the knowledge quiz that course participants did learn something new as they expected and believed because there was a significant short term increase in knowledge from pre to post course for all companies and subscales. As well, nearly all of the respondents (92%) reported making a behaviour change by doing exercises learned in the course, or changing an aspect of behaviour at home or work as they also expected and believed. The intervention did not show changes in perceived psychosocial factors related to work (reported in the next section 3.6.3.2). Since injury records and company safety were not examined in this study, it is not possible to compare them to the expectations reported by respondents.

3.6.3.2 Multivariate Analysis

3.6.3.2.1 Repeated Measures Analysis for Impact Questionnaire

Self Efficacy. It was hypothesized that *Back Course* participants would report an increase in self-efficacy for handling materials because of the practical component of the course. On the impact questionnaire, the items that make up the Spinal Function Sort is based on self-efficacy theory (initially part of Social Cognitive Theory). Self-efficacy refers to one's belief in one's own ability to do certain behaviours at certain levels of performance (Bandura, 1977). Overall for each of the 50 items in the Spinal Function Sort, there were improvements from pre to post course. However, the Spinal Function Sort was initially developed to quantify the disabled individual's perception of his/her ability to perform work tasks (Matheson & Matheson, 1989). The population in this study included employed individuals who may or may not have had a previous back injury. Thus, it is understandable that respondents had high pre course scores on the Spinal Function Sort that were generally in the 70's (on a confidence scale out of 100). Even though there were improvements seen for each item of the Spinal Function Sort, the ceiling effects pre course reduced the possible improvement in confidence from pre to post course.

Bandura proposed that self-efficacy is the most important condition for behaviour change (Bandura, 1977, 1986). Self-efficacy is influenced by four sources including verbal persuasion, vicarious experience, physiological arousal and performance accomplishments (Bandura 1977). Of particular interest in this study are the sources of verbal persuasion, vicarious experience and performance accomplishments. Verbal persuasion is the feedback of

people who will encourage behaviour change such as a spouse, close friend, co-worker, employer, course instructor or doctor. In the *Back Course*, the course instructor (and likely the course participants) provided verbal encouragement to handle materials using the five principles discussed in the course. After the course was delivered, co-workers who also took the course may have continued to provide verbal encouragement to handle materials using the principles described in the course. Vicarious experience is viewing other course participants doing a particular behaviour. Participants in the *Back Course* were shown how to handle materials by the course instructor and by other participants through practice sessions, and this may have continued in the workplace by co-workers who took the course. Performance accomplishments are a very important source of self-efficacy. Practising a behaviour is more likely to influence one's sense of mastery over the task. As people believe they can do a particular task, their confidence regarding the task should also improve. In the *Back Course*, participants are given an opportunity to practice the handling of a 12-pack of beer and a recycling container.

Job Content Questionnaire, Job Influence Subscale and Job Satisfaction Item. An objective of this study was to explore whether offering the *Back Course* would increase psychosocial perceptions of work, job influence or job satisfaction. However, there were no significant differences found between pre and post course quiz for any of the Job Content Questionnaire subscales, the job influence subscale or the job satisfaction item. This finding may not appear surprising since the *Back Course* was an educational course. Nevertheless, for all companies except the electrical utilities company, the majority of employees had never been given opportunities to take injury prevention at work before. Furthermore, company contacts

anecdotally indicated that they felt the *Back Course* improved company morale.

3.6.3.2.2 Multivariate Regression Findings

Differences Between Post and Pre Course Knowledge Quiz as Dependent Variable. The final regression model only included one variable, the expectation that respondents felt the course would be of use at home and work. Outcome expectations refer to the anticipatory outcomes of a behaviour (Bandura, 1977). Although the expectations measured in this study refer to expectations that an intervention will be of use, it makes intuitive sense that if a respondent expects the course to be of use, they are more likely to learn more from it.

Although gender was not significant in the final model, the univariate statistics suggested that being female was associated with a greater increase in pre to post course score than being male. Univariate statistics also indicated that respondents who expected that the course would result in a change in the way materials were handled at work were associated with a greater increase in pre to post course knowledge score than respondents who did not have high expectations.

Post Course Knowledge Quiz Score as Dependent Variable. The final model was difficult to select using the post course knowledge quiz score as the dependent variable. The final model initially selected included company and language. However, after examining the relationships of each company it was determined that the hotel was the critical variable accounting for the significance of the company variable. Those who work in the hotel had lower scores on the post course knowledge quiz than those from other companies.

Company was taken out of the final model to examine other variables given that hotel

was the only company driving the relationship. The second final model selected included the variables education, language and that management provides light duties for injured employees. Higher education was associated with higher post course knowledge quiz scores which makes sense intuitively. In addition, those who are more comfortable with a language other than English were associated with lower post course knowledge quiz scores which again makes sense intuitively. Finally, respondents who agreed that management provides light duties for injured workers also scored higher on the post course knowledge quiz than respondents who disagreed on that particular item. It is more difficult to interpret this finding. Perhaps, those with a positive outlook on company safety may be more likely to be open minded in an injury prevention course and thus may learn more in the course.

Self Efficacy as Dependent Variable. The final logistic regression model using the spinal function sort as the dependent variable included activity level and coworker support. Adjusting for co-worker support, respondents who reported being moderately active had greater odds of reporting confidence in ability to minimize risk of injury than a respondent who reported being very active. This finding is difficult to understand, but those who reported being "very active" did not improve as much after the course as those who reported being "moderately active". This is mainly due to ceiling effects of those who are "very active" pre course.

Adjusting for activity level, respondents who reported greater levels of coworker support had a greater odds of reporting increased confidence (post course compared to pre course) in ability to minimize risk of injury compared to a respondent with lower levels of

coworker support. This finding is consistent with self-efficacy theory. Self-efficacy is influenced by verbal persuasion and vicarious experience (Bandura, 1977). Workers who have coworkers that provide verbal encouragement and model the handling techniques discussed in the *Back Course* theoretically should be associated with improvements in self-efficacy. The coworker support scale is comprised of items related to general coworker support. It makes sense that this general coworker support subscale is also related to greater self-efficacy.

Although not significant in the final model, female gender was associated with greater odds of reporting confidence in ability to minimize risk of injury. The variable was not included in the final model because it did not contribute anything additional to the model, and did not influence the parameter estimates of the other two variables.

Exercise as Dependent Variable. The final model with self-reported exercise as the dependent variable included the independent variables of management encouraging supervisors to provide light duties to those with injuries, low back pain over the past six months, and the knowledge quiz score on the exercise subscale. Respondents who disagreed with the statement that management encourages supervisors to provide light duties to those with injuries had 3 times the odds of reporting that they did the exercises learned in the course than a respondent who reported he/she neither agreed nor disagreed with the statement. This finding is difficult to interpret, but individuals who do not feel supported by management when they are injured may do exercises as a preventive measure so that injuries do not occur.

Respondents with low back pain in the past six months had a greater odds of reporting doing the exercises learned in the course. It is understandable that those with recent

experiences with low back pain have additional motivation to attempt to prevent the recurrence of low back pain by exercising. A study of nursing staff in a geriatric hospital in Sweden randomized to receive exercise instruction during working hours reported fewer episodes of back pain compared to a control group without the exercise instruction (Gundewall et al., 1993).

Although knowledge does not necessarily result in behaviour change (Daltroy et al., 1997), the final model selected indicated that a high score on the exercise subscale of the post knowledge quiz was associated with an increase in respondents reporting doing the exercises learned in the course.

Although not significant in the final model, coworker support was found to be associated with increased reports by respondents of doing the exercises learned in the course. This finding is consistent with self-efficacy theory described earlier. Although not significant in the final model, those who reported greater confidence in their ability to minimize risk of back, shoulder or neck injury from pre to post course (self-efficacy) had greater odds of reporting that they did the exercises than those with less confidence in their ability to minimize risk of injury from pre to post course. This finding is consistent with Bandura's notion that self-efficacy may be one of the most important factors influencing behaviour (Bandura, 1977, 1986).

Behaviour Change at Work as the Dependent Variable. The final model included variables of gender, age and the expectations that the course would teach something new. Female gender was associated with an increase in the odds of reporting behaviour change at work. It may be that females were more likely to make behaviour changes at work.

Younger age was associated with an increase in the odds of reporting a behaviour change at work. Those who are younger may find it easier to change their work practices because their behaviours are less "entrenched".

Higher expectations that the course would teach respondents something new were associated with increased odds of reporting a behaviour change. This finding is consistent with self-efficacy theory that outcome expectations influence self-efficacy which in turn predicts behaviour (Baranowski et al., 1997).

Behaviour Change at Home as the Dependent Variable. The final model included variables of gender, expectations that the course would teach respondents something new and expectations that the course would result in a change in the way materials are handled at home. These findings are consistent with models previously described. Female gender and high expectations are related to a greater odds of reporting a behaviour change at home.

3.6.3.3 Outcome Evaluation Strengths and Limitations

This study systematically addressed the *Back Course*'s impact on participants' knowledge, self-efficacy and behaviour for the first time using a one group pre/post design. This design is limited for a number of reasons including history (i.e., events may occur in addition to the course which may influence the results) and maturation (i.e., changes in study participants may influence the results). Since the follow-up was six weeks post course, it is unlikely that history and maturation would influence the results.

Without a comparison or control group, it is not possible to rule out extraneous variables causing changes in knowledge, self-efficacy and behaviour post course. As well, it is not

possible to know how the *Back Course* compares to other courses since there was no course comparison. Company contacts agreed to participate in the evaluation after they had previously decided that they wanted to offer the *Back Course* to employees. Thus, they were not interested in being a "control" or comparison company.

This design is also influenced by threats of testing. For example, respondents may do better on the knowledge quiz post course simply because of practice, however, it is unlikely that respondents will remember so many questions (27 on true/false quiz and 5 videoclips).

A threat to the external validity of this study is the testing by treatment interaction bias which refers to the possibility that the pretest may change the respondents' ability to learn. (e.g., by highlighting the important terms to focus on during the course). In order to be sure that this course results in the same impacts in knowledge as found in this study, it is recommended that both the pre and post course quiz continue to be included when the course is offered to employees in the future. The results of this study may not be generalizable to offerings of the *Back Course* without the pre course knowledge quiz.

Although this design has many weaknesses, Borg and Gall (1989) assert that researchers are warranted in using the design if they are attempting to change behaviour or knowledge that is unlikely to change without the experimental treatment. In this study, it is unlikely that the knowledge and behaviour would change without being offered the *Back Course*.

As reported in the results, the response rate for the impact questionnaire was fairly low (46% including the paintbrush manufacturing company). It also appears from the comparison of those who responded to the impact questionnaire to those who only responded to the

knowledge quiz, that there may have been systematic differences between these two groups (e.g., perhaps they had different education levels). Although it is difficult to determine how this finding may have influenced the results, this bias may be an alternative explanation for the observed results.

The behavioural outcome variables examined in the regression analyses were based on single items that were developed for the purposes of this study, but have not been validated. Therefore, the analyses are reported with caution. It is noted that the findings are exploratory and meant to generate hypotheses for further study. When reporting behaviour changes, respondents were not able to specify the changes that were made. As well, respondents may have provided socially desirable answers (i.e., that behaviour changes were made) rather than an honest response. In addition to asking about behaviour changes, behaviour was videotaped in a very small sample of course participants before and after the course to observe any behaviour changes made and to examine whether behaviour changes were possible int the participants' work environment. Although those videotaped may have attempted to show socially desirable behaviour, the follow up time was at least six months post course so the videotapes may help to illustrate whether respondents are able to remember and do the socially desirable behaviour. This videotaped analyses was too small and the sample too selective to report in the overall findings, but the method is worth exploring in future studies of this course.

This study examined changes in immediate recall, self-efficacy and behaviour (i.e., six weeks post *Back Course*). Although the follow-up period was relatively short, the course impacts measured in this study are appropriate for the follow-up time post course. A longer

follow-up period is required for examining changes in back pain (Shi, 1993), lost time (Fitzler, 1983), absenteeism (Versloot et al., 1992) and injuries (Daltroy et al., 1997).

Outcomes reported in this chapter are important for program effectiveness, but are also influenced by other factors such as characteristics of the course participants and the course environment. The process evaluation in the following chapter describes how the outcomes may be affected by these other factors. Overall, the results of both the outcome and process evaluation will help to inform how and why the course was shown to increase knowledge and change self-efficacy and behaviour.

Chapter 4: Process Evaluation of the *Back and Upper Limb Injury Prevention* course

4.1 Introduction

Process evaluation must accompany outcome evaluation to determine how and why a program may or may not produce the desired results (Myers, 1999; Rossi et al., 1999). Ideally, process evaluation is conducted first to modify a program as needed so that outcomes can be evaluated under optimal conditions of delivery. If this is not possible, process evaluation should be conducted concurrently with outcome evaluation, as it was in this study (Myers, 1999). It is important to examine the context of program delivery and characteristics of deliverers (Sidani and Braden, 1998). It is also important to obtain the impressions of program participants and deliverers.

The process evaluation of the *Back Course* consisted of five methods of data collection: 1) observations of program delivery; 2) readability analyses of course materials; 3) focus groups with course participants; 4) follow-up interviews with a sub-sample three to six months after focus group participation; and 5) interviews with company representatives. Each data collection component is presented below in the same order with respect to purpose, methods and findings.

4.2 Observations of Course Delivery

The purposes of the direct observations of the *Back Course* delivery and the informal interview with the course instructor were to help gain a better understanding of the program, and examine the program materials and delivery in terms of content, coverage, audience

engagement and consistency across classes.

4.2.1 Methods

A *Back Course* taught in Oshawa at General Motors was observed by the author prior to offering the course to member companies of the WSCP. Three *Back Course* sessions offered to staff of the University of Waterloo in order to train the course instructor and to pilot the knowledge quiz were observed by the author. Seven scheduled *Back Course* sessions offered to the WSCP during the Spring and Fall of 1999 and one session during the Winter of 2000 were also observed. Field notes were taken by the author as observer during each session.

4.2.2 Results

Instructor Training. The instructor, with a Bachelor of Kinesiology, was trained to teach all *Back Course* sessions offered to member companies of the WSCP. The training entailed observing another instructor teach one session to employees of General Motors. The instructor also slightly revised the presentation to add a component on upper limb injuries, developed in consultation with the course developers. Course delivery was practised by herself and presented in front of the course developers. In addition, the instructor taught the course three times to University of Waterloo staff prior to teaching the course to the member companies of the WSCP.

Course Locations. For company convenience, the *Back Course* was taught either at the University of Waterloo or at the worksite depending on the wishes of the company representatives. During the study, the course was offered (and observed) at the University of Waterloo and at three different work-sites. The size of the rooms varied substantially. For

example, at the University of Waterloo a classroom that accommodated approximately fifteen students was used. Exercises and practice sessions were done outside the room in a main foyer. At the hotel and the electrical utilities, the classrooms were large with lots of room to do exercises. At the paintbrush manufacturing plant, a small classroom was used with very little room for movement. Exercises and practice sessions were done in shifts in an even smaller room.

Input of Instructor. The instructor felt there were differences in the course participants depending on the company. For example, at the paintbrush manufacturing plant the participants had trouble understanding English, and she wondered how much they learned from the course. She felt that there was less interaction between herself and the participants at this company because of the language barrier.

Observational Findings. Eight regularly scheduled *Back Course* sessions were observed as part of this process evaluation. One instructor taught all of these sessions with the help of three different assistants (e.g., to do demonstrations, to help with practice sessions, to fill in the certificates, etc.). The number of course participants present on the days observed ranged from 8 to 17. The 102 participants (average 12 per session) who participated varied in terms of their abilities to understand the English language. Generally at the hotel and the paintbrush manufacturing plant, there were more participants who had difficulties speaking English than the other participating companies. These course participants often spoke a language other than English to others present at the session. Although some of these participants completed the knowledge quiz, it is unknown how much they understood of the quiz. At the three work sites

where the *Back Course* was offered, all participants were from the same workplace, but at the university participants were made up of workers from two to three workplaces.

At the paintbrush manufacturing company, prior to taking the *Back Course*, the company representative called to indicate that the impact questionnaire would not be completed by participants because of their concerns with the questions. At one of the *Back Course* sessions offered at this company, several participants spoke to the graduate student researcher about their concerns with the psychosocial questions and with the repetitiveness of the questions.

Presentation Format. At the hotel and the university, tables and chairs were arranged in a U-shape formation and the instructor positioned herself at the front of the group. During two of the sessions offered at the university in June of 1999, the temperature seemed very warm in the classroom. At the paintbrush manufacturing plant, the participants sat in chairs lined up in parallel rows with the instructor at the front. This room was very crowded for participants and did not allow for participants to write notes during the course. As well, the practice sessions and exercises were done in shifts in an even smaller room adjacent to the classroom. At the electrical utilities company, tables and chairs were lined up in parallel rows with the instructor at the front. Exercises were done in a large room adjacent to the classroom.

All sessions were kept to four hours. The instructor began by welcoming participants and introducing herself before beginning the course. The instructor interacted with participants at the very beginning of each course by asking how many participants had been injured before. She appeared comfortable and was knowledgeable in answering questions. The instructor

appeared able to "reach" participants through relevant examples, and engaged them in demonstrations and examples that participants identified with. Throughout the course, participants interacted with each other and asked questions of the instructor for clarification and further explanation.

Content and Coverage. Course notes were distributed to all participants and the same overheads were used by the course instructor for each course. In one session, the instructor forgot to distribute the notes until after the first of two brief breaks. All *Back Course* sessions included the same basic content, demonstrations, examples and visuals (with the exception of the videotape). The amount of time and detail presented from session to session was fairly consistent. However, the participation level varied somewhat from session to session. In most sessions, there was a high level of participant involvement, but at the paintbrush manufacturing company, participants did not appear as interested or involved (e.g., did not ask many questions or volunteer many stories). It appeared that some participants of this group also had more difficulties understanding English (which may have accounted for their lack of involvement).

The videotaped portion of each *Back Course* session varied in terms of the number of job tasks shown in the course and the time spent discussing each job task. When the course was offered to participants from only one company, there were usually more videotaped examples of job tasks from that company than when the course was offered to more than one company. For example, there were only three videoclips of job tasks from the plumbing company, but there were ten videoclips of job tasks from the electrical utilities. The participants from the plumbing company attended with the chicken processing and the boiler service participants;

whereas the electrical utilities company participants attended with others from the electrical utilities company.

4.3 Readability of Program Materials

The purpose of this analysis was to measure the estimated grade levels required to understand the print material. Readability formulae examine measures of language variables such as sentence length, number of sentences, number of polysyllabic words and sentence complexity. Usually, the reading level necessary to understand information will be higher when the sentences are long and numerous and when there are a large number of polysyllabic words and complex sentences (U.S. Department of Health, 1992).

4.3.1 Methods

Printed program materials (i.e., course notes and take-home information) were analysed for independently by assessors using three readability formulas: the FOG Index (Gunning, 1968), the Fry's Readability Graph (Fry, 1977) and the SMOG Grading (McLaughlin, 1969). Sections were chosen from the beginning, middle and end of each printed resource. The average number of words per sentence (per bulleted item in these materials), number of polysyllabic words and number of sentences were determined for each printed section assessed resulting in the estimated grade level equivalency. The difference in analysis between the two observers served as a check of reliability.

4.3.2 Results

Program materials including the overhead notes, exercise hand-outs and checklist for ergonomic evaluation were assessed using three readability formulas by two different people.

Since overhead notes and hand-outs are in bullet format, (not full sentences), the readability formulae were modified to examine bullet points rather than complete sentences. Bullet points were put together to get longer passages to work with for the analyses. All had a sufficient number of words to enable these materials to be assessed.

The results are shown in Table 4.1. The two different observers independently assessed all materials at the same grade levels, except using the FOG Index for hand-out material. As can be seen, all course materials were at a grade equivalent reading level of between Grades 7 and 9.

Table 4.1 Readability Results

Formula	**Overhead Notes**		**Hand-Outs**		**Ergonomic Checklist**	
	Rater 1	**Rater 2**	**Rater 1**	**Rater 2**	**Rater 1**	**Rater 2**
FOG Index	Grade 9	Grade 9	Grade 6	Grade 7	Grade 8	Grade 8
Fry's Readability Graph	Grade 9	Grade 9	Grade 7	Grade 7	Grade 9	Grade 9
SMOG Grading	Grade 9	Grade 9	Grade 8	Grade 8	Grade 9	Grade 9

4.4 Focus Groups

Focus groups were conducted from September 1999 and June 2000 with participants of the *Back Course* to obtain their impressions and in depth feedback on the course, as well as to examine the reasons for possible program impact. The focus groups were conducted between three and six months after the course was completed by participants (Refer to Appendix M for Focus Group protocol, script, background questionnaire and participant description.)

4.4.1 Methods

4.4.1.1 Recruitment

The number of focus groups recommended for a project varies based on the topic, desired representativeness, and focus group composition. In general, it is recommended that at least two focus groups are conducted, but the number of groups is generally between two and eight (Krueger, 1994; Mertens, 1998). For this project, a total of eight focus groups using five of the seven companies and a total of 38 participants were conducted with participants of the *Back Course*. Volunteers for the focus groups were solicited by their company representatives. Two of the companies that participated in the *Back Course* were unable to participate in a focus group because of the timing of the focus groups with their seasonal work. Focus groups were made up of employees from either management or front-line staff of five different companies that participated in the *Back Course* (Table 4.2).

Table 4.2 Focus Groups Conducted by Company

Company	Management/Supervisors	Front-Line Staff
Hotel		2 focus groups (n=5, n=4)
Clothing Warehouse		1 focus group (n=3)
Paintbrush Manufacturing	1 focus group (n=6)	1 focus group (n=5)
Chicken Packaging Plant	1 focus group (n=4)	
Electrical Utilities Company	1 focus group (n=4)	1 focus group (n=8)
Totals	3 groups (n=14)	5 groups (n=25)

At the chicken packaging plant one focus group was conducted with only supervisory staff because the course participants included only supervisors. Similarly, focus groups were conducted with only front-line employees at the hotel and clothing warehouse because only front-line staff were course participants.

4.4.1.2 Measures

A standardized script was followed for all groups. In addition, there were standardized probes on the script to use when the facilitator felt that they may help the participants. An 11-item background questionnaire was also given to focus group participants after the focus group. This questionnaire was the same as the background questions included on the impact questionnaire to ensure that we had the same background information for all respondents (i.e., in case focus group respondents did not complete the impact questionnaire).

4.4.1.3 Procedures

Based on established focus group procedures, a seating plan, speaker log, field notes, debriefing notes and audiotaping of sessions were done for each focus group session (Krueger,

1994; Myers, 1999). A specific protocol was followed for each focus group (Myers, 1999).

4.4.1.4 Data Analysis

Data for the focus groups consisted of field and debriefing notes, audiotapes and the transcripts of each focus group session and debriefing session. During the discussion, the recorder made a seating plan and notes each time someone spoke, the first words each speaker spoke, as well as making field notes on patterns of group interaction and the expressions of participants. The primary findings before data analysis were verified with the focus group recorder. The facilitator and recorder of the focus groups engaged in a debriefing discussion immediately following each focus group to identify and interpret non-verbal expressions (e.g., shaking head, leaning forward) and facial expressions that may show interest, group dynamics, areas of agreement, disagreement, as well as the main ideas or issues that emerged. Each debriefing session was audiotaped and transcribed verbatim. After the data analysis was completed, the facilitator consulted with the recorder to verify the interpretations and findings that emerged from the data analysis.

The pseudonyms focus group participants selected replaced the real names of participants in order to protect confidentiality. All transcripts, field and debriefing notes were then imported into the QSR NUD*IST 4.0 program (Qualitative Solutions and Research – Non-numerical Unstructured Data Indexing Searching and Theorizing) (Richards and Richards, 1991). QSR NUD*IST is a program to aid in coding qualitative data into an index system, to search text and/or determine patterns in the coding.

Transcripts of audio-tapes were read several times at the beginning of data analysis to get an overall understanding of the data. Next they were analysed using the constant comparative analysis method (Glaser & Strauss (1967); Lincoln & Guba (1985)), as well as Lofland and Lofland (1995)'s suggestions for initial coding and memoing. The focus group sessions utilized a standardized script to ensure that specific topics were covered and addressed similarly in all groups. The script questions and prompts were used to guide the analysis. After each question and focus group were examined separately, they were compared across questions and focus group sessions. Constant comparative analysis method involves **unitizing** (i.e., breaking the text from transcripts into text units), and **categorizing** (i.e., organizing categories into text units that relate to the same content) (Lincoln and Guba, 1985). This method was used to code the transcripts. Once focus group text units were coded, comparisons were made with previously coded items in the same and different categories. Categories evolved as the transcripts were more thoroughly analysed. Using both constant comparison of codes and "memos" to clearly define categories and themes throughout the analysis, the categories became more clearly characterized (Glaser and Strauss, 1967; Lofland and Lofland, 1995). Eventually, a final index system was developed consisting of the main categories, sub-categories, corresponding quotes and memos. This content analysis was the process "of identifying, coding and categorizing the primary patterns in the data" (Patton, 1990, p. 381). The content of the main categories in the index system was then examined to identify main points and themes that emerged from the categories in an inductive or thematic analysis (Patton, 1990; Luborsky, 1994). Main points refer to the content of responses to a particular question; whereas themes

refer to generalized statements across the data by respondents about beliefs, attitudes, values or sentiments (Luborsky, 1994). After a number of main points and themes were identified using the final index system, summaries of each of were written. The final main points and themes considered were most pervasive across the focus groups.

Quantitative data from the background questionnaire (the same as the background questions on the impact questionnaire) were entered into SPSS. Frequencies were calculated for the categorical data that were received.

4.4.2 Results

4.4.2.1 Participants

The eight focus groups ranged in size from 3 to 8 people (Refer to Table 4.3). The sample of 39 participants, aged 22 to 60 years (mean 39), included 26 males (67%) and 13 females (33%). Five focus groups were conducted with front-line workers, while three were conducted with management staff members. The type of management positions held by course participants varied ranging from front-line supervisors at the chicken processing plant to a mixture of supervisors and upper management at the electrical utilities and upper management at the paintbrush manufacturing plant. More details about the job tasks of participants are found in Appendix M.

Table 4.3 Focus Group Composition

Site (Company)	Front-line or Management Staff	# of Participants	Gender	# of Injured
Chicken Processing Plant	Management	4	3 male 1 female	2 (50%)
Clothing Warehouse	Front-line	3	1 male 2 female	3 (100%)
Hotel	Front-line	4	1 male 3 female	2 (50%)
Hotel	Front-line	5	1 male 4 female	4 (80%)
Paintbrush Manufacturing.	Front-line	5	5 male	2 (40%)
Paintbrush Manufacturing	Management	6	3 male 3 female	4 (66%)
Electrical Utilities	Front-line	8	8 male	7 (87%)
Electrical Utilities	Management	4	4 male	2 (50%)
Totals	5 Front-line groups(n=25) 3 Management groups (n=14)	39	26 males 13 females	26 (67%)

4.4.2.2 Sample Characteristics

The description of the focus group sample, based on the background questionnaire can be found in Appendix M. Group, gender and injury differences are noted. The focus group findings are presented next, in the same order the topics were raised in the discussion themselves (refer to script in Appendix M).

4.4.2.3 Content Analysis and Main Points Across Focus Groups

The primary focus group findings are based on analysis of the recorded discussion sessions, as well as field and debriefing notes. Differences between focus groups and between management and front-line staff are noted. Representative quotes from participants are provided

for illustration. Quotes are attributed to company and gender of speaker (via pseudonyms selected by participants). Words with a **bold** typeface are used to show emphasis from the speaker's perspective (either through tone of voice or non verbal gestures).

Why Participants Signed Up For The Course. Company representatives indicated that all participants were required to take the *Back Course*, with the exception of management from the paintbrush manufacturing and electrical utilities companies. Participants indicated by their responses that they were aware that participation in the *Back Course* participation was mandatory.

"It was basically recommended that we go and attend it." (Jason, Chicken Processing)

"They put our names down for it." (Cher, Hotel 1)

Participants holding managerial positions from two companies indicated that they were strongly encouraged, but not required to attend the *Back Course* as the company contacts also indicated in their personal interviews. Participants holding managerial positions from the chicken processing plant were required to attend the course.

Factors Related to Course Participation. Focus group participants were then asked under what conditions that they would have voluntarily signed up for the course. Thirty-three (85%) of the 39 focus group participants indicated that they would take the course only if on company time. Six (15%) of the 39 participants indicated that they would take the course on their own time; while these same six also indicated that they would take the course even if they were required to pay for it.

Fee. The majority of participants in each group indicated that the $5 fee was extremely reasonable. The participants were then asked about a possible $20 fee (since $15 of the course fee was subsidized by the WSCP). Most participants thought that $20 was also reasonable for the course.

Length of Time. Generally, participants felt that the course length (4 hours) was appropriate given the variety of information and interactive format. Some quotes that reflect a number of ideas mentioned follow:

> *"I thought the length of the course was fine, especially since it was mixed in with doing exercises and also the videos and slides and everything that were shown."* (Jason, chicken processing)

> *"I would not go longer with a course of that type based on the number of seminars that I've attended and other presentations. If you go over three to four hours, people tend to lose interest in it."* (Tony, electrical utilities management)

Recommend this Course to Others. Most participants would recommend the course to others since "*it had features that you could apply both at work and home*"(Tony, electrical utilities management), *"it's one of the first courses where people came in and actually had you interacting with them"*(Palimar, Electrical Utilities–front-line), *" it was pretty interesting. It was more than just, here's a box and this is how you lift it."* (Kelly, clothing manufacturing), *"it made me stop and think about the way I use my back*" (Zena, hotel1). There was disagreement between management level members within the paintbrush manufacturing group. Two members said they would only recommend the course to front-line workers, not however, office workers. The others felt that it was important for both front-line and management workers to attend.

Program Activities - Likes and Dislikes. Table 4.4 presents a summary of the comments which emerged in the focus group concerning the impressions of the course. The comments of focus group participants and discussion are detailed in the next section.

Table 4.4 Summary of Impressions of Course

Main Categories	Main Points in Each Category
Likes	**Sections of Course**: examples (specifically mentioned several of them, e.g. Big Red, Electromyograph for feedback), practice sessions, exercises , principles, anatomy **Instructor**: liked the way it was presented, clear **Length of Time** **Fee** **Food** **Knowledge Quiz Piqued Interest** **Management Learned about Workers**
Dislikes	**Sections of Course**: Didn't like anatomy, exercises, practice sessions, questionnaires **Room:** more space, room was hot and crowded **English as a Second Language:** Difficult to understand for those who didn't speak English **Injury**: seriousness of back injury not stressed **Questionnaires**
Suggestions for Course Improvements	**Content**: add more on upper limb, repetitive strain injury, back injuries associated with forklifts, add more exercises, videoclips, practice examples, information on injuries and case examples of those with injuries, add more biomechanics, more information related to health professionals who treat back injuries **Format:** more pictures for those who don't understand English, play music during exercises, have more than 1 session, have refresher training, possibly focus the course: one with theory and the other with a more practical component (for those who don't understand English), train-the-trainer approach for some companies **Hand-outs**: give out reference lists to people
Barriers to Course Effectiveness	English as a second language Course was not taken seriously Age - young people may not take course as seriously Difficult to get help to lift when busy If not injured - may not be motivated Management may not understand the course
What would you take out of the course to cut the course in half?	Anatomy Section Theory for those who don't understand English

General Impressions. In general, participants had positive comments about the *Back Course*. Most of the focus group participants found the course clear and understandable due to the variety of examples and demonstrations shown, the opportunity to practice techniques learned, the course content, presentation style and instructor. For example,

> *"I like the way the course was presented because there was a variety ...not only do you just talk, but we had the audio and then we got into doing some actual exercises. We weren't just handed a piece of paper and said, here's something to read when you go home. We actually... interacted...I thought it was quite interesting."* (Sweetie Pie, hotel 2)

> *"I found it very informative, easy to understand."* (Bill, clothing warehouse)

> *"Myself, even though I didn't know all the terminology of the back beforehand, it was easy enough for me to understand. I had no problems relating with the different type of forces, how your back reacts at different angles and stuff, what force you're picking up."* (Butch, Electrical utilities management)

However, at two companies (hotel and paintbrush manufacturing) there were course participants who had difficulty understanding English. A management participant from one of these companies said:

> *"I found it was very clear. The only feedback I have... is that where we are here specifically, a lot of people don't speak English that well, and I suspect, based on sitting beside somebody who really had a lot of trouble following what was going on. For this group sitting here now, who all speak English very well, it would be fine. But anyone who didn't speak English well would have a problem following."* (David 2, paintbrush manufacturing management)

At the paintbrush manufacturing plant, a focus group participant who needed some translation during the focus group indicated that he did not understand all of the words during the course, and that some employees did not understand anything.

Course Content. Focus group participants spoke about the specific course components including: 1) videoclips, 2) practice sessions, 3) examples, 4) anatomy and 5) exercises.

1. Videoclips

In each group session, the videoclips of program participants in their work environment were most often remembered and most popular with participants. The videoclips were reported to help participants learn the concepts taught in the course. The following two quotes are illustrative:

> *"I like the fact that there was videotaping of actual people at the job site, that were actually there and so it was a lot more relative, you could relate to it a lot more and it actually made me pay attention more to it."* (Bruce, chicken processing)

> *"But the thing is, you think you're doing it correctly, but when you see yourself, you think, boy, is that ever stupid, why am I doing it that way? And then you think of some way to change it. Because I don't think you realize what you actually look like when you're doing it."* (Cher, hotel 1)

2. Practice Sessions

The practice time, when the course instructor observed participants lifting a recycling container and a 12-pack of beer, was identified as being another aspect of the course that participants remembered and liked. For example,

> *"I think people actually doing it and getting corrected at the time, that they would go and do it properly the next time. It gave them an idea of the proper way to do it."* (David2, paintbrush manufacturing management)

However, one participant did not like the practice session because she felt that it was "*embarrassing*"(Sandi, paintbrush manufacturing management) to do the practice session in front of everyone particularly if mistakes were made.

All participants were taught how to handle objects in the course, but not everyone lifted

properly during the practice sessions. Participants felt that actually practising the new lifting behaviour might facilitate behaviour changes particularly if a participant made mistakes during the practice sessions.

> *"The thing about the practical aspect too is that you may think you're doing it right, but to have somebody else look at you, they know you're actually bending over. I found that interesting, because I know everybody that went up there thought they were doing it right. But a few people weren't."* (David1, paintbrush manufacturing management)

3. Examples

A highlight of the course for participants was the use of examples. The examples specifically mentioned included "Big Red" (used to explain the moment), the electromyograph (to show the use of back muscles and the normal curve of the spine), the disks and silly putty (used to explain anatomy and how disks in the back work), the torque wrench (to explain the moment of the back), and the 12 pack of beer (used to explain handling techniques). Participants liked the examples because they explained technical concepts and provided visual pictures to assist with learning. For example,

> *"I think the models that demonstrated the forces were probably the thing that in my mind that would help most of the people identify with some of the forces that were involved. For myself, even when some of them were very simple, they did demonstrate some of the forces that apply to the body in a way that people with a less technical background could relate to."* (Tony, electrical utilities management)

4. Anatomy

Some participants enjoyed learning about the anatomy of the spine and how the spine works. Example quotes from the sessions include:

> *"I personally think it's useful, because I think you need to know a little bit about the anatomy and how things work."* (Bill, clothing warehouse)

> *"The part showed the actual back and how everything worked...I just thought that was really neat. That you could actually see what it was and what it was like. You could visualize it on yourself. "* (Cher, hotel 1)

Others indicated that the section on anatomy was not completely applicable to their work. For example,

> *"It was interesting but I don't know if it was really 100% useful."* (Kelly, clothing warehouse)

One member of the focus group indicated that the instructor " *went a bit too fast for me to comprehend"* the anatomy section; whereas, another member of the same focus group indicated that they "*found it almost the opposite*".

Back injuries including muscle strain, ligament damage, facets damage, disc herniation, spinal stenosis and nerve root compression were described in the anatomy section. One participant indicated that the seriousness of back injuries should be stressed in the course to a greater degree.

> *"Well, I don't think it was maybe stressed that much in the presentation of how serious it could be if you do get laid off with a back injury. Unless you've experienced it, because I've known people that have been off for years with back problems. And I think, from my perception it's likely to hurt for one week and you're back at work. And that's not quite as serious as it can be."* (David1, paintbrush manufacturing management)

5. Exercises

Four exercises to stretch and strengthen the back were described and attempted by course participants. Generally, participants liked the exercises they were shown, and liked being given the opportunity to try them.

> *"I liked ... the exercises at the end, to actually do the exercises rather than just to be shown them."* (Jason, chicken processing)

One of the members indicated that they didn't like doing the exercises. Unfortunately, the reason the participant did not like the exercises was not clarified. For example,

> *"The exercises drove me crazy. ... I did the exercises and I really didn't want to do them and I did them. "* (Sandi, paintbrush manufacturing management)

Course Location. The course was offered at the University of Waterloo for four companies (only two of the companies that participated in the focus group sessions though-the clothing warehouse and chicken processing plant), while the hotel, the electrical utilities company and the paintbrush manufacturing plant held the course at their own company. At the university, participants indicated that the room was "*hot*" and "*crowded*". One participant stated that:

> *" It (*the location*) took away from the course, I felt....We needed more space. And then we had to go out in the hall to do the exercises. "* (Jason, chicken processing)

> *"I think if you had more space and everybody doesn't feel that closed in, especially during the exercises ...because if people have more space around them, they'll feel more comfortable and they won't care so much trying to do....you know, like the idea is to do them properly but I think people were having a hard time because they didn't have the space.. "* (Beck, clothing warehouse)

At the hotel there were no specific comments about the location except that the participants indicated they needed more room during the exercises. One participant said,

> *"...it's not really nice to do exercises head to head, bump each other, I bumped my feet to the other girl"* (Cora, hotel 2)

At the paintbrush manufacturing plant the course was offered in a small room. The exercises and practice sessions were done in shifts in a very small room located adjacent to the room the course was presented in. Interestingly, only one front-line member specifically commented on the room being small for the practice sessions. At the electrical utility, the

course was offered in a large training room with another fairly large room adjacent to it for the exercises. No one commented specifically on the location the course was offered in, even when asked.

Knowledge Quiz. Questions regarding the knowledge quiz were not included on the focus group script since it was part of the course evaluation, however, one participant indicated that they liked the knowledge quiz because they realized that they did not know all of the concepts on the quiz.

> *"I liked when we first got the questionnaire. I think it was the tool to measure how much we had learned. I remember going through the questionnaire and not knowing the answers, like thinking that I knew, you know, a fair bit about lifting things, right. And I went through it and it was, oh, I don't know what the answers are to these questions. And so then I, it piqued my interest."* (Sandi, paintbrush manufacturing 2)

Applicability. One participant indicated that he did not feel the course was applicable to his work.

> *"I like the way the course was presented, but I thought maybe it didn't really pertain a lot to what we were about."* (Bruce, chicken processing)

Suggestions for Course Improvements. One of the questions asked during the focus group was, "if we had to cut the course into two hours what would you take out of the course". In three of the eight focus groups, participants suggested that the course should not be cut into two hours. Quotes illustrative of this idea are:

> *"It would be pretty tough to cut it down without losing the impact that the course could have. To try to cut it down to two hours, either take out information that's probably relevant to at least a significant part of the group, or you gloss over a lot of things that probably should have more attention spent on them."* (David2, paintbrush manufacturing management)

> *"I don't think you could really downsize it. I think... to try to downsize it, a lot of information would be missed that you need."* (Cher, hotel 2)

Several participants suggested that the theoretical section including anatomy and biomechanics be cut. An illustrative quote is:

> *"I would leave in the videos and the exercises and the practical applications. And leave out a lot of the physics of the back and all the photos of it."* (Jason, chicken processing)

Offer Tailored Courses. A focus group participant who had trouble speaking English indicated that it may be good to have two tailored courses: one for those who understand English, and another more practical course for those who do not understand English. The full course would be offered to those who understand English.

> *"I think when we were taking the course here, some of the people don't understand it at all, some of the people understand 30%--50% like me. And I think, if we select a group, of people who understand English, and then... show them the whole course, and if some other people like me and just the easier parts, something that explains, that can be explained easily."* (King, paintbrush manufacturing front-line)

In the management focus group at the same company, one participant came up with a similar idea for front-line workers. She suggested a more practical hands-on course for front-line workers and for those who do not understand English, and the full four-hour course for others. One individual from that focus group thought that although offering two different courses may be a good idea, some employees might be slighted or offended if they did not receive the entire course.

> *"Yeah, because I'm just thinking if I was an employee, like if I didn't have very good comprehension, I know it would help, but I would be somewhat slighted or offended."* (David, paintbrush manufacturing management)

Course Additions. Participants were also asked "is there anything that could be added to the course to make it better?" Participants had numerous suggestions that are highlighted in Table 4.4. The most substantive change suggested in seven of the eight focus groups was adding a larger section on the upper limb. Illustrative quotes follow:

> *"The course was named back and upper limb but to me it was all about back. I don't remember anything about upper limb...For me you could spend as much time on the upper limb as on the back. "* (Palimar, Electrical utilities front-line)

> "*They should have added a part on upper limb... The instructor talked about your back. What about your upper part of your body?* (Gloria, Hotel 1)

Not all focus group participants agreed with this suggestion. In one of the focus groups, the participants indicated that the upper limb was not a large cause of injuries in their industry, so they did not recommend adding an upper limb session.

> "*In the context of the injuries in the industry that have been sustained, I don't think we have the big problem with the upper limb. It's largely with the back and slips and falls. Those are the principle charted areas for our industry.*" (Tony, electrical utilities management)

Some participants in several focus groups suggested adding a session on repetitive strain injury and another session on setting up a computer station.

Focus group participants also suggested adding more videoclips: "*You should do more videotaping like, where I work in that room, I lift a lot of boxes, nobody came and looked at what I'm doing. I'm doing a lot of lifting, overhead lifting, putting boxes on a shelf, and in the laundry room, taking stuff*" (Gloria, hotel 1); *"Longer video section, more, like you only had a couple of things."* (Jason, chicken packaging), exercises: *"I think more exercises that you can do would be good."* (Cher, hotel 2) and practical examples: *"Add more actual examples"*

(David1, paintbrush manufacturing management). Specifically, examples such as lifting an awkward object such as a bag of salt or a bucket of water were suggested course additions. *" I think rather than a case of beer and recycling container as Butch was saying – those things are very easy to lift up. They're the right width, they have handles. In a course like that I would like to see what is the right way to lift something that is really awkward to get a hold of. How do you do it?"* (Jake, electrical utilities management)

With regard to the exercises, front-line participants from the electrical utilities company felt strongly that learning how the exercises were helping the back should be part of the course. Four of the eight participants in this focus group expressed this view adamantly.

> *"It would be nice to know why those exercises strengthen your lower back. What are they doing to your back?"* (Al, electrical utilities front line)

However, not all participants in other focus groups agreed with this. Some felt that not everyone would want to know why the exercises strengthen the lower back and suggested that it may be helpful to explain this individually to a participant if they were interested.

> *"For someone who has an interest, knowingwhat portion of the body or the skeleton structure that it helps to improve the performance of, some people take a very great interest in that and it might be a motivation for them. But you get some other people who couldn't care less about understanding the whys; just give me the dos and leave me alone."* (Tony, electrical utilities management)

Additional changes suggested by course participants included:

1. giving course participants a reference list for additional information related to the course
2. playing music during the exercises.
3. adding a section on sitting on a forklift (because it vibrates) and its affects on the back
4. simple pictures would enable those with poor English skills to understand the concepts
5. videotaping the practice sessions so that course participants could see what they actually looked like when they lifted in comparison to others in the group.

6. including some information on which health professionals to visit if a back or upper limb injury did occur (i.e., what a chiropractor does compared to a massage therapist and a physiotherapist). One participant, however, indicated that they did not want the instructor to be "selling a product or service" to them; they preferred having a more objective instructor.

Course Scheduling and Follow-up. Focus group participants also had suggestions for course scheduling and timing of courses. One suggestion in several of the groups, was adding a refresher course a few months after course completion to highlight the theory and practical issues from the course (e.g., six months was suggested by one person).

> *"I think they should have this course continue, not just a one-time thing. It should be continued."* (Gloria, hotel 1)

Some focus group participants had suggestions for the refresher course including a more tailored practical course in their work environment. It was recognized, however, that if the course was tailored specifically to each job within a company it would be more costly to prepare and offer the course.

> *"One of the issues from the delivery of the course, if you try and tailor it more is the amount of research that the facilitator and instructor has to do prior to delivery of the course. The office environment is really standard from one location to another but some trades related area, what we get involved with here as an electric utility are going to be very different from a water works or a sewer or a construction worker on a house construction site or an industrial construction site. So although it would be nice to tailor it I'm not sure how practical it's going to be, given the diversity of some of the trades-related jobs that are out there."* (Tony, electrical utilities management)

Another participant suggested that the refresher course should focus on the use of a particular piece of equipment. Providing a demonstration to show staff how to use equipment would be beneficial for the company.

Several participants also suggested that the program be offered over several sessions instead of in one four hour time block.

> *"If you're going to have a longer course, then you'd almost maybe have to include that, but, or have two or three different sessions, not all on the one day. I know, right towards the end of the session I was at, I had more than enough information to transmit through my brain...For anything, that I've ever taken, I've always gotten more out of an hour, hour and one-half, of concentrated, you know, instruction, rather than spending something more over a whole day."* (Jason, chicken packaging)

Course Impact. Participants were asked the main thing that they got out of the *Back Course*. They were also asked what they learned that they applied at work or at home. The responses varied, but the main points are summarized in Figure 4.1. Many participants across all focus groups indicated that their awareness of handling of objects at work and home increased after taking the course, but their practices may not have changed.

> *"I can't say that I've consciously made any changes to what I do. I'm probably more aware of what I should be doing and am not doing. That's not to say that I've changed anything. I'm more aware of it."* (David2, paintbrush manufacturing management)

> "*It made me aware not to lift and twist at the same time*" (Al, electrical utilities front-line)

Participants from across all focus groups also indicated that their knowledge increased as a result of taking the course. The participants reported learning more in general about preventing back injuries and more specifically about: 1) how injuries occur, 2) biomechanical principles, 3) spinal anatomy and 4) exercises to strengthen the back. For example:

> *"For me anyway it was the thing that you can lift improperly and be okay. But over time, it will gradually get to a point where you're going to cause yourself an injury. And I found because I lifted improperly, it made me realize why I haven't been injured yet."* (David1, paintbrush manufacturing management)

"I didn't know you should wait an hour after you wake up to lift because of the discs in your back not being even which was informative, you know, somebody could say, you know, "You shouldn't lift for an hour before you get out of bed", and you go, "Yeah, OK pal, whatever", but this kind of explains why you shouldn't." (Bruce, chicken packaging)

"I know a lot more about my ligaments and my disks in my back than I knew before." (Y2J, paintbrush manufacturing front-line)

In addition to changes in knowledge, focus group participants identified changes made to their behaviour and to their environment as a result of the course. Participants in all focus groups reported some examples of behavioural changes that were made.

"*Yeah, before I used to reach for items, now I pull them closer to me.*" (Moe, paintbrush manufacturing front-line)

"Warming up. Contracting the torso muscles before you lift up. Or even just getting out of bed in the morning, and not just getting up and going like crazy. Getting up and giving myself a chance" (Zena, hotel 2)

"*I've done all the exercises.*" (Jason, chicken packaging)

"Well, if I decided to change furniture, in the past, I would have tried to do it by myself. Now I don't. I wait until there is somebody around that can help me. And I think that's all part and parcel of this course. You learn after a while that you can't do everything by yourself, you've got to look after number one. You have to look after you." (Sweetie Pie, hotel 2)

Other participants across focus groups felt that the behaviour changes were short term changes only. Illustrative quotes,

"I noticed it most within, I'd say, about the first two weeks after the course, everybody was all, oh, now be careful, lift properly, and then it kind of slowed" (Kelly, clothing warehouse)

"I think that right after the course it made them think about what they were doing. I think that over time old habits creep back in. I think right after the course yes, but after time they go back to their old ways." (Wally, electrical utilities management)

Focus group participants who work at the hotel also indicated that as a result of the course, changes were made to their equipment and work environment. The course made participants and their employers more aware of potential environmental changes that could help prevent back injuries in the future. Some equipment and plans for additional environmental changes occurred after the course such as the vacuum used by staff in the public areas and the cart used by the mini-bar staff in housekeeping. One participant reported that the new vacuum cleaner is not as heavy or as awkward as the older vacuum cleaner.

> *"I think the type of vacuum we have now is, in one sense, is different from the old canister type. It's still heavy–not as heavy, but it's more manoeuverable around the stairs, you know. It's not as cumbersome as the canister, but it's still, you still got to be careful with the cord and everything on the stairs."* (Zebob, hotel 2)

In addition, there are plans at the hotel to raise the mini-bar refrigerators so that housekeeping staff do not have to bend down in every room to put things into the refrigerator.

Focus group participants from other companies also indicated that they became more aware of environmental (i.e., in the workplace related to job tasks) changes that could be made to reduce back injuries as a result of the course. Unfortunately these changes were either not suggested to management or were not acted upon. This will be discussed more when examining the comparisons between management and front-line employees.

Barriers that prevent people from making behaviour changes identified in the focus groups included time and equipment or the work environment. Illustrative quotes relating to time follow:

> *"We're all rushing around, trying to get too much done."* (Beck, clothing warehouse)

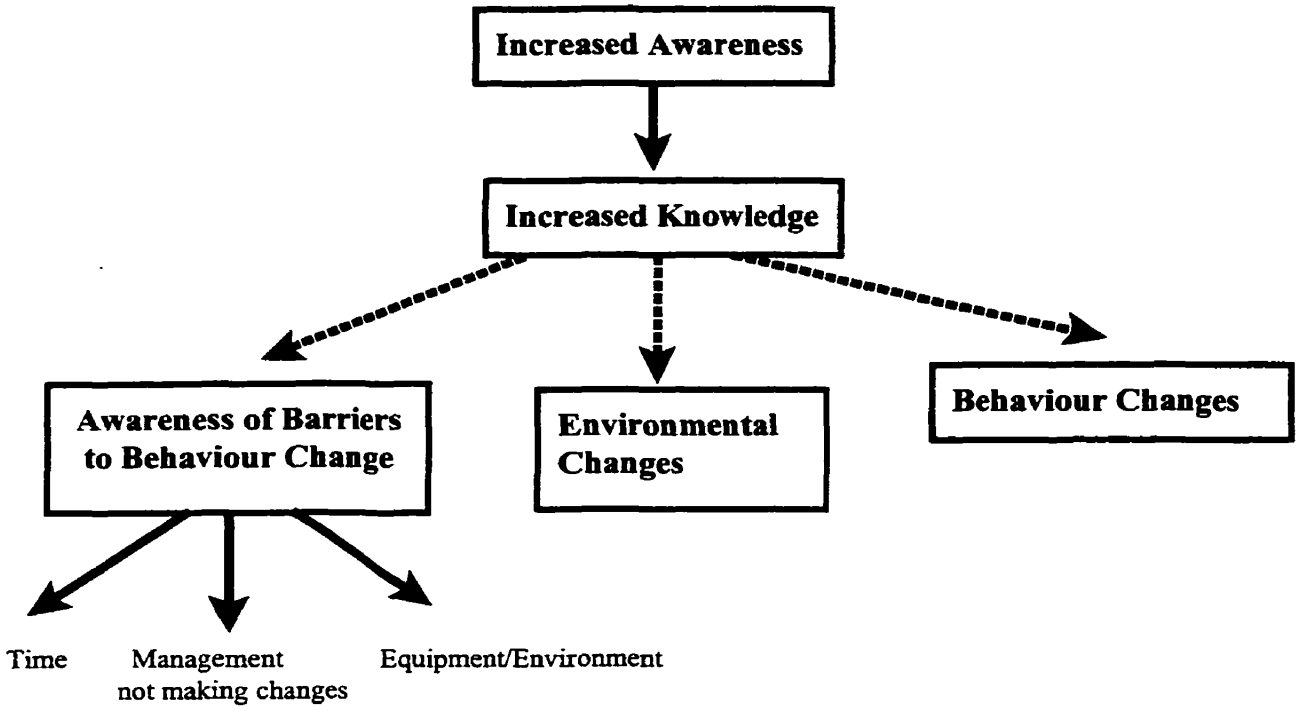
> "*Yeah, when it is busy, a lot of that stuff that we learned is just out the window.*" (Bill, clothing warehouse)

Participants who identified the work environment and equipment as a barrier felt that it is difficult to make behaviour change if the environment is not conducive to behaviour change. For example,

> "*But your work conditions have to be improved sometimes too. Like if you're trying to work in a situation and it hasn't been improved to be able to lift properly or to do it properly, then it's not going to benefit you.*" (Beck, clothing warehouse)

Summary of Course Effectiveness. Figure 4.1 presents a summary of the changes focus group participants felt resulted from the *Back Course*. Most participants felt that their awareness of handling practices increased and their knowledge increased. However, increased awareness and knowledge did not necessarily mean a change in behaviour. Although, many participants identified examples of behaviour changes made; some indicated that these changes were only short term behaviour changes. Participants said that the course also made them aware of potential environmental changes that could assist in changing their handling practices. In one company, environmental changes were made as a result of the course content and the analysis of workers' handling practices based on the videotaping done prior to the course. In addition to behaviour and environmental changes made, some participants felt that the course made them aware of barriers to making behaviour change which are highlighted in the left of the figure.

Figure 4.1 Summary of Changes as a Result of the *Back Course*



Addressing Injury Prevention at Work. Focus group participants identified a number of ways that injury prevention is addressed in their workplace and these are listed by company in Table 4.5. Participants identified both primary prevention strategies such as offering training courses to employees and secondary prevention strategies such as offering light duty and physiotherapy for injured workers. Activities were similar across companies and they generally included having a Joint Health and Safety committee and prevention activities such as training courses. The hotel and electrical utilities also had a suggestion box for changes, although participants were not sure how often the boxes were used.

One participant felt that small companies have difficulty offering injury prevention activities because of the number of staff dedicated to safety in small companies compared to large companies.

> *"But I think a lot of prevention is still relatively new, there wasn't a lot of attention paid to prevention. ...I think it started a lot with WHMIS and it's been carried on. People are seeing that it's very important in the workplace, to make sure it's a safe place. There's a lot of new legislation and so on that's come out in the last five years. And I think* ***part of too is company size. The larger companies have teams of HR people and safety people on the floor and liaisons with unions and all sorts of things, but in smaller companies you may have one person. And they may be just keeping track of payroll and so on. So it's a different focus.*** *"* (Sandi, paintbrush manufacturing management)

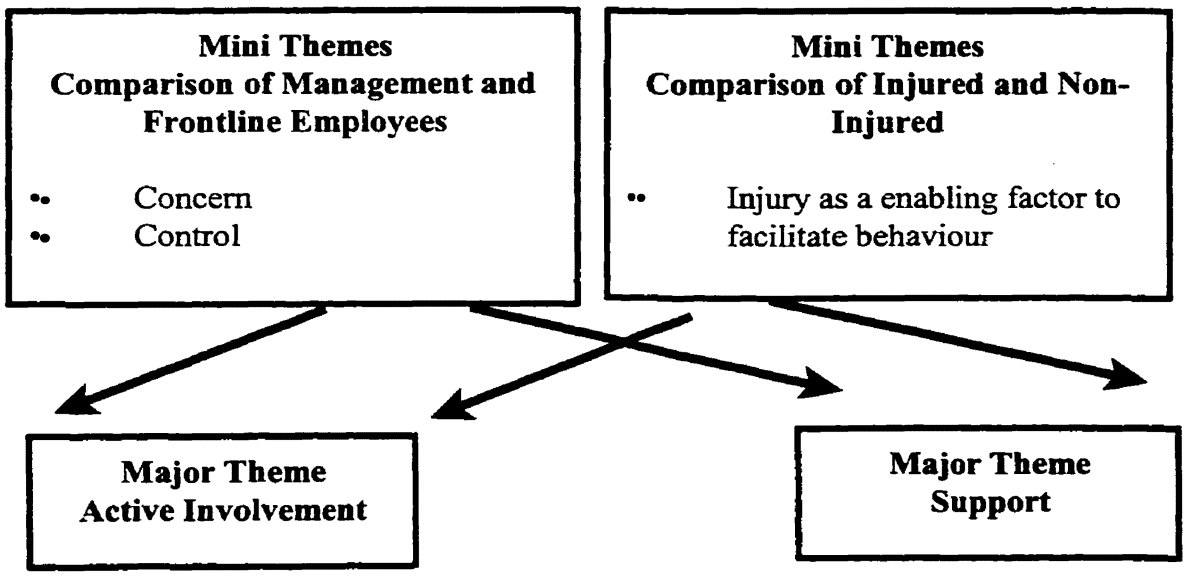
Table 4.5 Activities by Companies to Prevent Injuries at Work

Company	**Activities to Prevent Injuries as Mentioned by Focus Group Participants**
Chicken Packaging Plant	-keep floor clean to prevent slips and falls - help co-workers when lifting -offer training courses such as ergonomics
Clothing Warehouse	-equipment such as carts to help in lifting -monthly safety inspections -safety committee
Electrical Utilities	-benefits such as physiotherapy and massage -light duty for injured workers -environmental and equipment changes -offer training courses such as electrical safety, CPR, Flash -suggestion box for ideas -safety committee and monthly meetings
Hotel	-safety committee, recommendations are made to committee for changes -suggestion box for safety ideas -posters to prevent injuries
Paintbrush Manufacturing	-offer training courses such as forklift, First Aid, propane handling and WHMIS -monthly safety meetings

4.4.2.4 Focus Group Themes

In the analysis, themes emerged across focus group discussions and questions. They were identified by examining generalized statements of respondents about beliefs, attitudes, values or sentiments that were of over-riding importance to respondents (Luborsky, 1994). Two types of themes were found in this analysis: 1) mini themes and 2) major themes. Three mini themes were found by examining generalized statements contrasting the beliefs, attitudes and values of management and front-line employees; and injured and non-injured employees. These mini themes included concern, control and injury, an enabling factor to facilitate behaviour change. Two major themes were then found by examining these mini themes to find generalized statements about values, beliefs, and attitudes across all data and all questions asked. The major themes included active involvement and support. Mini themes and major themes will now be described in greater detail.

Figure 4.2 Development of Themes



Mini Themes

The three mini themes of concern, control and injury, an enabling factor that facilitates behaviour change will be described in the following section.

1. Concern

The first mini theme called **concern,** was developed by examining the similarities between front-line and management staff. Management staff involved in the focus groups felt that their participation in the course was important to its success, and this feeling was shared by front-line employees. A quote that indicated management felt that offering the *Back Course* showed concern for employees follows:

> *"I think offering injury prevention courses* ***shows concern of management*** *for the employees' welfare, that you are concerned. You don't want to see them get hurt at work."*

Two management teams indicated that the course should be attended by management and front-line staff so that the course's importance would be emphasized.

> *"I think, aside from what we take out of it, even if it's a matter of perception to the employees in the plant that* ***it's not just important to them, it's important to everybody****."*

Front-line employees felt that the course should also be attended by both management and front-line staff, but only three of the seven companies sent management to the course. The front-line employees indicated if management did not attend the course, they would not be aware of what the front-line staff learned.

> *"Well, supervisors, I think, who have never been on the floor, don't even really understand the work itself and they think, well, just go do it, and do it, and do it. If they take the course, I think it will show them, or open their eyes in so many different ways, in order to understand what their employees are doing. So I think that's the only way that will help a supervisor or manager."*

"I think it would be good for management to take it. I mean, in our course, we actually had people from the office. They took the course too. They learned a lot of stuff that they didn't know we actually do."

"Yeah, because I think that's a lot of the reason why things don't get changed in an employment setting, because the employees go to these seminars and come back with all these wonderful ideas and the employer goes, sorry, we don't need to do that."

2. Control

The second mini-theme called control, was developed by examining the differences in the emphasis of ideas between management and front-line employees. The mini theme **control** refers to control over the work environment and control over being injured. Management suggested that work environment or equipment changes should occur from bottom-up, while the front-line employees suggested that changes occur from the top down. However, it was stressed that the climate of the company should be supportive of suggestions, otherwise they would not occur.

*"I think that change has got to be **bottom up, as opposed to being top down**. Like people who actually do the work and say, look, this is really tiring and you know, I could injure my back. We should really raise this up and it will cost the company $200 to do this. But since we do this for 40 hours a week or whatever, you know, we should seriously consider it. I think that's how things are going to change."*

*"It probably is a case where, you're right, **it's bottom up, but it needs to be initiated from the top where whoever's at the top** goes to them and says, have you seen this video. Or you had this course, now what can we do here to make things better for you?"*

In terms of environment or equipment, front-line employees suggested that environment or equipment changes are **controlled by** management and occur when management wants to make changes. The front-line employees in different companies indicated that they often suggested work environment/equipment changes to management, but changes were not made by

management. The views are reflected in these representative comments:

> *"I think we have always suggested to the company, we've suggested a lot, but we've found a lot of things don't get done."*
>
> *"There were a lot of recommendations made to make the job easier where you don't have to use your back for bad situations and nothing gets done about it. ... It takes years to change it."*
>
> *"That's part of the reason I stopped. They say that they're proactive but I said no, you're reactive. Proactive is doing something before the injury happens. When you're reactive - it's only after the accident happens that they actually do something. And that's what happens."*
>
> *"You end up relying on your co-workers instead of trying to work through suggestions because they've fallen on deaf ears in the past unless there's an injury."*
>
> *"Change always comes from on top. From the top."*
>
> *"Things don't work upwards here"*

Back injuries can be reduced by individuals through behaviour change and by companies through company policies and a changing work environment. Front-line employees emphasized that the **control** of injuries should occur at both management and individual levels, but they felt that when management offered educational courses they generally did not consider changes in policy or a new work environment. Front-line employees indicated that management "*wiped their hands*" of the problem of back injuries by offering this course. They felt that management believed employees could prevent back injuries because of their education (regardless of work environment). Some workers felt that if the exercises learned in the course were not regularly done, then the management would attribute blame to the employee if the employee was injured.

> *"But their idea too is, a lot of people when you say, oh, I went to a Back course, they go, oh, you learned how to lift a box, good for you. And I think sometimes the employers think too, good, they know how to lift properly now. We don't have to worry about it.*

They don't consider that there could be changes within the actual workplace that would help with the lifting."

"Now if you have an injury they will come back and ask, did you do the exercises you learned this morning? Why didn't you do them?"

"But your work conditions have to be improved sometimes too. Like if you're trying to work in a situation and it hasn't been improved to be able to lift properly or to do it properly, then it's not going to benefit you. But if your whole team was taking what you learned... plus your work conditions are proper and... you're lifting the proper way, then it's easier to do both."

3. Injury, an Enabling Factor to Facilitate Behaviour Change

A third mini-theme, called injury, an enabling factor to facilitate behaviour change was found when responses of injured and non-injured employees were examined and compared. There were some differences in the emphasis of ideas between "ever" injured and "never" injured employees that highlighted the mini-theme called the **enabling factor**. Ever being injured appeared to facilitate behaviour change. In general, "ever" injured focus group participants indicated that they took the course more seriously than those who were never injured in the past. Those who were injured at some time in their lives reported changing handling practices and doing the suggested exercises more than those who were never injured. Also those who were ever injured believed that those with no previous injuries did not take the course as seriously.

"Well that's one of the reasons I've been doing the exercises. I do have a bad back and the only way I can keep as good as what I am is to keep doing all kinds of exercises."

"I think they (those who have been injured including the speaker) would take more out of the course and learn more out of it. And they're probably more concerned about it too because if you've never had back problems, you don't know how much it really hurts and that...you're kind of out of commission for at least a few days after you severely hurt yourself."

"Well, yeah, like for myself because I've had back problems, I take it more serious. But for someone who's, let's say young and they don't have back problems... it's funny."

Those who were never injured indicated that they may think about doing exercises and changing their handling practices if they were ever injured. One person who has never been injured said that it would take a "*broken back*" before he would make changes to his behaviour.

"I think to be honest, if I ever got hurt, I'd think about it (changing handling practices) then."

Major Themes

Two major themes emerged from the development of mini themes across the analysis of all questions and all data: 1) **active involvement** and 2) **support**.

1. Active Involvement

The first theme to be discussed is labelled **active involvement.** The effectiveness of the *Back Course* appeared to be dependent on the active involvement of course participants, the course instructor, and management. As indicated in the analysis of mini themes, active participation of management in the course was viewed as very important to all course participants. By participating in the course, management is more likely to understand why a work environment change may be necessary to improve the injury record at the company and to understand their employee's request to make a change to the work environment. In addition, management may be less likely to expect individual behaviour change in the absence of a change to the work environment if they were actively involved in the course (e.g., both individual behaviour and the work environment were identified in the course as being important to reduce injuries).

Course participants who were ever injured are likely more aware of the spine and potential injuries that may occur than those who have never been injured. As a result of previous experience, those with previous injuries are likely more actively involved in the course. Active involvement may help to explain why those who have been previously injured report behaviour change more often than those who have been never injured. For example, one interviewee in the follow-up verification indicated that he was injured after the course and began to think more about the concepts learned in the course and think about the way he lifted prior to lifting materials so that he would not re-injure himself again. He felt that he may have paid more attention to the course if the injury would have occurred prior to taking the course.

The components of the course that were most well-liked were the interactive components: practice sessions, exercises, examples (demonstrations), and videotape of course participants at work. These components required **active involvement** of course participants and the course instructor. For example prior to teaching the course, the instructor videotaped course participants in their work to better understand their work environment and to be able to compare the videotape to a post course videotape. By videotaping course participants, the instructor actively prepared for the course and actively involved participants before the course started. When the videotape was shown during the course, it actively engaged participants who knew the person who was videotaped or knew the job required to do the task videotaped.

The theme of **active involvement** cuts across mini themes, questions, groups of participants and focus groups. In order to influence the behaviour of course participants, focus group participants indicated that active involvement of management, course participants and the course instructor are important.

2. Support

The second theme to be discussed is labelled **support.** Focus group participants felt that the support of people (co-workers and management) and an environment make behaviour changes easier and possible. In the focus group sessions and in the follow-up interviews, it was stressed that management **support** of the *Back Course* was critical to its success. **Support** was shown by management in offering the course to employees. (For example: "*Offering injury prevention courses shows concern of management for the employee's welfare, that you are concerned.*" (Management) and *"It was nice to have a preventative back course. It was good and it was needed...and long overdue* (Front-line)"). Support was also shown by management in participating in the course. (For example, *"It's not just important to them, it's important to everybody*" (management) and *"If they take the course it will show them...to understand what their employees are doing.*" (Front-line)) One focus group recommendation was having a refresher course for participants in order to reinforce principles learned in the course and to discuss practical tips for handling materials in specific work environments. Management could show additional **support** by offering a refresher course to participants in order to make the course more effective.

Co-worker **support** was also identified as important for making behaviour changes by the focus group facilitator and by focus group participants. Co-worker support was important to focus group participants. (For example, "*you end-up relying on co-workers*" to help with lifting to reduce risk of injury.")

A **supportive** environment was also identified as critical for making behaviour changes. Employees indicated that in order for changes to occur, their equipment and work environment need to allow the individuals to change their practices. For example from the follow-up interviews:

> *"It's all well to learn all these things but if you don't have the support - for instance of the ergonomic keyboard - if they said well no it's too expensive or whatever - if you didn't get the equipment required to do your work well then it wouldn't be worthwhile. Why would they teach you that if you couldn't follow through?"*

Thus, the theme of **support** also cuts across mini themes, questions, groups of participants and focus groups. In order to influence the behaviour of course participants, support of management, co-workers and a work environment would assist in reaching this goal.

4.5 Follow-up Interviews

Follow-up interviews were conducted with a sample of focus group participants to verify the main findings from the focus groups, and to examine whether additional work practices or equipment/environmental workplace changed as a result of the course. At the end of the focus group session, participants were asked whether they would consent to a follow-up interview by phone once the results had been analysed for purposes of verification. All 39 of the respondents (100%) signed this consent form and provided their telephone numbers, as well as the most convenient time to call.

4.5.1 Methods

4.5.1.1 Recruitment

From the pool of 39 who agreed to follow-up interviews, 16 participants were purposefully sampled to ensure that the views of both men and women, and both front-line and management staff, were represented in the follow-up interviews. Otherwise sampling from each focus group was random (names were picked from a hat); interviewees were not selected based on the extent of focus group participation or the views expressed.

4.5.1.2 Measures

A standardized script was also used for all follow-up interviews conducted with focus group participants. There were also probes on the script to use when the interviewer felt that they may help the respondent. (Refer to Appendix N for Follow-Up Interview script.)

4.5.1.3 Procedure

A sample of focus group participants was called between three and six months after the focus group sessions for a follow-up interview to verify the focus group findings with participants and to obtain additional feedback and recommendations to improve the *Back Course*. A telephone attachment on the tape recorder allowed the follow-up phone interviews to be audiotaped.

4.5.1.4 Data Analysis

Participants' responses to the follow-up interviews were transcribed and analysed using the QSR NUD*IST 4.0 program (Richards and Richards, 1991) the same way the focus group sessions were analysed. After the categories were developed, the content was further analysed

to identify the main points. Descriptive summaries were written and the follow-up findings were compared with the focus group findings.

4.5.2 Results

4.5.2.1 Participants

Follow-up verification interviews were held with a sample of participants from each focus group. Table 4.6 illustrates the sampling strategy and results for the follow-up verification interviews.

Table 4.6 Sampling Strategy for Follow-Up Telephone Verification

Company	Group Size and Composition	Agreeing to Follow-up	Sampling Strategy	Sampling Results
Chicken Processing Plant	Management 3 (75%) male 1 (25%) female 2 (50%) injured	N=4 entire sample	1 male, 1 female	1 male
Clothing Warehouse	Front-line 1 (33%) male 2 (67%) female 3 (100%) injured	N=3 entire sample	1 male, 1 female	1 male, 1 female
Hotel	Front-line 1 (25%) male 3 (75%) female 2 (50%) injured	N=4 entire sample	1 male, 1 female	1 male, 1 female
Hotel	Front-line 1 (20%) male 4 (80%) female 4 (80%) injured	N=5 entire sample	1 male, 1 female	1 male, 1 female
Paintbrush Manufacturing	Front-line 5 (100%) male 2 (40%) injured	N=5 entire sample	2 males	2 males
Paintbrush Manufacturing	Management 3 (50%) male 3 (50%) female 4 (66%) injured	N=6 entire sample	1 male 1 female	1 male, 1 female
Electrical Utilities	Front-line 8 (100%) male 7 (87%) injured	N=8 entire sample	2 males	2 males
Electrical Utilities	Management 4 (100%) male 2 (50%) injured	N=4 entire sample	2 males	2 males
Totals	26 (67%) males 13 (33%) females 26 (67%) injured	N=39 entire sample	N=11 N=5 females 1 female not available	N=11 males N=4 females

4.5.2.2 Findings

The interviewer began by reviewing the concepts learned in the *Back Course* to refresh the memories of respondents. The main findings emerging across the eight focus groups, and in relation to the views specifically expressed in each interview's own group were reviewed with each person for verification purposes. The interview was also used as an opportunity to explore related issues such as behaviour changes made since the focus group, and environmental changes in the company made since the focus group. The findings from the interview are presented in the same order as the topics were raised in the structured interview itself (refer to Appendix N).

Recommend the *Back Course* to others.. Consistent with the focus group findings, all respondents indicated that they would recommend the course to others.

General Impressions. Participants were asked what they thought of the finding that although most participants found the course clear and understandable, some may have had trouble following the course if they did not understand English. Similar to the focus group session, mixed opinions on this issue emerged. Six interviewees indicated that they did not think there would be difficulty in understanding the course. For example, "*I don't know that the course was really all that hard to follow.*" and "*No, because there was enough visual stuff that I think that if they didn't understand English very well that they would pick up the gist of it.*" Others indicated that they felt that it would be difficult to understand without understanding English. For example, "*I think some of the stuff, especially about... the more technical terms, if you didn't understand English it may have gone over your head.*" and "*I only understood about*

60 per cent. Some of the people don't even understand 5 per cent. For them it was like a waste of time. There should have been more pictures instead of some medical words.".

Interviewees were then asked if they had any suggestions for improving the course for those who had trouble with English. Some suggestions included providing an interpreter, more demonstrations, teaching the course more slowly, more pictures and using words that were easier to understand.

Course Additions. Interviewees were reminded that some of the groups suggested adding a longer section on the upper limb. They were also reminded that not all focus groups or individuals within groups agreed with this suggestion. Most of interviewees remembered their group's discussion of this topic and their own personal views remained consistent (for those who contributed to this aspect of the discussion). Similar to the focus group session, there were mixed opinions on the issue of adding a longer section on the upper limb. Five reported that there should be a longer section on the upper limb, one interviewee felt that there should be a longer section on the shoulder and two reported that adding more on upper limb may be helpful for workers who use their upper limb the majority of the time. One interviewee indicated that they would only add a new section if the course was going to be longer. The other six interviewees felt that the content was fine the way it was.

One focus group recommended a short refresher course after a period of time in order to remind people of the principles discussed in the course. Interviewees were asked what they thought of this idea. All but one interviewee was in favour of a short refresher course for course participants. For example, "*really good idea*" and *"people tend to forget especially if there's a*

lot of information like a four hour course".

Interviewees were also asked if they had other suggestions for making the course better. The suggestions were similar to those in the focus group findings such as more videotaping of participants.

Behaviour Change. Since the focus groups took place soon after the course, it was felt that it would be useful to inquire again about any change in behaviour related to the course. Interviewees were asked if they looked at the exercise sheet or had done the exercises. Six interviewees reportedly had looked at the exercise sheet and seven had done the exercises. Interviewees were also asked if they made any changes to what they do at home and work. All indicated that they felt more aware of lifting materials and most felt that they had made some changes to the way they handle materials. Interviewees were also asked what barriers prevent them from making changes at home or work. They identified "*demands of the day*", "*time*", "*forgetfulness*", "*laziness*", "*awkward positions required for work*", "*confined space at work*", "*work overload*" as barriers preventing them from making changes at home or work.

Work Environment. Interviewees were asked if their company made any changes to their work environment since the focus group session. Six interviewees from four different companies indicated that changes had been made to their work environment since the focus group. Changes in one company included equipment such as vacuum cleaners, putting laundry bins on a spring so that bending is not required as much and raising mini-bar refrigerators so that staff do not need to bend over to put contents into it. These changes were believed to occur as a result of recommendations from employees who had taken the course and due to the hiring of a new

management person who was keen to make these changes. In another company, new pieces of equipment were purchased as a result of pressure from staff that use the equipment and changes in a management position. In a third company, equipment changed (suspended loaders), and this change was initiated because of the videotape analysis during the course.

4.6 Interviews with Company Contacts

Interviews were conducted with one representative from each company to obtain feedback concerning expectations for the WSCP and the *Back Course* and to explore whether the expectations of the WSCP and the *Back Course* were met.

4.6.1 Methods

4.6.1.1 Participants

Interviews were conducted with one company representative from management and/or health and safety from each of the seven companies that participated in the *Back Course.*

4.6.1.2 Measures

Individual semi-structured interviews were conducted with representatives of each company who offered the *Back Course* during the study period. The interview used a semi-structured format to gain a fuller understanding of their reasons for offering the course, whether their expectations were met and possible barriers of offering this and other injury prevention courses. Refer to Appendix O for Interview Guide.

4.6.1.3 Procedure

The individual interviews were audiotaped and fully transcribed. The interviewer also recorded additional information such as body language and responses that may help in the data

analysis. Information recorded by the interviewer helped in transcription of the audiotapes and provided perspective from the interview not captured on audiotape. All interviews were fully transcribed. The transcription, notes, and background questionnaire results were used for qualitative data analysis.

4.6.1.4 Data Analysis

All interviews with company representatives were audiotaped and transcribed verbatim. Data for the interviews consisted of field notes, audiotapes and transcripts of each interview. Transcripts were then read and hand-coded on hard copies of the transcripts. All data were then imported into the QSR NUD*IST 4.0 program (Richards and Richards, 1991). The interview data were analyzed using QSR NUD*IST 4.0. The interviews were only verified with interviewees at the time of the interview, and only one interviewer was present in each interview.

4.6.2 Results

4.6.2.1 Participants

For each participating company, interviews were conducted with a company representative (i.e., generally a member of management) between two and four months after the course was offered for their employees. As you can see, the position of those interviewed ranged from human resources and safety, to safety coordinator, to owner of the company (Table 4.7).

Table 4.7 Interview Sites and Characteristics of the Management Representative Interviewed

Site (Company)	Session Date and Time	Attended Class	Position
Broiler Service and Repair	September 7, 1999. 2:00 p.m.	Did not attend	Upper Management
Chicken Processing Plant	August 17, 1999. 1:00 p.m.	Did not attend	Human Resources/Safety
Clothing Warehouse	August 19, 1999 1:20 p.m.	Did not attend	Operations Manager
Hotel	October 7, 1999 11:00 a.m.	Did not attend	Human Resources/Safety
Paintbrush Manufacturing	December 1, 1999. 9:00 a.m.	Attended	Human Resources/Safety
Plumbing Company	August 11, 1999. 2:30 p.m.	Did not attend	Company Owner
Electrical Utilities	February 18, 2000. 10:00 a.m.	Attended	Safety Coordinator
Totals		5 - Did not attend 2 - Attended	

4.6.2.2 Findings

Representative quotes from participants are provided for illustration of the interview findings. The findings will be presented in the order that they appeared on the script. Companies were described by respondents and those responses are found in Appendix P. Respondents were asked the three most common causes of injury in their company. Company representatives varied in their responses (Appendix P for responses by company), but five of seven identified an aspect of the work environment as a reason for injuries occurring, four indicated that injuries are caused by lack of training, three indicated that they are due to

carelessness and three indicated a specific type of injury occurring most frequently (slips and falls, back/shoulder injury, cuts/scrapes). Respondents were also asked who provides safety training to their employees. All respondents indicated that they receive training from some external sources (e.g., Industrial Accident Prevention Association, contacts made in the Safe Communities Program, other external consultants) and three respondents also indicated that they provide training to their employees. When asked who is responsible for safety at their organization all indicated management, but three also indicated that individuals are also responsible for their own safety. No companies utilized incentives for safety except the electrical utilities company. The electrical utilities company gives awards to individuals every five years and gives awards to groups of people for safety milestones reached (example, number of months without a lost time injury for one work group). In terms of safety programs, all but two companies have a Joint Health and Safety committee, all provide training to employees, all provide safety information to employees in various formats (e.g., posters, memos, Employee Handbook, newsletters, off-the-job safety course information). The electrical utilities company also has additional components to their safety program including:

- job planning to allocate equipment resources, examine and control deadly hazards
- safety meetings with all staff every other month to go over accidents and incidents and provide statistical feedback of the relevant safety statistics
- crew visits/audits to observe people working and commend them when they are doing things right and correct them gently and try to convince them to change their behaviour if it is incorrect

In terms of Off-the-Job safety, companies indicate that they provide information about off-the-job safety to employees that they receive from Safe Communities and other sources (e.g., bulletin boards, word of mouth, memos). The clothing warehouse contact identified the *Back Course* and First Aid as training that they provided to their employees related to off-the-job safety.

Appendix Q shows the responses for the next set of questions related to expectations of the WSCP and the *Back Course.* Respondents indicated that the primary reason they joined the WSCP was the financial incentive provided by the WSIB. Safety training and interest in improving health and safety in the workplace were additional reasons given for participation. Two company representatives also indicated that a well-known business contact strongly influenced their decision to join.

Respondents were asked what training programs offered by the WSCP they had participated in to date. All had participated in the mandatory occupational health and safety training, the Safe Workplace Awareness Training and had sent employees to the *Back Course.* Two company representatives also attended other occupational safety training courses to improve their company's health and safety program including Accident Investigation and Return to Work. Four of seven sent employees to a subsidized First Aid program; two sent employees to Workplace Hazardous Materials Information Systems (WHMIS); and four posted off-the-job safety courses for staff such as Car Seat Safety. One representative also assisted as a member of the Waterloo Safe Communities Executive Committee in initiating the Young Worker Awareness Program in schools in Waterloo Region.

Company representatives were asked about their expectations of the program. Three expected a financial incentive, four expected networking opportunities with safety professionals and other business contacts in the community, four expected training opportunities for themselves and their employees, and three expected help in developing their occupational health and safety program. The following quotes illustrate their expectations.

> *"I didn't really know what to expect at first. I knew that there would be training. I wasn't sure how good the training would be...I was looking forward to the networking. I was looking forward to... meeting other companies in my same position. And I guess just the opportunity to learn, basically."*

> *"The incentive was a big draw, ...and the promotion of health and safety of the staff. The general manager felt it would be a very worthwhile program for the community."*

> *"There's two reasons, the one that grabbed me, of course, was the incentive. The second reason is that we have a mandate to promote public safety and that's part of the Safe Communities mandate as well."*

Company representatives were then asked if their expectations for the Waterloo Safe Communities program were met. Four respondents indicated that their expectations were met, as illustrated by the following comments.

> *"I was pleased with the training and the networking. I met a lot of people and I was able to feel confident in what I had done for the Ministry of Labour, I had done it properly."*

> *"I think it's a great, great program...to offer an incentive to even save money is one thing, but the training and the time that's been put in, I think it's great. It is well run, and the consultants are great. It really pushed me to do the things that I had... been procrastinating... Even if there would have been no financial incentives, I would have still become involved."*

Two respondents indicated that their expectations of the program had not been met, while one indicated that they had been partially met. These representatives said they wanted

more networking opportunities, more occupational safety training opportunities for employees, more advance notice for courses and better communication with participating companies. One respondent felt that as new companies were recruited, there were fewer resources for all of the companies and felt "*left behind*". However, another respondent indicated wanting more companies to participate so the financial incentive would continue from year to year. Quotations illustrative of these perspectives follow.

> *"I'd like more training. I need stronger training. Also the big thing is, they need more networking events. Like, more opportunity for people to get together and chat ...So I think they need more...opportunities for the different employers to get together and discuss their problems.... Because one contact offered to show me his safety manual and give me some tips there because he's got a really good program."*

> *"Communication has improved over the last little while. But even at the meetings, people were saying they weren't getting the faxes and they weren't aware of the training that was going on. There was even one meeting...we were told the next meeting will be on this day, and as it turned out, I couldn't make it. But then the I got a fax that it was the following week. That wasn't communicated."*

> *"I would like more notice for meetings and training."*

One company representative spoke about time and fear of the unknown (with regard to health and safety programming) being a barrier to getting involved in the Waterloo Safe Communities Program.

> *"Time is a big barrier for small companies. Not only that, but you have people coming into your workplace doings audits. And I can see people being afraid of that, especially if they don't have a Health and Safety program already. Oh, what are they going to do and how much work will I have to put into it? It's a fear of not knowing. But then the benefits far outweigh the barriers."*

Company representatives were asked why they participated in the *Back Course*. Four indicated that back injuries were the most or very common injuries in their industry, three

indicated that the low cost was a incentive to participate, two indicated that their staff do a lot of physical handling of materials and two wanted to be pro-active and encourage employees to lift properly. Company representatives were asked about their expectations for the course. Five expected to raise awareness about back injuries and provide information about lifting more effectively, three expected lifting practices of course participants to improve, one expected to improve back strength of course participants and two hoped to reduce injuries. Quotations illustrative of these concepts follow.

> *"I felt that it was important for the employees to learn how to do things properly... Because that is a big part of their job. They're lifting and turning. And they have to do it properly to be healthy. If they're healthy, they're working, they're happy, then everyone wins."*

> *"I've been looking for a back course for some time. Back injuries are the number 1 injury in our industry. While we haven't had a large number here lately, the statistics from the safety association indicate that about 50% of all injuries are back related in our business and faced with that overwhelming number, it makes you think you have to do something pro-actively to help people look after themselves and prevent injury."*

> *"We really want to work on home safety and ...that's one of the reasons we're offering it to everybody, because a lot of the work here doesn't involve lifting."*

> *"I hope that there will be less back injury. Hopefully the course will prevent it."*

One respondent also indicated that it was expected that the course instructor would not endorse and attempt to sell a product to employees during the course. This respondent indicated that other consultants hired to provide back and upper limb education (e.g., health professional such as a chiropractor or other consultant) attempted to endorse and sell products, so the validity of the information given to course participants was questioned.

Company representatives were also asked if the *Back Course* met their expectations.

The feedback from respondents was very positive; all indicated that they felt the course was worthwhile. Several said that it was positively received and several indicated that the content and examples were excellent. One respondent indicated that a few of the course participants were "*overwhelmed with all of the information they received*", but was not able to provide examples or reasons for this. One respondent said that this course was the "*best I've seen*" and another was impressed by the videotaping of course participants before and after the course. Some of the quotations that reflect these comments follow.

> *"I think... the morale* (of staff) *is definitely a lot better. I think that some of the old time employees had never seen interest like that before, in them...There were... a few days after the course, people were saying, "OK, keep the curve in the back, and keep the loads close". It was also a really good icebreaker too. ...I think that it was well worth it."*
>
> *"I got some feedback from the guys that it was a good course, and they were glad that they went. That's as much satisfaction as owner I can get from it."*
>
> *"I didn't expect it to be as good as it was...So I was very pleasantly surprised."*

Respondents were also asked whether they would recommend this course to others. Four respondents indicated that they would, three thought they might, but did not feel comfortable to recommend because they did not attend the course. Quotes about why they may recommend the course follow.

> *"Well there's a few reasons (I would recommend the course), number one, the content is excellent. The way that....the instructor puts the course across. She shows us examples and so, even for the people who necessarily don't have English as their first language, they still learn."*
>
> *"I've been looking for something (back course)... and this is the best I've seen. I ...had a great benefit from it myself, just understanding the overall physiology...presented well... it's a good, simple method of explaining the ideas to people, like the demonstrations ... I can see that; I understand that. I also like the five steps (principles)."*

Company representatives were also asked if they knew of any changes that were made to the company as a result of the course. Five respondents did not know of any changes made to their company as a result of the course, while two indicated that they noticed changes. One respondent felt that the company morale improved as a result of the course, and another respondent indicated that some changes to the work environment changed as a result of recommendations made to management at the time of videotaping of course participants. Larger wheels were put on the mini-bar cart, new vacuums were purchased for employees in the public areas and plans were made for additional changes in the future.

Company representatives were also asked if they observed any individual changes to behaviour in course participants. None of the respondents were able to answer the question, but felt it would be better addressed by the course participants themselves.

One company representative suggested a follow-up refresher course to the *Back Course* to reinforce the concepts learned and to follow-up with practical suggestions for participants.

> *"I think there should probably be a one hour or half an hour follow-up in about 6 months ... Well if you actually scheduled the opportunity for people to discuss it, and talk about things they've...thought about since the course it would be helpful."*

The paintbrush manufacturing company did not complete the impact questionnaire. The representative from the paintbrush manufacturing company was asked why course participants complained about the impact questionnaire, and why management then decided not to have participants complete it. She felt participants were "*intimidated*" by the questionnaire.

> *"I think the problem was, they got the package, English is their second language, and why do they want to know these things? Why do they want to know how I think my supervisor felt about it. And they questioned that. I don't think they could relate it to the back training.*"

She also said that there were some other political internal company issues happening between management and front-line employees which may have contributed to resistance of employees in completing the impact questionnaire.

4.7 Consent and Confidentiality

The Office of Research Ethics at the University of Waterloo reviewed and provided ethics clearance for each data collection component of this study. Consent was received at several different times: informally during the recruitment process, at the beginning of the focus group and interview and at the end of the focus group session.

Appendix R contains the cover information and the three separate consent forms for participation in the focus group–for participation, to audio-tape and for follow-up, respectively, as well as the two different consent forms for participation in the interview–for participation and to audio-tape. Consent for participation and audiotaping was explained and signatures were obtained following introductory comments–before both the focus group and interviews started. All participants completed the consent forms; everyone agreed to audio-taping; everyone also provided consent for follow-up contact.

4.8 Discussion

This process evaluation used multiple data sources to obtain a more thorough understanding of the *Back Course*. The evaluation included observations of the *Back Course,* focus groups with course participants, follow-up interviews to verify the findings of the focus group and interviews with company contacts. This section discusses the findings of this process evaluation in the context of the published literature.

4.8.1 Observation

Eight sessions of the *Back Course* offered to participating companies of the Waterloo Safe Communities Program were observed. These sessions of observation revealed that the instructor who taught the course was thoroughly trained by the course developers and practised delivering the course a number of times prior to offering the course to participants. This emphasis on practising resulted in a high level of consistency of course content. In each course the same overheads, handouts and content was covered. The examples covered in each class were consistent. The only difference in course content was the videotaped examples of course participants. These examples were specific to each workplace. Since some of the courses had participants from more than one company, they generally had fewer examples than courses with participants from only one company.

It should be noted that the course developers and the course instructor had a background in biomechanics rather than adult education. Although the content of the course may have been scientifically accurate, the terminology utilized may have been more complex than if the course was developed by an expert in adult education. In addition, a course offered by an adult education expert may have utilized specific teaching and learning principles to help adults learn, rather than simply teaching the biomechanical principles to course participants.

There was inconsistency in room setup since the course was offered in some individual companies and was also offered at the University of Waterloo. When the course was offered at the paintbrush manufacturing plant, the participants had very little room and were unable to write notes throughout the course. The participants had to do the exercises and practice

sessions in shifts since the room was so small. Most other rooms were large enough to provide room for participants to sit at a table and write notes if they wanted.

There were differing levels of interaction between the instructor and the participants. The instructor believed this was mainly due to difficulties participants at some companies had speaking English. She also felt that the course setup may have influenced course participation. At the paintbrush manufacturing company, there was little room for volunteers to get up and participate in the planned examples.

Limitations of the *Back Course* observation are that the course was only observed by one individual (author). Thus, there was no way to verify the findings with another individual who also observed the course sessions. Since there were observations conducted in all the company settings at a variety of times, it was felt that this was a strength of the observations.

4.8.2 Readability

Readability assessed by the FOG, Fry and SMOG grading scheme was evaluated at a Grade 9 level, the hand-outs were evaluated at a grade 6 - 8 level and the ergonomic checklist was evaluated at a grade 8 - 9 level. The educational level predicted by these readability formulae could be lowered by reducing the length and number of syllables of words, by reducing the number of words in each sentence (or bullet point). For example, rather than using words like "recurrence" perhaps "relapse" or "return" could be used; and instead of "interferes" perhaps the word "affects" could be used. By reducing the words and syllables, it is likely that more of the participants would be able to read the material given to them.

Overall, 11% of respondents had less than a high school education. As well, there were eight individuals who did not respond to the questionnaires because they had difficulty with English and three who preferred other languages to English, but were able to respond to the survey. These individuals may have had difficulty with the print materials given to them in the course. It is recognized that due to the content of the course, it is difficult to avoid some difficult terms. For clarity purposes, defining difficult terms using pictures and examples at the end of the hand-outs may be a good idea to increase the comprehension of course participants.

4.8.3 Focus Groups

4.8.3.1 Course Content

The course content was viewed positively by course participants. The participants particularly remembered and enjoyed the videoclips shown in the course that were tailored to job tasks within each company, course examples, practice sessions and exercises. Several suggestions for improvements of course content included adding more on the upper limb and doing a refresher course with participants to reinforce the principles learned in the course approximately six months after the course is offered. The literature has also reported anecdotal or quantitative evidence that back courses are well received. For example, Schenk et al. (1996) reported that a back school was well received from questionnaire responses of the school's relevance to work. However, no qualitative data were reported in the literature reviewed.

4.8.3.2 Course Outcomes

Quantitative data have been reported in the literature to show improvements in knowledge (e.g., Woodruff et al. 1994, Walsh and Schwartz, 1990). Changes in behaviour have shown mixed results (e.g., Daltroy et al., 1997 and Feldstein et al., 1993). However, qualitative data collection strategies to examine Back Schools to better understand how and why they may or may not be effective have not been reported in the literature. In this process evaluation, focus group participants reported increased awareness, increased knowledge and changes in behaviour. Focus group participants from one company also indicated that as a result of recommendations from course participants, some changes were made to their work equipment and environment to make it easier to make behaviour changes. Other focus group participants did not make recommendations to management about potential workplace changes due to workplace difficulties and tensions between management and front-line employees. Barriers that prevent individuals from making behaviour changes were identified by focus group participants including time, equipment and the work environment.

4.8.3.3 Themes Identified

The Demand Control Model (Karasek, 1999; Karasek & Theorell, 1990) predicts that psychological strain, injury and illness occurs when the psychological demands are high and the worker's decision latitude is low. Johnson (1986) and Johnson & Hall (1988) have expanded this model to indicate that jobs high in demands, low in control and low in social support result in the highest risks of illness and injury.

Mini themes emerging from the focus group qualitative data included concern of management, control over work and whether or not an individual was previously injured. When management concern is shown by attending the course, by making changes in the workplace to equipment or work stations and by offering the course, the course is more likely to be effective. Furthermore, when individuals feel that they have some control over environment and equipment changes or that they can influence change, it appears that the course is more likely to be effective. In this process evaluation many front line employees did not feel that they would be able to influence change to work equipment or work stations which may limit the ability of individuals to make changes to their behaviour. Finally, those who had previous back, shoulder or neck injuries reported being more interested in the course and reported making behaviour changes, more often as well.

From this examination of mini themes, the major themes of active involvement and support emerged. In order for the *Back Course* to influence participants, active involvement of management, course participants and the course instructor was shown to be important. As well, support of people including both co-workers and management were also reported to influence the behaviour of course participants.

4.8.3.4 Strengths and Limitations

The focus groups were conducted with a structured protocol and script. Established and rigorous guidelines were followed for collecting and analysing the data and verifying the results (through inter-rater checks and follow-up interviews). However, the findings are restricted by the script and the time allotted (Krueger, 1994). The sample description is limited by the

background questionnaire which was kept fairly short because of the multiple methods of data collection on this sample.

A total of eight focus groups were conducted for this evaluation which is in line with recommended guidelines (Krueger, 1994; Mertens, 1998). Conducting these eight groups were enough to achieve saturation. Saturation refers to repetitive comments and findings that emerge across the focus groups (Myers, 1999). It is believed that additional groups would not have produced different findings.

The focus group sample of 39 was limited because participants were selected by their company contacts based on their availability on the day of the focus group. Thus, focus group participants may have differed from course participants. The background characteristics of focus group participants were compared with impact questionnaire participants. This group may also be different from all course participants, however, it is difficult to know how they may differ. The proportion of males and females and those having difficulties with English was very similar to the proportion of course participants. The proportion of those with some/completed college and some/completed university was slightly higher in the focus group sample than those who completed the impact questionnaire. This may have been due to the fact that three focus groups were held with management employees (which is a greater proportion than those who participated in the course and also likely to have higher levels of education). Also there was a larger proportion who had been previously in the focus group sample than those who completed the impact questionnaire (67% compared with 58%) only.

Course participants were also selected for participation in the *Back Course* by the company contacts. It is difficult to know how representative this group may be to other potential participants of the course. Participants selected by company contacts may be generally agreeable employees or may be willing to take on extra tasks at work and generally positive in nature.

Participants in the focus groups worked together which may have impacted the focus group sessions and the results. Participants may have felt that confidentiality in the focus group was limited since anything they shared in the group may have had later consequences if someone in the group repeated something that was said. In addition, if focus group participants were friends they may have agreed with each other because of the friendship. Alternatively, if focus group participants did not get along, they may not have agreed with each other because of their previous problems.

4.8.4 Follow-up Interviews

The focus group follow-up interviews supported the findings of the focus groups. About half indicated that there may be some difficulty for those who have trouble understanding English. Suggestions for improving the course for those individuals included providing an interpreter, more demonstrations, using words that are easier to understand and showing more pictures. Approximately half also felt that adding a section on the upper limb may be a course improvement. However, most of these individuals felt that this should only be done if the course was longer or another section was added to the current course content.

4.8.5 Company Contact Interviews

The companies involved in the *Back Course* were larger than many of the other companies involved in the Waterloo Safe Communities Program. For example, the size of companies involved in the *Back Course* ranged from 15-200 with an average of 86; whereas the size of companies interviewed for the needs assessment ranged from 3 to 400 with an average of 55. These companies also had fairly well established health and safety programs in their workplaces compared. For example, all of the companies had Company contacts indicated that the low course cost and having employees who do manual handling job tasks were the main reasons that the course was offered to employees. Company contacts felt that the *Back Course* met their expectations, but did not know the course's impact in the workplace.

Chapter 5: Summary and Recommendations

5.1 Introduction

The studies described in this thesis represent steps in a systematic program evaluation process (Myers, 1999) designed to provide direction to the Executive Committee of the Waterloo Safe Communities Program about the Off-the-Job Safety Component and to the developers of the *Back Course* about the *Back and Upper Limb Injury Prevention* course. The results of each study will be discussed in relation to the other two studies. Furthermore, recommendations based on these results will be made to inform program development, program delivery and improved evaluation of this and similar interventions in the future.

5.2 Strengths and Limitations

Mixed methodology combining both quantitative (pre and post questionnaires) and qualitative methods (observation, focus groups with course participants and interviews with company contacts) was a strength of this program evaluation. Mixed methods studies use triangulation techniques (e.g., use of more than one data source to study the same phenomenon) (Tashakkori and Teddle, 1998). Triangulation across methods was incorporated into this study since both quantitative and qualitative approaches were utilized. Triangulation within methods was also incorporated into this study since observation, focus groups and interviews were utilized to conduct the process evaluation.

The companies targeted for this program evaluation were member companies of the WSCP. The WSCP is targeted to small and medium sized companies with WSIB insurance premiums of less than $90,000. Small businesses are considered hard to reach because of the

small number of employees at each site and their lack of resources (Eakin, 1992). Small businesses have also been reported to have documented higher rates of health and safety problems in their workplaces (Spiegel and Yassi, 1989). In the needs assessment, a total of 53 of 78 companies involved in the Waterloo Safe Communities Program participated. Furthermore, 44 company representatives indicated in the needs assessment that they were interested in offering a Back Course to employees. However, only seven of these 44 companies (including two hundred thirty workers from these companies) that expressed interest in an Off-the-Job Safety Program participated in the *Back Course* and its evaluation. Difficulties of delivering service to companies involved in the Waterloo Safe Communities Program are consistent with the literature that show small businesses lack the motivation to deal with health and safety issues (Eakin and Weir, 1995).

Overall, the companies involved in the Waterloo Safe Communities Program are not completely representative of other companies in the City of Waterloo of comparable size. In an evaluation of the Safe Communities Incentive Program conducted by the WSIB (1999) (including the Waterloo Safe Communities Program among other programs), businesses with fewer than 10 employees were significantly under-represented, while all larger categories were over-represented; natural resources industries were under-represented, while manufacturing industries were over-represented and involved companies had higher risk of injury than a weighted comparison group. Since companies that participated in the needs assessment and the process and outcome evaluation are also different than other companies involved in the Waterloo Safe Communities Program, the generalizability of the findings of the needs

assessment are further restricted.

The analysis of the process and outcome evaluation was completed at the level of the employee with the company being a variable included in the data analysis. Although most course participants (other than management) were involved in manual handling in their work, it is unknown whether the course participants differed from other employees in companies that did not participate in the course.

5.3 Findings

5.3.1 Knowledge

Overall, the findings of both the process and outcome evaluation indicated that respondents' knowledge increased after taking the *Back Course*. This finding is also consistent with the literature that suggests that knowledge may increase after taking back education courses (Woodruff, 1994; Schenk et al., 1996; Walsh and Schwartz, 1990; Daltroy et al., 1993).

Both the process and outcome evaluations were used to examine more details about what participants learned and what factors influenced increases in knowledge. The outcome evaluation showed that those who had higher expectations that the *Back Course* would be of use at home and work had greater increases between pre and post course knowledge quiz than those who had lower expectations. Also, respondents with higher education, with English as a first language and in a company where management provides light duties for injured workers had higher scores on the post course quiz than those with lower education, who speak a language other than English (primarily) and those who work in a company where they did not feel that management provided light duties for injured workers. In the process evaluation, focus group

participants highlighted many things that they learned and remembered from the course including learning more in general about preventing back injuries. Specifically, program participants remembered and liked the videoclips of coworkers in their work environment, practice sessions, use of demonstrations and exercises to strengthen the back.

The outcome evaluation showed that course participants had difficulties applying theoretical concepts. The process evaluation suggested ways of improving the course so that participants may be better able to apply course concepts. The results of the knowledge quiz showed that course participants had large improvement on the simple true/false questions. However, participants had difficulty completing complex analyses of risk on the videoclips even after taking the *Back Course*. These findings suggest that while knowledge increased for all subscales (including videoclips), participants had difficulties applying the knowledge they learned in the course (e.g., average post course score was still less than 60% on videoclips). Focus group participants suggested the addition of complex examples such as lifting awkward items (e.g., bag of salt) would be beneficial for applying theoretical knowledge to scenarios which are often encountered in the "real world". Also, a follow-up refresher course (suggestion was confirmed in the follow-up interviews) was suggested to summarize course concepts and discuss difficulties and potential solutions with handling materials at work and home.

The findings from the outcome evaluation of difficulties applying multiple, complex concepts were consistent with other studies reported in the literature. Chaffin et al. (1986) found that safe lifting behaviours increased for two of five principles taught in a Back Injury Prevention course, those principles that were the most simple to learn. Furthermore, Carlton

(1987) reported that there was a significant difference in safe lifting practices for course participants (compared to a control group) in a laboratory setting, but the safe lifting practices were not applied to participants' work tasks. As well, Videman et al. (1989) indicated that trained nurses scored significantly higher in skill assessment than controls, but that the patient handling skills were still rated below the midpoint of the 7-point scale. In this study, the work environment was cited as a reason that handling practices may not have changed.

5.3.2 Self-Efficacy

The findings of both the process and outcome evaluation showed that respondents had an increased confidence in ability to minimize risk of injury after taking the *Back Course*. This increase in confidence to minimize risk of back, shoulder or neck injury refers to the concept of self-efficacy (Bandura, 1977). However, self-efficacy was measured using the Spinal Function Sort which was developed initially for a disabled population (Matheson and Matheson, 1993). As a result, there were demonstrated pre course ceiling effects (by frequency histograms and negative skewness (i.e., symmetry of the distribution) values for 46 of 50 items) for self-efficacy which may have reduced the maximum change that was possible.

The outcome evaluation showed that coworker support and activity level were significant predictors of reported increases in confidence in ability to minimize risk of injury. Theoretically, self-efficacy is influenced by coworkers who provide verbal persuasion and vicarious experience for course participants (Bandura, 1977). Coworker support was also found to be significantly related to musculoskeletal disorders in an auto plant (Neumann et al., 1999) and social support was related to symptoms of the neck and shoulders in a study of health care

personnel (Ahlberg-Hulten et al., 1995). The coworker support subscale found to be a significant predictor of reports of self-efficacy is part of the Job Content Questionnaire that measures constructs of the Demand/Control/Support Model (Karasek, 1989; Karasek & Theorell, 1990; Johnson (1986); Johnson & Hall (1988)). Other subscales from the Job Content Questionnaire were not found to be significant predictors of self-efficacy in this study. The Demand/Control/Support model postulates that jobs that are high in demands, low in personal control and also low in social support (both coworker and supervisor support) at work have the highest risk of illness and injury. This model has been supported by studies that examine different health outcomes such as cardiovascular disease (Johnson et al., 1989) and musculoskeletal disorders (Bongers et al., 1993).

The process evaluation also illustrated that the support of both coworkers and management influence the self-efficacy (and behaviour) of course participants. Focus group participants indicated that support was related to control of the workplace environment. For example, if management maintained a lot of control over health and safety issues and were not perceived to listen to employees, then employees would not make recommendations to management. Employees with little personal control expressed cynicism in making behaviour changes since they felt that management was not supporting other work environmental changes.

The focus group findings delineate the importance of psychosocial aspects of work for *Back Course* participants to feel confident in their ability to minimize risk of injury. Job satisfaction may also relate to the themes of support and control that emerged from the focus groups. A number of studies have found that back courses result in improved attitudes about

work and job satisfaction (Sirles et al., 1991; Hurri, 1989; Fitzler, 1982). Findings have shown that work satisfaction is also strongly associated with symptoms of low back pain (Hurri, 1989). Furthermore, the subscales of the Demand/Control/Support Model have been shown to be associated with work dissatisfaction (Landsbergis et al., 1992). It is difficult to know how the focus group findings parallel the quantitative findings relating to job control and support, particularly since the themes that emerged from the focus groups were determined by the author who is aware of the Demand/Control/Support Model.

Active involvement of company management, course participants and the course instructor, which refers to commitment and willingness to participate in an intervention, were also perceived to influence course effectiveness in the process evaluation. Active involvement included providing opportunities for course participants to practice the theoretical concepts and to apply the concepts to videotapes of risk situations. This finding supports the concepts that self-efficacy is influenced by verbal persuasion, vicarious experience and performance accomplishments (described in 3.6.3.2.1). This theme also referred to management's active involvement in the course by participating, listening to employees' recommendations after taking the course, making environmental changes in the workplace and providing additional opportunities to learn to minimize risk of back, shoulder and neck injury. Management's active involvement may increase an employees' sense of control over their work environment, increase an employees social support and might thereby reduce risk of and illness injury.

Active involvement of management has been recommended by Wegman (1996) for the manufacturing sector. Smith (1997) has postulated that organizational support for an

intervention may increase the motivation and feelings of security in employees. However, the ways that management should be involved, informed and participate in education and other types of interventions has not be identified.

Participatory interventions refer to interventions that involve employees and employers various stages of the intervention research/evaluation in an informal or formal way (Saari, 1992). Participatory interventions have been reported to result in improved communication among stakeholders in a workplace that result in benefits beyond the intervention's control (Saari, 1992). The involvement of stakeholders may range from the initial intervention planning to the data collection, and analysis stage. The participation of all stakeholders is extremely time consuming, but may result in additional indirect benefits.

5.3.3 Behaviour

In the outcome evaluation, 68% of respondents reported doing the exercises learned in the course. Of these respondents, 20% reported doing the exercises regularly while 23% reported doing the exercises several times while 56% reported doing the exercises a few times. As well, 79% reported behaviour change at work and 75% reported behaviour change at home. However, these retrospective reports of impact must be viewed cautiously (Myers, 1999). In the focus groups, course participants suggested that they may have made behaviour changes, but they indicated that many of these changes were short term changes only. This findings is consistent with other reports in the literature that indicate that subjects revert to their old lifting practices after a short period of time (Park & Chaffin, 1974). It has been suggested that ongoing reinforcement and feedback may motivate participants to continue with their changes

in lifting practices (Komacki, 1980). In the focus groups, participants also identified barriers that prevent course participants from making behaviour changes, such as time, and management not making changes to the work environment or equipment. Videman et al. (1989) reported that even when patient handling skills were significantly higher than controls, they were still rated below the midpoint of a 7-point scale. The authors also identified an unsatisfactory ergonomic work environment as a reason for this problem.

In the exploratory analyses of the outcome evaluation which examined factors predicting whether a course participant will exercise, a high score on the exercise subscale of the post course knowledge quiz, low back pain, and disagreement with the statement that management encouraged supervisors to provide light duties to those with injuries were all significant predictors included in the final regression model. The significance of low back pain was consistent with the process evaluation finding that those who reported to have experienced back pain or injuries also indicated being more likely to complete the exercises learned in the course (also confirmed in the follow-up interviews). This may be due to a number of reasons such as increased motivation because of their injuries or that these individuals did not perform other exercises regularly.

Female gender, younger age, and expectations that the *Back Course* would teach something new were all significantly associated with participants reporting behaviour changes at work in the outcome evaluation. Furthermore, female gender, expectations that the *Back Course* would teach participants something new and expectations that the course would result in a change in the way materials are handled at home were significantly associated with reporting

behaviour changes at home. The finding that expectation is related to behaviour is consistent with self-efficacy theory that outcome expectations influence self-efficacy which in turn predicts behaviour. Female gender was shown in this study to be related to reported behaviour change at both work and home. This finding is consistent with another study that reported that females with low back pain adhered to health education messages more readily than men (Hurri, 1989). Polanyi et al. (1997) examined factors associated with workplace musculoskeletal disorders and found that women reported higher levels of symptoms than men, although the explanation for this finding was unknown.

5.3.4 Company Culture

The basic rationale for the Off-the-Job Safety component of the Waterloo Safe Communities Program was to improve the culture of safety in the workplace, increase knowledge and change safety practices at home and work. The culture of safety refers to a company's shared values, beliefs, norms and assumptions about safety issues that guide the behaviour of employees in an organization (Maniero and Tromley, 1989). However, the findings of the needs assessment showed that company contacts were interested in promoting off the job safety to employees, but were generally unwilling to pay for worker time or pay course fees unless the course was directly related to workplace safety. Thus, although the WSCP Executive Committee was prepared to offer health and safety programs to workers to improve the culture of safety in the workplace, employers in the WSCP did not see the need or have motivation to offer off-the-job safety training or programs to their workers during work time. As a result, it was not meaningful to examine whether an off-the-job safety program

changed the culture of safety in the workplace.

Changes in company climate (i.e., set of perceptions shared by workers which guide the behaviour of workers in doing job tasks (Diaz and Cabrera, 1997)) were examined in the impact questionnaire after the *Back Course* was taken and no differences were shown when compared to the pre course items and subscales. This finding is not surprising given that the *Back Course* was a four hour education program, rather than an Off-the-Job Safety program with multiple components.

5.4 Recommendations

Based on the multiple sources of data gathered for this project, recommendations are offered for other researchers attempting to conduct an evaluation of this and other health and safety education initiatives in the future. Finally, recommendations for consideration and deliberation by the developers of the *Back Course* and the Executive Committee of the Waterloo Safe Communities Program will be made.

5.4.1 Future Research

Limitations of this study and the findings that emerged from this study are helpful in making recommendations for future research. This study examined the immediate knowledge recall of participants, but it is unknown whether knowledge was retained after the course. Linton and Kamwendo (1987) also suggested long-term knowledge retention should be examined after a back course is taken, in addition to assessing behaviour changes. Future research examining this type of educational intervention should consider assessing long-term knowledge retention as an outcome.

Respondents were asked to self-report their behaviour change in this study. A future study should objectively measure behaviour change by: 1) videotaping or directly observing participants in both a clinical (laboratory) and an applied occupational setting to determine whether job design influences the behaviour or 2) asking participants to record their activities and behaviour in a diary or log. For direct observation, a checklist should be developed based on the contents of the *Back Course* to allow observers to determine if the behaviour changed from pre to post course utilizing the principles discussed in the course. In addition, in order to evaluate whether the exercises were being completed, respondents should be asked to keep an exercise log. Furthermore, effectiveness of the exercises could be examined by measuring flexibility and strength both pre and post course.

Gender was a significant predictor for behaviour change in this study, however the small sample size precluded subgroup comparisons. Stratifying by gender in future studies may help to determine the gender effects on behaviour and their interaction with reporting of injuries and pain symptoms. Furthermore, there is some evidence that workplace support is perceived differently by men and women. In one study by Ahlberg-Hulten et al. (1995) men perceived both supervisors and coworkers as less supportive than the women in the study. Social support and coworker support that differs between men and women could be explored in greater detail if a study was stratified by gender.

The *Back Course* examined in this study was delivered by an expert in biomechanics. In other courses reported in the literature physical therapists (e.g., Daltroy et al., 1997), occupational therapists (e.g., McCauley, 1990) and consultants (Chaffin et al., 1996) delivered

the back educational courses. The influence of the course instructor's background on this study can only be speculated at this time. Future research should examine the effects the instructor has on the course outcomes by stratifying by instructor's background (i.e., biomechanics, physical therapy, occupational therapy and adult education).

Injury prevention efforts must consider factors at several levels within a company–the entire organization, worksite, team, occupation and individual. However, current measurement tools, data collection and analysis in the workplace do not take into consideration the complex hierarchical levels within an organization. Literature in fields such as organizational behaviour and human resources have already developed multi-level theory and methods which will be helpful in informing intervention research. Multi-level methods are used when social processes are believed to occur at a number of different levels and are hierarchically structured (Klein et al., 1999). For example, lifting behaviour or patterns of injuries can be modelled taking into consideration variables at the organization, worksite, team, occupation and the individual level. Examining multiple levels in an educational intervention may be helpful for understanding findings that emerged from the focus groups that included coworker support, active involvement, and other psychosocial issues in the workplace.

Finally, active involvement of stakeholders could be specifically examined in a participatory intervention designed to reduce musculoskeletal disorders in the workplace. The intervention could be developed by participants based on their experience, in addition to the recommendations made by the researchers.

Pragmatic Considerations for Future Intervention Studies

In order to conduct a similar study in the future, it would be worthwhile to pre-screen companies and have eligibility criteria for companies in order for them to participate in a program evaluation. Although restricting the companies that may participate in a program and evaluation may restrict the study's generalizability, it would increase the internal validity of the results. The five criteria for company eligibility follow:

1. Company Commitment to the Course

Having assurances that management and staff associations or unions support the program offered and the evaluation study would be beneficial. The level of support and commitment could be assessed by doing presentations to management and staff associations or union executive committees. That way, hopefully those opposing the questionnaire and evaluation would be identified and the issues would be discussed prior to starting the program and the evaluation.

As discussed previously, management commitment to the *Back Course* may also include commitment to attending the course and to being open to environmental changes suggested in the workplace after taking the course. This commitment may result in management taking time to take the course and in management spending money on new equipment or work design features.

In the presentation to management, the researcher could indicate that educational changes are more effective with management support of the initiative. The researcher could stress how important their participation in the course is and the importance of being open to

potential environmental changes (to work environment and equipment). Management could be given ideas about taking action steps after the course to identify ways that the company could be made more safe for handling materials by including all company members.

2. Company Size

In order to conduct an evaluation, it is very difficult to do so in a small company for reasons of the logistics of data collection (time, distance to get to companies and the fact that not all employees can have the same time off) and difficulties making company comparisons with such small numbers. Monetary resources or other incentives provided to a company may enable them to participate fully in all aspects of the data collection. For this study, scheduling focus groups with the smallest companies was difficult and did not occur for two companies. Thus, it is recommended for an evaluation study that a company should be at least medium sized company with 50-100+ employees.

3. Company Turnover

One problem in this evaluation was turnover in some companies between pre and post course measures. This may not be surprising since many companies offered part time employment with low levels of education required. However, this is an important consideration for data collection and should be examined prior to determining the companies in which to conduct research or evaluation.

4. Time of Year

When the final companies are selected for program delivery and evaluation, the time of year should not coincide with the companies' busiest time of year. As well, scheduling data

collection on a calendar with the company contacts prior to completing the intervention may be a good idea (even if the dates change) so that they are reminded of all aspects of the data collection and are given these dates on a calendar.

5. Language Issues

Language issues should be dealt with prior to offering the *Back Course*. In this particular study, the language issue was identified prior to data collection, but the course was not adapted as a result of the concern. If language is identified as a difficulty in the companies then the program and the evaluation materials need to be revised accordingly. Furthermore, if the program and the evaluation materials are not revised then these companies should be restricted from participating in both the program and the evaluation.

5.4.2 *Back and Upper Limb Injury Prevention Course*

The first set of recommendations addresses modifications to improve delivery of the existing program. The second set of recommendations presents new initiatives to complement the existing program offered.

5.4.2.1 Recommendations for Existing Course

Continue to Include the Knowledge Quiz before and after taking the course

In order to be sure that the course results in the same impacts in knowledge as found in this study, it is recommended that the knowledge quiz continue to be administered to course participants both before and after taking the course. The results of this study may not be generalizable to offerings of the course without the pre course knowledge quiz.

Reduce the Grade Level Required to Read Take Home Materials and Overheads

Although there were increases in knowledge across all subscales and companies, reducing the grade level required to read the take home hand-outs and overheads to a grade six reading level may be helpful for some course participants, particularly those from companies with little education required for jobs and those with poor English language skills. In this study, 11% of respondents had less than a high school level of education making the course materials difficult for them to understand. It is likely that many of those who did not complete the questionnaires also had difficulties with the comprehension of course materials. The revised course materials could be examined using readability formula initially, and then examined by asking workers to review the materials and indicate where they have difficulty with comprehension.

The focus group participants indicated that some people had difficulty understanding a majority of the course. This could account for differences the observer saw between companies in the participants' interactivity and perceived interest in the course. The following suggestions are based on participant feedback to enhance the Back Course when offered to similar companies involved in this evaluation:

- reduce the grade level on hand-outs by using words with fewer syllables, fewer letters and simpler concepts
- have simple pictures in addition to overheads to help those with poor English skills to understand course concepts
- have a translator present during the course to translate difficult sections of the course to course participants

Ensure the Room is Adequate in Size and the Room Set-up is Appropriate

By being extremely flexible in offering the *Back Course* where employers wanted it, the course delivery occurred in classroom environments that were too small. The small class size inhibited class interaction. For example, in one particular location, participants were required to do the practice sessions and exercises in shifts because of the size of the room. As well, not having a place for participants to write or move made it uncomfortable to do examples and to have an interactive course with ease.

Thus, it is suggested that:

> •Prior to offering the *Back Course* in a certain location, the room should be examined (as it was). Locations that are not appropriate because of their small size should be ruled out. Rather than trying to be accommodating to the needs of the company, the company should be informed that offering a course in such a location may compromise its effectiveness.

Encourage Active Involvement and Support of Management for Course Effectiveness

Active involvement of management in the *Back Course* should be strongly encouraged. A consistent theme across focus groups and questions asked was the importance of active involvement by all stakeholders for course effectiveness. Active involvement means that the course would be more effective if management attended the course, asked employees for recommendations of their work environment and committed to making environmental changes in the workplace.

Another consistent theme across focus groups and questions was the importance of management support for course effectiveness. The theme of support suggests that the course would be more effective if management provided an environment that workers would feel

comfortable making recommendations about environmental changes. Specifically management should be encouraged to:

- attend the *Back Course* to show their support and interest in the offering the initiative to employees
- provide an environment that would allow workers to feel comfortable making recommendations about changes in the workplace
- make changes to the work environment to show commitment to reducing back injuries in the workplace

Some additional recommendations made by course participants included:

- playing music during the exercises;
- giving participants a reference list so that they can find additional information if interested;
- having examples that are awkward to lift (e.g., bag of salt) adding a section on sitting on a forklift (because it vibrates) and its affects on the back;
- videotaping the practice sessions so that course participants could see what looked like when they lifted in comparison to others in the group;
- including some information on which health professionals to visit if an injury did occur (i.e., what a chiropractor does compared to a massage therapist and a physiotherapist).

5.4.2.2 Complementary Courses

Courses that may complement the *Back Course* are suggested in order to provide additional service to companies who may be interested in educating their employees.

Consider a Refresher Course for Course Participants

Many focus group participants suggested that a refresher course should be offered to remind participants about the *Back Course content* and the practice of handling materials at work. There were different ideas about the content of such a course. For example, suggestions included: 1) a review of the biomechanical principles and an opportunity to discuss difficulties handling material on the job; 2) demonstration of the use of new equipment; and 3) practice lifting awkward items such as lifting a bag of salt.

Consider an Additional Course about the Upper Limb

Many participants felt that the course content was primarily related to the back with a very short amount of content dedicated to the upper limb. Course participants thought that adding another module to the course on the upper limb would help to reinforce the principles learned in the course, but also provide some new information to participants. Some felt that the content of upper limb may be even more relevant to their work.

Train-the-Trainer Approach for the Course

Training employees to train others may be more helpful in diffusing information throughout a company. This approach would provide comprehensive training for some members of a company. These individuals would then teach other employees what they learned. Companies with employees who have difficulties speaking English may have more success with coworkers who train those with language difficulties than an instructor (coworkers may already need to communicate at work). If the train-the-trainer approach is developed for this course, the impact of the course should be evaluated and compared to the traditional approach to teaching employees.

5.4.3 Waterloo Safe Communities Program

The interviews conducted with company contacts resulted in some ideas for improvements to the Waterloo Safe Communities Program. There are three primary suggestions as follows.

Better Communication to Participating Companies

Communication includes promotion of events such as networking, meetings and courses in addition to providing information to companies about others in the program for additional networking opportunities. The company contacts felt that the communication was often too late to make arrangements to attend functions. They felt that they should be given several weeks notice for meetings and many weeks notice to be able to participate (or to send employees to) in courses.

Offer A Wide Variety of Health and Safety Programs

Participating companies appreciated being given information about health and safety courses even if they were charged money to attend the courses. They wanted an increased variety of course offerings to be sent to them so that they (and their employees) could participate in even more health and safety activities.

Provide Opportunities for Employers to Network with other Participating Companies

One of the primary reasons that many of the companies took part in the *Back Course* was to talk to other companies in a similar situation and to learn from them. These company contacts wanted more opportunities to talk to other company contacts about health and safety. They felt that the required Safe Communities Incentive Program gave them time to meet others from different companies and wanted a chance to develop the relationships developed at the 16 hour course more fully.

5.5 Concluding Remarks and Future Research

The needs assessment, process and outcome evaluation were designed to be exploratory in nature. The findings from the needs assessment influenced the choice of the *Back Course* that was evaluated in the process and outcome evaluation. Further evaluation involving the *Back Course* is warranted after considering and taking action on suggestions for course improvements. Through the process of continuous evaluation and subsequent program modifications, the workplace and the programs that are offered in it will take strides in reaching their safety goals to help prevent injuries and provide high quality programs for employees.

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Appendix A
Sample List of Courses for an Off-the-Job Safety Component

Recreational Safety
Delivered By: Dr. Robert Lee, Waterloo Sports Medicine Centre
Timeframe: 1-2 hours
Format: interactive talk and slide show

Fire Safety
Delivered By: Waterloo Fire Department
Timeframe: 1-2 hours
Format: interactive talk

Fire Extinguisher Safety
Delivered By: Waterloo Fire Department
Timeframe: 1-2 hours
Format: interactive talk and practice

Car Seat Safety
Delivered By: Infant Toddler Safety Association
Timeframe: 1 hour
Format: one-on-one car seat safety check and talk

First Aid
Delivered By: St. John Ambulance or Canadian Red Cross
Timeframe: 7 hours (Emergency First Aid), 13 hours (Standard First Aid)
Format: interactive course
Cost: $47, $67 respectively

Bike Safety
Delivered By: Certified CAN BIKE Instructors
Target: Children 8-13 years old
Timeframe: 90 minutes
Format: one certified instructor per 8 cyclists, key bike handling skills

Preventive Back Care
Delivered By: Kinesiologist
Timeframe: 4 hours
Cost: $5
Format: interactive course with practice sessions

Stress Management
Delivered By: Corporate Trainer
Timeframe: 1 - 1.5 hours
Cost: Undetermined
Format: interactive course with short relaxation component

Appendix B
Needs Assessment Survey

Possible Topics of Interest to Companies for Off-the-Job Safety Program

Name of Company:

_____

Contact Person:

_____

How many employees do you have?

_____

Please check the topics of interest to your company:

- ☐ Preventive Back Care
- ☐ Personal Protective Safety (example, hearing and sight)
- ☐ Recreational Safety
- ☐ First Aid
- ☐ Use of Disposal of Solvents/Paints
- ☐ Sun Sense
- ☐ Slips and Falls
- ☐ Upper Limb Repetitive Strain Injury
- ☐ Exercise Programs
- ☐ General Nutrition
- ☐ Caregiver Support (example, caring for elderly relatives)
- ☐ Eating Disorders (example, anorexia)
- ☐ Stress Management
- ☐ Ladder Safety
- ☐ Hazardous Chemicals in the Home
- ☐ Child Safety
- ☐ Smoking Cessation
- ☐ CPR
- ☐ Electrical Safety
- ☐ Fire Safety
- ☐ Other: please specify:

_____

_____

_____

Please check topics that your company would have the expertise to offer programs for participating companies:

- ☐ Preventive Back Care
- ☐ Personal Protective Safety (example, hearing and sight)
- ☐ Recreational Safety
- ☐ First Aid
- ☐ Use of Disposal of Solvents/Paints
- ☐ Sun Sense
- ☐ Slips and Falls
- ☐ Upper Limb Repetitive Strain Injury
- ☐ Exercise Programs
- ☐ General Nutrition
- ☐ Caregiver Support (example, caring for elderly relatives)
- ☐ Eating Disorders (example, anorexia)
- ☐ Natural Gas & Propane Tank Safety
- ☐ Mechanical Safety (moving parts) (example, snowblowers, lawnmowers)
- ☐ Stress Management
- ☐ Ladder Safety
- ☐ Hazardous Chemicals in the Home
- ☐ Child Safety
- ☐ Smoking Cessation
- ☐ CPR
- ☐ Electrical Safety
- ☐ Fire Safety
- ☐ Other: please specify:

_____

_____

_____

Thanks for completing this form!

Questions: Contact: JenniferYessis
University of Waterloo, Health Studies and Gerontology
(888-4567 Ext. 6018, or 886-2686)

Appendix C
Needs Assessment Interview Guide

I am interviewing you today to ask you what types of off-the-job programs you would be willing to offer to your employees. You can decline to answer any questions that you choose. Your participation in this interview is totally voluntary and in no way will affect the services you receive from the Waterloo Safe Communities Program or may receive in the future. No one individual or company will be identified in the results.

Company Contact Initial Interview

General Company Information

Survey for contact person:

General Information:

1. Name of company

_____

2. What is the address?

_____

_____

_____

3. What is the phone number

_____

4. What is the type of business?

_____

_____

5. What is the type of ownership of your company?
    1. Family, individually owned enterprise or partnership
    2. A corporate enterprise: shares closely held
    3. A corporate enterprise: shares widely held
    4. Subsidiary of a larger corporation
    5. A franchise

5. What is the type of industry?

_____
_____
_____

6. What is the average number of employees who work in the company?

_____

7. Do you have a union?

1) Yes
2) No

8. How do you currently train employees for Off-the-Job safety?

_____
_____
_____

9. From the initial survey, I received from you, you indicated that you were interested in the following topics (read from survey)_____.

i) Would you be willing to offer employees paid time to take these courses?

_____
_____
_____

ii) Would you be willing to pay the fee for employees to take these courses?

_____
_____
_____

iii) What would you be willing to pay for these courses? ($5, $10, $25, $50, $150)

_____
_____
_____

iv) Would you be willing to advertise or promote these programs?

v) Would you suggest that employees take these types of courses on their own time?

10. What time of year works best to offer programs to your company?

11. What time of day works best for programs?

12. Would you be willing to take part in an evaluation of these programs that might include focus groups, interviews and questionnaires?

13. How do you currently train employees for Off-the-Job safety?

Appendix D
Summary of Relevant Published Studies

Table 1

Study (Reference)	Purpose, Design	Population	Dependent Variables	Independent Variables	Course Description	Time Frame
Design: post test only						
Carlton, 1987	**Purpose** - To evaluate an educational program to change behaviour. **Design** - post test with control	n=15 intervention n=15 control	-Performance of safe body mechanics on new task -Performance of safe body mechanics at work	Body Mechanic Training	-1 hour body mechanics course -content: high risk work style factors, maintain a straight back and bend the hips and knees during the lifting and lowering of objects -A visual aid, Jack-the-Back was used to facilitate a basic understanding of structure as it relates to function -Each subject received feedback (from others in course and the instructor) while being videotaped	2 weeks follow-up
Schenk, Doran, Stachura, 1996	**Purpose** - To evaluate the impact of a back education program. **Design** - post test with control	randomly assigned, 3 were assigned to back school group n=74 back school group n=64 video group n=67 control group	-lifting posture measured by lumbar lordosis using ruler -knowledge score -attitude questions	-back school -video program of back school -no education	i) 2-hour education through back school which included practice and feedback on correct technique ii) 2-hour video presentation of same instructor	immedia te post test
Woodruff, Conway, Bradway, 1994	**Purpose** - To evaluate a back program on changing knowledge among recruits **Design** - post test with control	n=3,431 male recruits aged 17-35 years - intervention group n=1,658 control group	-Back Knowledge -Nutrition Knowledge	-Intervention -demographics	-slide presentation & handbook -postural curves of body -anatomy of the spine -exercises and behaviours to protect the back	immedia te post

Study (Reference)	Purpose, Design	Population	Dependent Variables	Independent Variables	Course Description	Time Frame
Design: pre/post test						
Chaffin, Gailay, Woolley and Kuclemba, 1986	**Purpose** - To evaluate lift training in terms of behaviour change using video analysis method **Design** - pre/post test	N=33 workers in a warehouse	Safe lifting techniques as outlined in developed checklist	-Lift Training	-Pro-Back program from Visucom Productions Incorporated (4 hours in length) -were taught 5 principles: get as close to load as possible, keep the torso as erect as possible, don't lift and twist the torso, lift smoothly-don't jerk the load, get a good grip on the object, clear work area	3 months
Fitzler, 1982	**Purpose** - To reduce injury claims **Design** - pre/post test	All workers at the company	-Cost -Lost Time	-Intervention	-Education in addition to management program (eliminate unnecessary lifting, reduce workplace hazards) -Education is one-to-one basis -Spinal anatomy, physiology, treatment regimen, posture, exercises -Treatment for back pain	Plan for 1 year
Fitzler, 1983	**Purpose** - To reduce injury claims **Design** - pre/post test	All workers at the company	-Cost -Lost Time	-Intervention	-Education in addition to management program (eliminate unnecessary lifting, reduce workplace hazards) -Education is one-to-one basis -Spinal anatomy, physiology, treatment regimen, posture, exercises -Treatment for pain	1 year follow-up

Study (Reference)	Purpose, Design	Population	Dependent Variables	Independent Variables	Course Description	Time Frame
Lepore et al., 1983	**Purpose** -To reduce lost time and costs after the intervention. (education and supervisor accounting) **Design** - pre/post test	N=1000	-Cost -Lost time	-Intervention	-Back injury prevention training -Supervisor accident reporting system -Follow-up course after 7 months	1.5 years
Wickstrom, Hyytiainen, Laine, Pentti, Selonen, 1993	**Purpose** - To determine if a safety program with education and participatory ergonomics reduces illness at work. **Design** - pre/post test	Sheet metal workers in a manufacturing plant	-Absenteeism -Sick leave -Biomechanical work load	-Demographics -Intervention	Presentation of the biomechanics of the lumbar spine incorporated into training provided for foremen and the safety representatives of the employees -instruction of back fitness occurred as well for 2 sessions	7 years
Wollenberg, 1989	**Purpose** - To evaluate 3 different back injury prevention programs. **Design** - pre/post test	n=58 in 4 different industries -Back education and mandatory exercise -Back education and exercise -Back education and exercise demonstration	-Body mechanic performance	-1 of 3 different intervention courses	A-1.5 hours of information and exercise instruction + 10 min. daily exercise requirement B-1 hour required classes of information and exercise with no follow-up C-1 hour of information and exercise demonstration only	3 months
Design: **Non-Randomized Control Trial**						

Study (Reference)	Purpose, Design	Population	Dependent Variables	Independent Variables	Course Description	Time Frame
Engels, Brandsma, van der Gulden, 1997	**Purpose** - To evaluate an ergonomics educational course using a developed check-list -To evaluate the use of the developed check-list for the purposes of examining ergonomic errors in standardized nursing tasks. **Design** - pre/post test with control	All nurses from same nursing home. 12 nurses - intervention (2 nurses from every intervention ward were selected) 12 nurses - control group	-Number and percentage of harmful postures -Ergonomic and biomechanical errors -inter and intra-observer reliability for the check list	-ergonomic educational course -check list developed for this study	-taught safe practice and ergonomic awareness taught in 10 sessions (length was not indicated) -nurses trained to work with proposed ergonomic improvements and guidelines -train-the-trainer approach (they were to teach other nurses)	15 months
Engels, van der Gulden, Senden et al., 1998	**Purpose** - To evaluate an ergonomic educational courses for nurses **Design** - pre/post test with control	All nurses from same nursing home. 12 nurses - intervention (2 nurses from every intervention ward were selected) 12 nurses - control group	-Number and percentage of harmful postures -Ergonomic and biomechanical errors -Perceived physical exertion	Ergonomic educational course	-taught safe practice and ergonomic awareness taught in 10 sessions -nurses trained to work with proposed ergonomic improvements and guidelines -train-the-trainer approach (they were to teach other nurses)	15 months

Study (Reference)	Purpose, Design	Population	Dependent Variables	Independent Variables	Course Description	Time Frame
Feldstein, Valanis, Vollmer et al., 1993	**Purpose** - To evaluate an educational program called the "Back Attack" **Design** -pre/post test with control	Intervention group (n=30) - from one medical centre Control group (n=25) - from another medical centre -participation rate 59% despite the course being offered during paid time	-Flexibility -Proprioception (4 tests) -Evaluation of patient transfer	Educational course -education, job title, height, weight, previous history of back fatigue, pain and injury	-course based on focus group sessions with nurses -educational sessions were offered in a single 2 hour session (extra nurses covered the patient care while nurses attended sessions) -instruction on body mechanics, techniques for patient transfer, one-on-one assistance, reinforcement on the proper use of equipment to help with transfers and a problem identification session on environmental hazards -also 8 hours of practical time on units over a 2 week period (assistance & feedback)	1 month follow-up
Mantle et al., 1981	**Purpose** -To determine whether back care advice given to early in pregancy can reduce back pain. **Design** - pre/post test with control	N=85 (pregnant women)	-incidence and severity of low back pain	-Intervention	-Back education: care related to individual's job, information about back pain and relief of it, instructions for handling materials. -Two sessions with 6 per class	9 - 10 months

Study (Reference)	Purpose, Design	Population	Dependent Variables	Independent Variables	Course Description	Time Frame
Versloot, Rozeman, van Son, Akkerveeken 1992	**Purpose** - To evaluate the cost effectiveness of a back school program in industry, and to evaluate the effect of back school on incidence and length of absenteeism **Design** - pre/post test with control	Bus drivers from a Dutch bus company n=200 intervention n=200 control	Absenteeism rate Cost	Back school	-3 session (1-3 hours, 2-1.5 hours, 3-1.5 hours) -Session 1: motivation, responsibility for one's own health, and mind-body interactions in relation to injury -Session 2: stress, coping strategies and relaxation training -Session 3: body mechanics including sports, working posture, and seat adjustment -only session 1 mandatory	6 years
Videman, Rauhala, Lindstrom, Cedercreutz, Kamppi, Tola, Troup 1989	**Purpose** - To evaluate a back education program on patient handling skills **Design** - pre/post test with control	N=98 intervention N=111 control group	-anthropometric and strength tests -psychometric tests back pain, free time activity -skill assessment videotaped	-intervention	-40 hours of classroom training covering lifting techniques for patient transfers -course included practical/theoretical over 2.5 years in duration -control received some, but not as much training as intervention group	2.5 years

Study (Reference)	Purpose, Design	Population	Dependent Variables	Independent Variables	Course Description	Time Frame
Weber, Cedraschi, Roux, Kissling, Von Kanel & Dalvit, 1996	**Purpose** - To evaluate who volunteers for back programmes and the programme's impact on back pain and health consequences **Design** - pre/post with matched control group (for age, gender, professional status, back pain and nationality)	n=772 who registered for course were part of intervention group n=593 control group	-Back pain -Number of doctor's visits, drug intake and sick leave during last 6 months	-Intervention -Demographics	- back school consisted of 8 weekly lessons of 90 minutes each -small groups (7-12) -instructor: physiotherapist -epidemiology, anatomy, biomechanics, diagnostic tools, pain concepts, psychological, stress management, ergonomics, workplace evaluation, muscle physiology, strength, fitness, sport activities and self-care -home and work focus	8 months follow-up
Wood, 1987	**Purpose** - To evaluate a feedback-oriented educational program **Design** - pre/post with control	No numbers described -3 units -Glengarry/Chandler - intervention -Fairfield - control	-Number of wage loss claims filed by nurses for back injuries caused by interaction with residents	-Intervention or control -Personnel program (budget for lost time claims transferred to personnel director)	-feedback on correct techniques was the critical factor rather than formal classes on new material -physiotherapist met with nursing staff in small groups and evaluated the ability to perform safely a single person transfer and 2-person lift -30 minute observations of each staff member -1 hour classroom demonstration: body mechanics, lift and transfer techniques, use of equipment	2 years
Design: **Randomized Control Trial**						

Study (Reference)	Purpose, Design	Population	Dependent Variables	Independent Variables	Course Description	Time Frame
Daltroy, Iversen, Larson, Ryan, Zwerling, Fossel et al., 1993	**Purpose** - To evaluate an educational program to prevent low back injury for effects on knowledge, attitudes and behaviours **Design** - Randomized Control Trial	4000 postal workers Unit of analysis - work unit,34 into 17 pairs Randomly assigned 1 work unit to receive training and other control	-Knowledge -Perceived helping and reinforcement by coworkers and supervisors -Attitudes -Frequency of stress -history of back injury -job satisfaction	-Intervention: course or control group and participation in reinforcement sessions -year of training, craft, gender, age, years employed by the postal service	-2-90 minute sessions -12 workers, supervisors per class -Lecture, discussion, film and slides, pamphlets, demonstration and practice -Content: safe lifting and handling, posture, pain management, stretching & strengthening exercises, group discussion of barriers to implementation, on-site work ergonomic analysis	2.5 years Septemb er 1985-Septemb er 1990
Daltroy, Iversen, Larson, Lew, Wright, Ryan et al., 1997	**Purpose** - To evaluate an educational program to prevent low back injury **Design** - Randomized Control Trial	4000 postal workers Unit of analysis - work unit, 34 into 17 pairs Randomly assigned 1 work unit to receive training and other control	-Occurrence of Back Injury, its cause and cost -Time off from Work -Musculoskeletal Injuries	-Intervention: course or control group -Sex, Age, Duration of employment, work unit, shift, hours worked	-2-90 minute sessions 12 workers, supervisors per class -Lecture, discussion, film and slides, pamphlets, demonstration and practice -Content: safe lifting and handling, posture, pain management, stretching & strengthening exercises, group discussion of barriers to implementation, on-site work ergonomic analysis	5 years Septemb er 1985-Septemb er 1990

Study (Reference)	Purpose, Design	Population	Dependent Variables	Independent Variables	Course Description	Time Frame
McCauley, 1990	**Purpose** - To evaluate the effect of on-the-job body mechanics instruction on work performance of young workers **Design** - Randomized Control Trial	n=30 new workers n=15 for intervention n=15 for control ages 14-19 years	-Body Mechanics Evaluation: lifting and lowering, pulling an object, transferring an object through lateral movement at waist level	-training: back school for intervention group or general safety training for control group	-experimental group received 1 hour of back school training provided by an occupational therapist -learned about anatomy of the spine, orientation to principles of reducing mechanical stress to the spine and 15 minutes of job specific instruction one-on-one -control group received 1 hour of safety training provided by worker's compensation insurance company	4 weeks
Shi, 1993	**Purpose** - To evaluate a back injury prevention program **Design** - Randomized Control Trial	6 divisions selected because of high prevalence of injury n=4 divisions of the county government randomly selected as the intervention group n=2 divisions randomly selected as the control group	-costs of program compared with benefits obtained -benefits included: participants' satisfaction and risk reduction, and reductions in workers' compensation and medical claims and sick day costs related to back injuries	-injury prevention program to intervention group	-Intervention: education, training, physical fitness and ergonomic improvement -Education: fitness, reduction of backache, weight control, stress management, smoking cessation, cholesterol reduction, nutrition and interpersonal communication -3 back safety training sessions focused on body mechanics, hazardous tasks, injury prevention methods and strength building -fitness emphasized -recommendations on ergonomics by experts to make safety equipment more available	1 year

Study (Reference)	Purpose, Design	Population	Dependent Variables	Independent Variables	Course Description	Time Frame
Walsh and Schwartz (1990)	**Purpose** - To evaluate a multimodal intervention and the adverse effects of using a lumbosacral corset in the workplace **Design** - Randomized Control Trial	Warehouse Workers 3 groups randomly assigned n=30 Lumbar Supports n=30 Educational Program n=30 Control	Knowledge of back pain Absenteeism in days (lost time) Productivity Abdominal Strength	Body mechanic training Body mechanic training plus orthosis	-Education - 1 hour educational program stressing proper lifting techniques -Lumbar Supports	6 month follow-up

Table 2

Study (Reference)	Measures	Procedure	Findings	Implications	Limitations	Future Areas of Research
Design: post test only						
Carlton, 1987	-WEST 2 Work Capacity Evaluation Device as the novel task -WEST 2 Body Mechanics Evaluation (designed to evaluate body mechanics during lifting and lowering of weight trays) -Work-Related Body Mechanics Evaluation	-1 month before: pilot study to ensure validity of the modified WEST 2 checklist -experimental group received course -2 weeks later all subjects asked to attend a 20 minute body mechanics evaluation -1 week later, subjects observed in work environment-food service kitchen	-Significant improvement in safe lifting on new task in laboratory -No significant difference on performance of safe lifting at work	-although subjects performed better in laboratory, they did not perform better at work which may have been due to the job pace requirements -work environment may have made it changes at work difficult (changes may not have been possible)	-small sample size	-increase sample size to determine whether changes will occur
Schenk, Doran, Stachura, 1996	-12 item cognitive test -10 item affective measure -measured lumbar lordosis	-received course -psychomotor data collected immediately after course -all participants completed pencil and paper tests	-subjects in back school showed significant differences in techniques compared to video and control groups -video group did not differ from control group on knowledge and lifting -significant differences in affect among groups	-interactions with course instructor are very important to success of a course	-did not conduct baseline assessments -only examined immediately post course which may only get immediate change	-conduct baseline assessment especially for lumbar lordosis -longer follow-up period

Study (Reference)	Measures	Procedure	Findings	Implications	Limitations	Future Areas of Research
Woodruff, Conway, Bradway, 1994	-Demographics -Health -History of back problems -Knowledge items -Nutrition items	-Healthy Back intervention administered during July 1991 -immediately after a brief questionnaire administered -controls completed questionnaires without intervention	-significant difference between intervention and control groups for Back Knowledge (intervention group with significantly higher score)	-short term knowledge increased -perhaps this affected behaviour too	-no pre-test assessment	-conduct pre-test assessment
Design: pre/post test						
Chaffin, Gailay, Woolley and Kuclemba, 1986	-Background survey of workers (amount of time on job, education, etc) -Data collection checklist for videotaping asking about 5 principles discussed in course	-analyst selected a worker, videotaped the worker -analyst attempted to obtain an unobstructed sagittal plane view of the worker while lifting -videos viewed immediately and data recorded on data sheet -videotaping after course was from 35-51 days after the training session	-increased safe lifting behaviours on two of the five principles - the prevalence of jerking the loads reduced from 21% to 2% of lifts and the prevalence of inadequate gripping of the objects reduced from 11% to 1% after training -showed a decrease in twisting (but not statistically significant) -may have been ceiling effects for keeping load close to the body before the course	-the type of lifting behaviours most likely to be changed are the ones that are simple to learn -difficult to make some changes without environmental change	-limited number of subjects -data collected were simple and limited in scope	-was there a change in knowledge as well as a change in some behaviours
Fitzler, 1982	-Number of back injuries -Work population -Lost time -medical costs	-implemented a program -examined the change in costs and injuries after program in operation	-average number of lost days dropped 53.3% -compensation cost per claim 75% reduced -medical costs reduced by 68% -total costs per claim reduced by 74.8%	-programs being offered are believed to have an impact. Thus, money will continue to be spent on these programs	-no measurement of program implementation or process -was the program reaching the people	-difficult to know what cause the change: the education or the management program

Study (Reference)	Measures	Procedure	Findings	Implications	Limitations	Future Areas of Research
Fitzler, 1983	-Number of back injuries -Work population -Lost time -medical costs	-implemented a program -examined the change in costs and injuries after program in operation	-increased rate of incident reporting -50% reduction in frequency rate of lost time -worker's compensation costs reduced by factor of 10	-programs being offered are believed to have an impact. Thus, money will continue to be spent on these programs	-no measurement of program implementation or process -was the program reaching the people	-difficult to know what cause the change: the education or the management program
Lepore et al., 1983	-Injury costs per year -Back claim costs per year -Back injury frequency	-Injury statistics gathered -Course developed -Management training -Back course (1 hour) -6 months later statistics gathered -7 months after training refresher course offered -statistics examined 4 months after that	-average annual costs for back injury 67.5% reduced -funds extended reduced by 57% -savings of $65,569 -lost time injuries reduced by 71%	-program is believed to be efficacious -will continue to be offered to save money	-no measure of program implementation or process	-unable to determine which program caused the change the management change or the education
Wickstrom, Hyytiainen, Laine, Pentti, Selonen, 1993	Sick leave	Pre test before beginning of program. Intervention included intervention sessions about back care and ergonomics and included employees in ergonomic program. Post test following intervention.	Reduction in average sick leave from 3.2 to 1.9 per person-year.	A multi-component ergonomic intervention can reduce sick-leave and therefore costs for a company.	Sick leave is a "leap of faith" from musculoskeletal disorders.	Obtain a self-report of musculoskeletal disorder to correlate with the sick leave variable.

Study (Reference)	Measures	Procedure	Findings	Implications	Limitations	Future Areas of Research
Wollenberg, 1989	-Body mechanics questionnaire	-Subjects recruited -Participated in 1 of 3 different courses -1 week and 3 month follow-up	-Back education and exercise with mandatory exercise showed 12.9% increase in body mechanics scores -Back education and exercise instruction group showed 5.1% increase in scores -Back education and exercise group demo. 13.3% increase	-reinforcement can influence behaviour -demonstration may be as effective as mandatory instruction and exercises	-difficult to know why there were differences between group since the demographics and injury history differed by group as well	-does program input into a program increase compliance
Design: Non-Randomized Control Trial						
Engels, Brandsma, van der Gulden, 1997	-Intra and inter observer reliability -Number and percentage of harmful postures -Number and percentage of ergonomic errors	**Check List Development** -defined by experts & literature -errors were classified under 5 headings **Observation** -all participants performed a number of tasks -Tasks were videotaped with the same recorder -Check lists were recorded for five recordings by one observer two different times (3 weeks between) and another observer evaluated the tapes on the same videotapes for inter-observer reliability	-Inter and intra observer reliability were 92% with k of 0.84 and 93% with k of 0.86 -the mean number and percentage of errors was significantly reduced in nurses after training -for each specific task, the mean percentages of errors decrease over all three observations -the differences between groups were even greater after 15 months	-it is possible to create a reliable check-list to examine the ergonomic errors of nurses -trainees tend to make fewer errors than controls which indicates that the educational course has value	-Recorded tasks were limited -nurses were conscious they were being videotaped (but controls were not better at each assessment so this may not have influenced results) (performance bias) -trainees may have been more keen than controls (baseline differences between groups too)	-study behavioural effects in daily routine to see if they change as a result of the educational intervention

Study (Reference)	Measures	Procedure	Findings	Implications	Limitations	Future Areas of Research
Engels, van der Gulden, Senden et al., 1998	-Perceived exertion (using the Borg CR-10 scale) -Errors against biomechanical and ergonomic principles scored using a checklist developed for this study -number and percentage of harmful postures	-Tasks were videotaped with the same recorder -Camera to subject distance was 4.5 m. -videotapes were edited, observed in random order to blind the observer to the trainee or control status of the nurse -measures taken 2 weeks prior to course, 3 months after then 15 months afterwards	-Trainees showed a significant improvement in the number and percentage of harmful postures and errors, but controls did not -The change in postures and errors did not result in a change in perceived physical exertion -Trainees required more time for their tasks than controls (particularly spent lifting because they were more likely to use a lifting device)	-the course was successful in teaching nurses manual handling skills, however under time constraints it is unknown whether they would continue to work safely	-Trainees selected on basis of enthusiasm for working safely and on the basis of their own knowledge and skills -Thus, the trainees may have been more eager than control -videotaping reducing 3-D view to 2 dimensions	-investigate changes made at work on a regular basis, not only when being videotaped performing a number of tasks
Feldstein, Valanis, Vollmer et al., 1993	-Initial history. -Back Pain Questionnaire over one month -Transfer Evaluation - quantification of the employee performance -Flexibility assessed -Proprioception (4 tests) (walking a straight line, a deep knee bend, balancing right foot with eyes closed, and on left foot)	-participants completed questionnaire prior to intervention and then one month later -a research assistant who was blinded to control and intervention groups answered questions during questionnaire administration, and conducted flexibility tests -transfer evaluation performed by a blinded trained nurse observer	-Intervention and control groups did not vary with respect to baseline characteristics -significant difference in the flexibility of those participants who reported back injury compared to those who did not -controlling for task and level of patient dependency the intervention group had a 19% improvement in their total score for quality of patient transfer, 26% improvement for actual transfer	-low participation so there may be barriers to getting nurses to participate –high levels of back fatigue and pain in nursing staff -BMI related to pain -course appears to be effective in improving behaviour in short term	-nurses were not randomly assigned to intervention because of the environmental assessment that impacts all employees	-study reasons for low participation and ways to improve participation -evaluate program with longer follow-up and more participants
Mantle et al., 1981	-Back pain -Pregnancy outcome -Weeks of pregnancy	-Participants randomly allocated to treat/no treat -Treat: 2 informal sessions on back care -Follow-up: just after delivery	-significant decrease in pain -reduced incidence in low back pain	-important to do trial when the program has been examined to	-lack of process evaluation -many people in "treat" group did not attend session	-process and outcome evaluation again

Study (Reference)	Measures	Procedure	Findings	Implications	Limitations	Future Areas of Research
Versloot, Rozeman, van Son, Akkerveeke n 1992	-per employee, number of days of absenteeism per incidence (2 years prior to training, 2 years during training, 2 years after training) - short absenteeism (1-8 days), intermediate absenteeism (8-43 days), long absenteeism (> 42 days)	-costs of program compared to savings by decrease in absenteeism -hidden costs of absenteeism caused by loss of production, hiring extra personnel and errors due to inexperienced personnel not taken into account -costs of total training per employee considered + costs of wages due to lost working hours considered	-Significant decrease in absenteeism in experimental group -Annual savings of $900 per employee -incidence of absenteeism did not change -change in absenteeism for experimental group was 6.5 days per year compared to control group -change in absenteeism for experimental group only was $700 per employee -reduction in personnel costs to company were between $70,000 and $103,400	-Back course appears to result in annual savings per employee	-did not differentiate absenteeism data for causes -bus drivers were different by group (control group seemed to have a less strenuous job than intervention) -contamination of intervention to control group may have occurred	-distinguish between injury and illness when examining absenteeism
Videman, Rauhala, Lindstrom, Cedercreutz , Kamppi, Tola, Troup 1989	-Anthropometric Tests -Strength Tests (abdominal, back) -Psychometric Tests -Prevalence, severity, disability, onset of back pain, free time activity, self-assessment of physical work-load -Skill assessment via videotape	-Tests were conducted prior to entering nursing program -the 40 hour course took place over 2.5 years -Tests were conducted after the nursing program was completed	-trained nurses scored significantly higher in skill assessment than the controls -the patient-handling skills were still rated below the midpoint of the 7-point scale -anthropometric and strength tests had little or no predictive value for back pain or injury -major risk factors for injury were poor patient-handling skill, low numbers of repetitions in the sit-up test, and high work-load scores	-instructional program based on ergonomics and biomechanics lead to improvements in patient handling skill -nurses with poor patient handling skills were at increased risk of back injury -poor job design is problematic if new skills are taught, but cannot be used	-differential drop-out in control group (only tested 65% of the control group for the follow-up skill assessment vs. 94% in intervention group) -limited description of program	-assess self-efficacy and skill when evaluating programs

Study (Reference)	Measures	Procedure	Findings	Implications	Limitations	Future Areas of Research
Weber, Cedraschi, Roux, Kissling, Von Kanel & Dalvit, 1996	-Back pain: ever pain, present pain, time since pain onset, pain occurrence, localization of present pain -Demographics: gender, age, nationality, present activity -# of doctor's visits	-registered for back school course -completed questionnaire before course and 8 months later -the control group completed questionnaires with no intervention	-Number of consultations with physicians was reduced significantly in participant group compared to control -for all other variables both groups improved -results support that those who volunteer for back program often have back problems (life prevalence was high in intervention group)	-motivation for volunteering for course is related to pain and symptoms -control group had greater intake of drugs than intervention (may deal with back pain in different ways)	-only looked at those who volunteered for the program which limits generalizability of study	-relationships between locus of control, health behaviours and determinants of participation should be examined
Wood, 1987	-time loss (hours) -demographics -work experience -injury information -whether the current injured part had been recorded -hospital unit -section -equipment -resident -cause of injury	-new budget system for time loss claims -claims entered through Personnel -back course was offered to intervention group -from March 1982 - February 1983: number of combined wage-loss claims for the Experimental Units was compared with the claims for the Control Unit	-No significant differences -there were 5 wage-loss claims for the experimental units compared with 7 wage-loss claims for the control group (not significant) -the combination of the Personnel program and the Back education significantly lowered back injuries for nurses compared to other hospitals	-effectiveness of the Personnel and education programs likely due to the new system and organization at the hospital	-difficult to isolate the effect of the Personnel program (and the education program)	-study another population other than nurses who may have received training in school in manual handling
Design: **Randomized Control Trial**						

Study (Reference)	Measures	Procedure	Findings	Implications	Limitations	Future Areas of Research
Daltroy, Iversen, Larson, Ryan, Zwerling, Fossel et al., 1993	-Knowledge Quiz -Perceived helping of coworkers/supervisors -Controllability of back health -Lifting and posture on the job -Health behaviours on the job -Tired back -History of injury -Background	-cross-sectional survey of a random sample (n=200) of study population to assess differences between experimental and control units in worker knowledge, attitudes, and self-reported behaviour midway through the study	-Trained experimental workers scored 4.6, untrained experimental scored 3.2 and controls 2.8 (diffusion of knowledge from trained to untrained experimental) -mailhandlers knew more than clerks, college educated knew more than those with less college, those with a history of low back pain knew more than those with no history -trained experimental workers had lower scores than untrained, control in helping/reinforcement -workers with tired back at end of day with longer duration of employment were more likely to report tired back -correlations of variables were as predicted (although weak correlations)	-halfway through the study, knowledge of trainees increased in comparison to control -no significant change in self-reported back-healthy behaviours or proportion of workers with tired back	-measures selected may have been insensitive to see meaningful differences in outcomes of interest	-examination of social support in the workplace may be an important factor in assessing the effectiveness of an educational intervention

Study (Reference)	Measures	Procedure	Findings	Implications	Limitations	Future Areas of Research
Daltroy, Iversen, Larson, Lew, Wright, Ryan et al., 1997	Data collected from computerized Postal Service records: subject's craft category, sex, age, duration of employment, work unit, shift and hours worked. Data from Workers' Compensation Claims and Postal Accident Reports: occurrence of back injury, cause and cost, and diagnoses.	Compare rates of low back injury in control & intervention using log linear models. Unit of analysis was work units. (Analysis was based on the assignment of work units to be trained; regardless of actual percentage of workers trained.	-Over 5 years, 2534 workers and 134 supervisors received education -after training tracked injuries for 6 months -trained workers had lower rates of injury in 3 of 4 comparisons and untrained workers in intervention group units had a higher rate of injury than untrained workers in control group units -trained and untrained workers had similar rates of major lifting and handling injuries -education program did not reduce the cost per injury, or the time off from work per injury -education program did not reduce the rate of related musculoskeletal injuries or the rate of repeated injury after return to work. -knowledge of trained workers was increased after training	Back education may need to be combined with additional methods of injury prevention to reduce injuries. Education may increase knowledge, but not necessarily change costs and injury. Understanding why education was not effective or other factors that may be effective in effecting change would be desirable.	Power reduced to 30% due to small numbers of workers assigned to training and contamination of control group. Staff turnover and movement of trained and untrained workers.	-Back education when incorporated with other methods of injury prevention may be effective. -Examine perception of work to determine whether changes may be made. -Process evaluation may improve effectiveness of the intervention.

Study (Reference)	Measures	Procedure	Findings	Implications	Limitations	Future Areas of Research
McCauley, 1990	Body Mechanics Evaluation Checklist to evaluate worker's lifting, lowering, pulling, and transferring of objects in work environment conducted by observer	-custodial helpers and groundskeeper assistants included in study -prior to hiring, job classifications were randomly assigned to experimental or control group -independent observer was blind to subjects' assignment -workers told observer was performing a job analysis and the workers should continue with their jobs	-experimental group had a significantly higher total score than control group -during lifting experimental group had better score than control group, but was not significantly different -the experimental group had a significantly better score for pulling and transferring than control group -greatest different occurred during pulling and transferring	-in short term it appeared that low back school was effective for changing behaviour -back education should begin during early years of employment and should include body mechanics instruction	-longer observation may have provided a more in-depth view of a worker's ability to maintain proper positioning -short term examination	-expand program to determine if early intervention for workers changes behaviour and reduces injuries over the long term
Shi, 1993	-Health Risk Assessment -occupational risk factors (4) -psychosocial risk factors (8) -demographic/behaviour (7) -costs/benefits	-intervention group given a Health Risk Assessment before and after the back injury prevention program -compared costs with benefits of program	-participation rate was 77% -self-reported back pain prevalence was reduced -significant increase in doing back exercise -Significant decrease in risk status for those in program	-risk status of participants improved -medical claim savings for intervention group vs. control	-reliability/validity of Health Risk Assessment was unknown -can't differentiate the effects of the different program components -possible Hawthorne effect	-study individual components in a similar program to assess the importance of each component

Study (Reference)	Measures	Procedure	Findings	Implications	Limitations	Future Areas of Research
Walsh and Schwartz, 1990	-Abdominal strength from physical testing -cognitive data determined by the pain/back injury questionnaire to assess knowledge of body mechanics -work injury incidence (employee health records) -productivity 6 months prior and during study (time lost for all causes, lost earnings and accident injury rates) -use of health services	-abdominal strength measured, demographics and back questionniare -subjects randomly allocated to one of 3 groups i) control ii) education iii) education/lubosacral orthosis during working hours for 6 months -intervention -6 months later outcome assessment: abdominal strength, cognitive data, work injury incidence, productivity, health services used.	-Knowledge of back pain increased significantly in both experimental groups vs. control -Decreased absenteeism from baseline seen for both experimental groups (non-significant) -Significantly less lost time in body mechanic with orthosis group -No significant change in productivity in any groups	-most applicable to workers who handle materials -appears that use of orthoses has no adverse effect on abdominal strength and may contribute to decreased lost time from injuries	-small sample size with some drop-outs -was not double blind -compliance with corset was unknown	-increase sample size -ask about compliance wearing corset

Appendix E

Videotaping Course Participants: Methods Results and Discussion

Methods

Participants. The sample of participants in the *Back Course* was videotaped prior to and approximately six to eight months after taking the course. Attempts were made to videotape participants in sagittal plane view. In addition, the forces exerted while handling materials were estimated with a scale in newtons. In the analysis stage, the most demanding posture for each task was selected for analysis.

Procedure. Videotaping was conducted in all seven companies that participated in the *Back Course*. Unfortunately, the post course videotaping of the electrical utilities and the plumbing company were not completed before this thesis write-up. Based on the jobs that course participants do, representative actions of manual handling tasks were identified for each job by the employees in consultation with the researchers. Inclusion criteria for videotaping was one person selected for each job task. For example at the hotel, one course participant from housekeeping was videotaped vacuuming, another course participant was videotaped making a bed, another course participant was videotaped cleaning the bathrooms and another course participant was videotaped stocking the mini-bar. When possible these same participants were videotaped doing the same tasks before and after the course.

Data Analysis. The videos of each job task before and after the course were viewed, and the most demanding posture for each job task was selected. The videotape was frozen at the most demanding posture for each job task. The computer mannequin on the 4DWatbak computer

program (Ergowatch, 1999) was matched to the most demanding posture. The Watback program calculated the compression, shear and moment after the hand forces and the direction of the forces (e.g., lift up, push down) were entered into the computer.

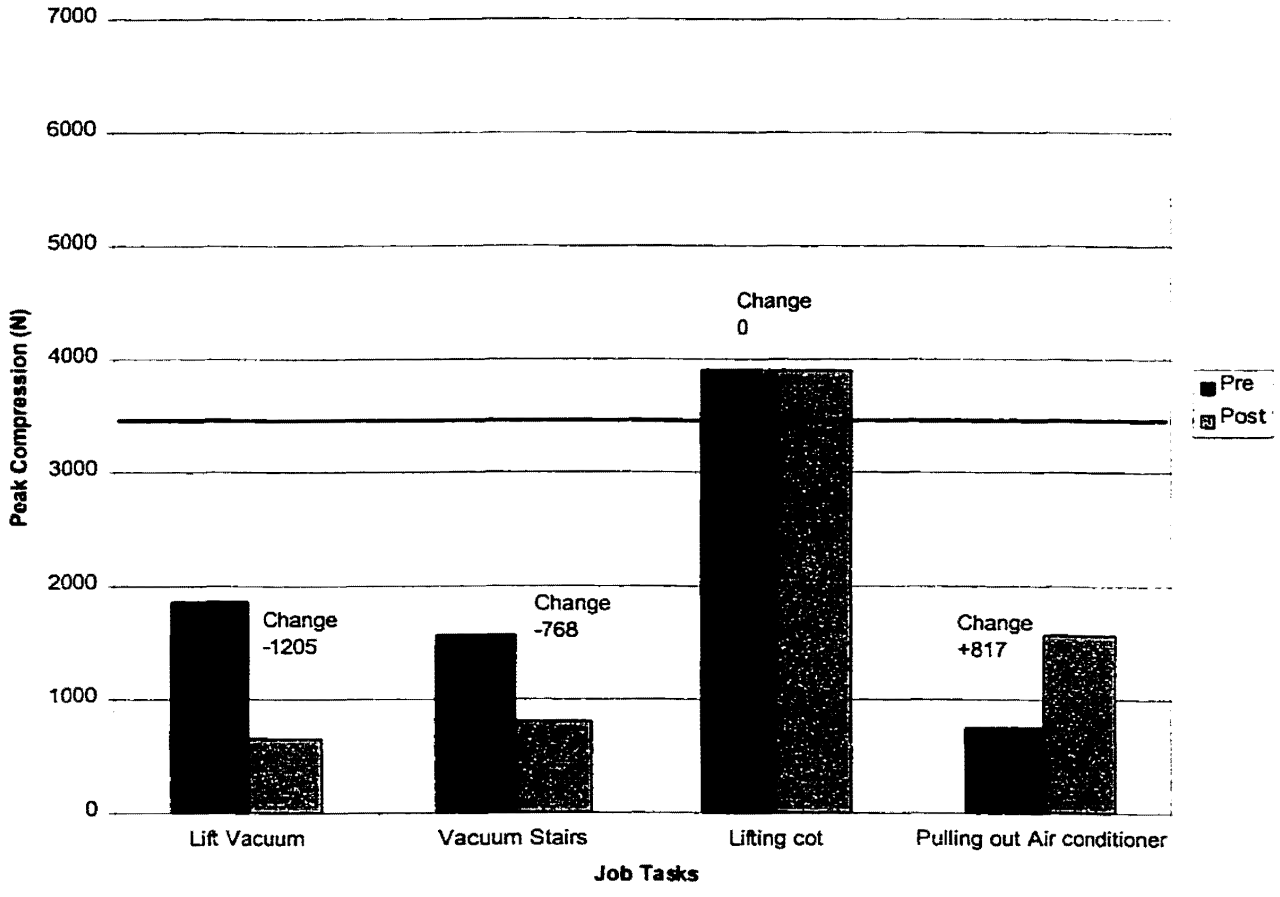
Results

Course participants were videotaped before and six to eight months after course participation. Data from five of the companies were included in the write-up of the thesis. Due to the small sample size, the results are exploratory in nature. Attempts were made to ensure that the job tasks were similar both before and after the course, although this was difficult in some cases. For example, at the hotel, air conditioner height and locations were at different pre and post course. Quantification of the forces required to do the job tasks included "peak" (one time highest observed forces) forces on the low back. Accumulated forces could not be quantified because this would require performing a complete job analysis for each individual.

Of the 26 job tasks, examining peak compression, there were improvements (i.e., decreases in peak compression) in ten job tasks, no changes in 8 and negative changes in 8 job tasks videotaped. Differences smaller than 5% were considered no change. The following figures illustrate the differences between pre and post course in job task peak compression. Peak compression was illustrated since it there are standards for compression in the workplace. The National Institute for Occupational Safety and Health in the United States suggests that risk of injury increases at 3400 N of spinal compression (NIOSH, 1981). Overall, nine job tasks had higher levels of peak compression than 3400 N; five of the job tasks had 3400 N or greater of spinal compression both before and after the course; two had less than 3400 N of spinal

compression after the course and two had more than 3400 N of spinal compression after the course not before the course started. The job tasks videotaped were moderate risk jobs since many of them had levels of spinal compression greater than 3400 N.

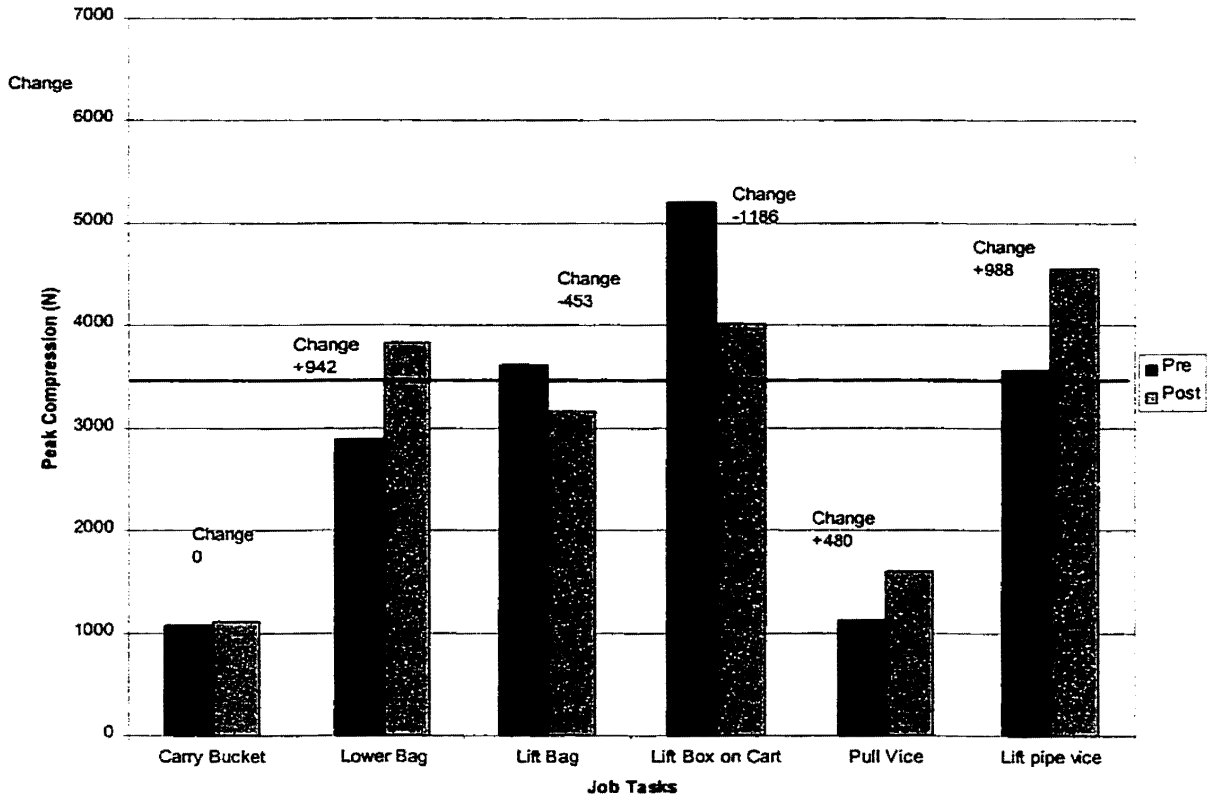
Videotape of Job Tasks at Hotel Before and After Course*



*job task of pulling out air conditioner was in a different position in pre and post course measurement

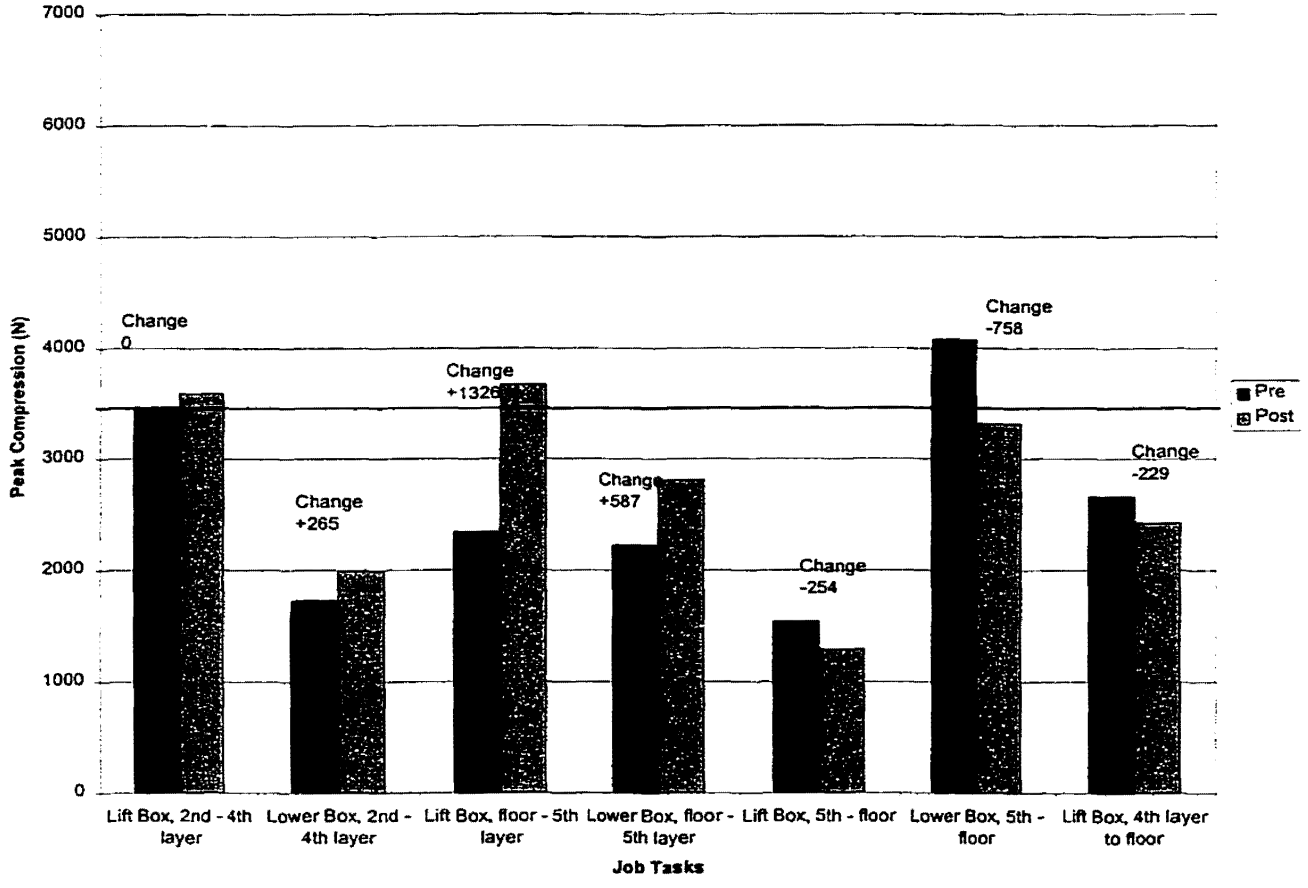
-line at 3400 N refers to the National Institute of Occupational Safety and Health's Action Limit for peak compression

Videotape of Job Tasks at Boiler Service Before and After Course*



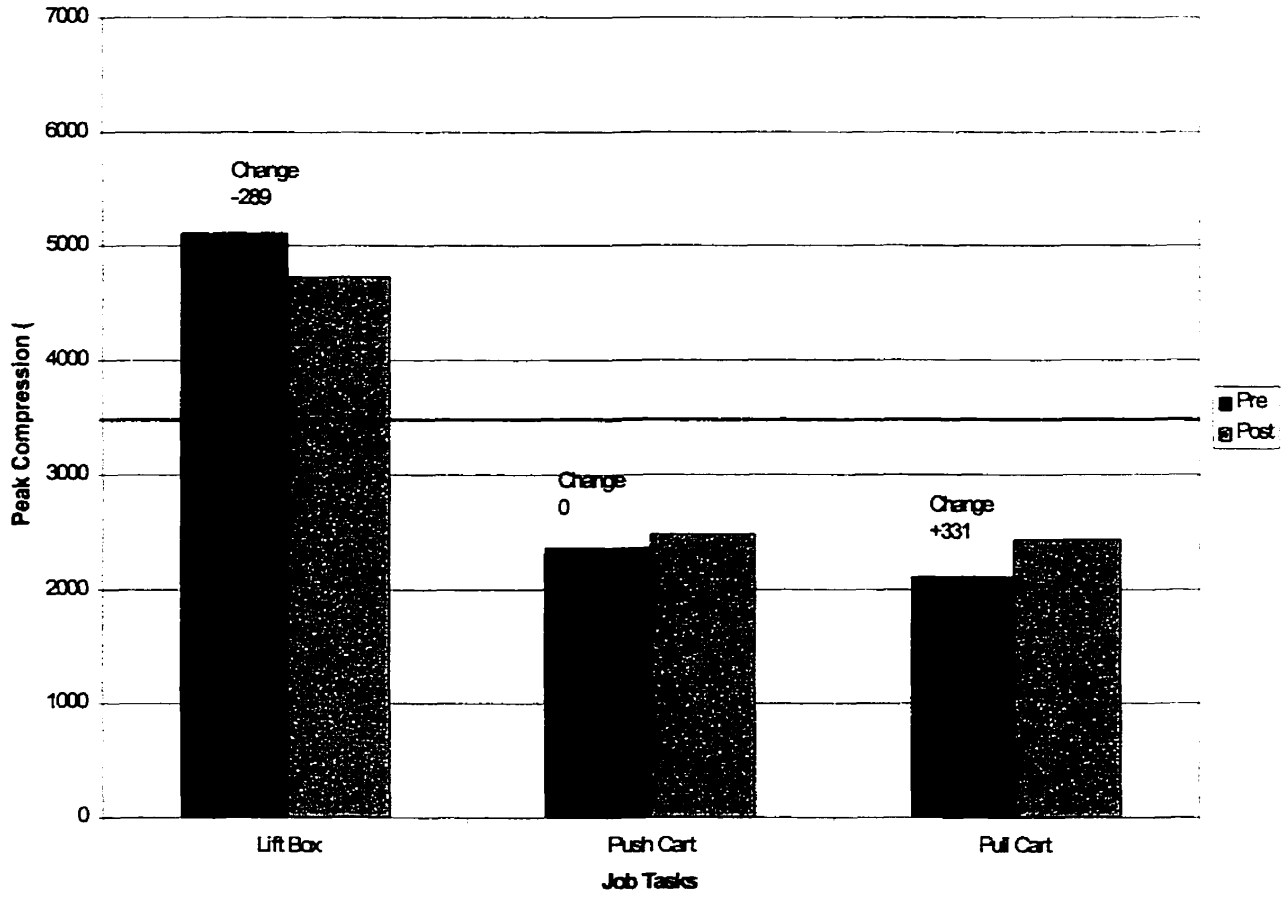
*line at 3400 N refers to the National Institute of Occupational Safety and Health's Action Limit for peak compression, job tasks were slightly different for pre and post course measurements

Videotape of Job Tasks at Paintbrush Manufacturing Before and After Course*



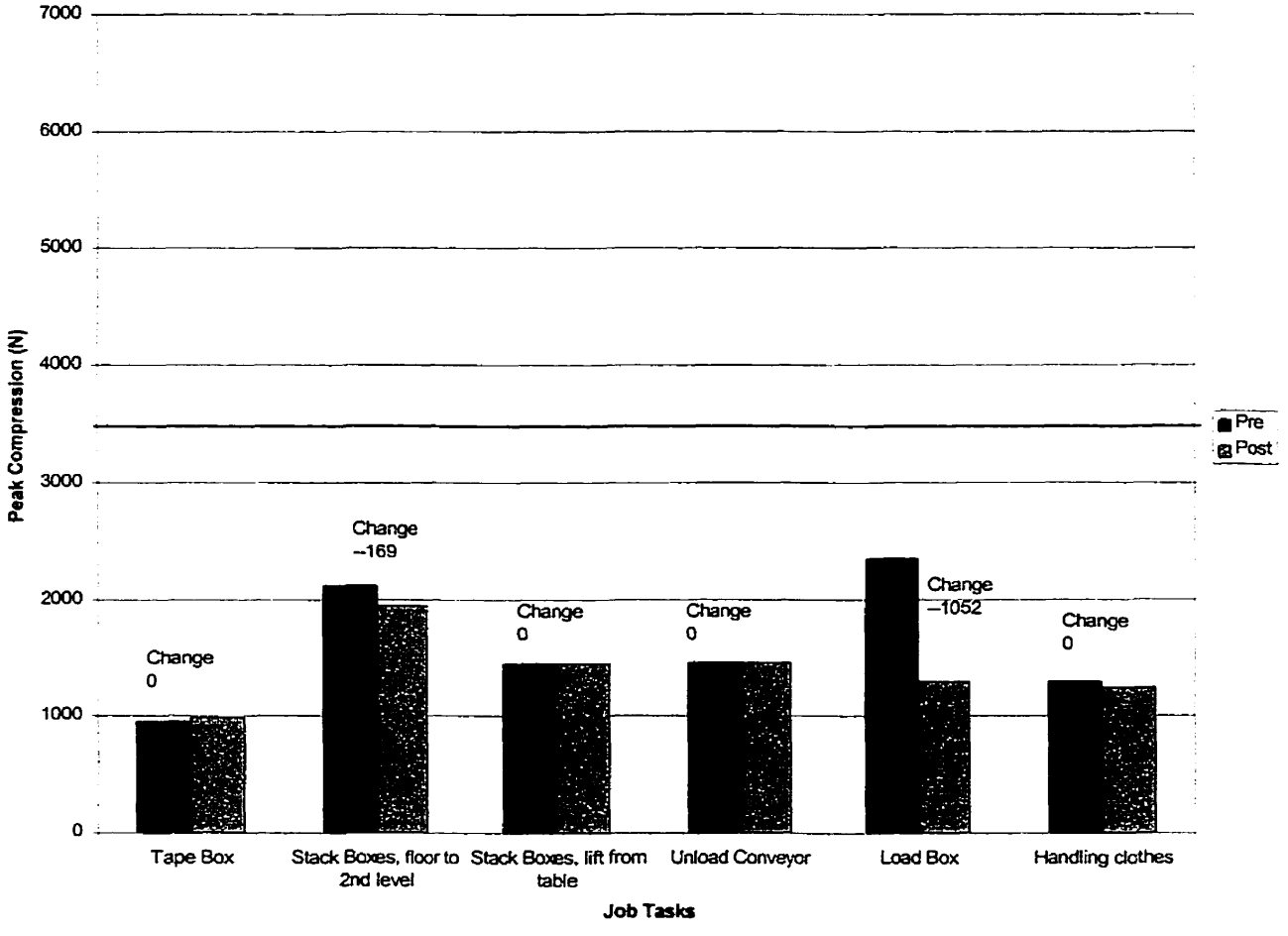
*line at 3400 N refers to the National Institute of Occupational Safety and Health's Action Limit for peak compression

Videotape of Job Tasks at Chicken Processing Before and After Course*



*line at 3400 N refers to the National Institute of Occupational Safety and Health's Action Limit for peak compression

Videotape of Job Tasks at Clothing Warehouse Before and After Course*



*line at 3400 N refers to the National Institute of Occupational Safety and Health's Action Limit for peak compression

Discussion

These results show contradictory results. There were positive changes in ten jobs, negative changes in eight jobs and no changes in eight. Even under conditions where it is likely that those videotaped will show socially desirable lifting practices, not all participants did. Thus although participants' knowledge increased and the participants reported their behaviour to change, when a small sample of participants were videotaped they did not all show the desirable behaviour changes, and some

lifting practices were negatively changed. It may be that in complex situations including analysis of videotapes and changing behaviour in practical settings, participants do not know how to change their lifting practices after taking the course. Perhaps a follow-up course should include practical lifting situations and more videotape examples for analysis. It may also be that education alone may not result in the desired behaviour changes. Alternatively, job design may not have allowed program participants to make changes to their lifting practices at work. Thus, education should be accompanied by job design and policy changes as well.

However, limitations make interpretation of these data difficult because the sample was very small and selective. Not all course participants were videotaped, and those who were videotaped were not randomly selected but were selected based on their availability and interest on the day of the taping. Another major problem was that the job tasks were not identical on pre and post course measurement. This was due to changes in the position of the participant, the height they were lifting from and the objects they were lifting. These changes make comparisons between tasks impossible to do with accuracy.

In this study, the follow-up time was between six to eight months after the course. A future study should examine changes in a shorter follow-up time period, in addition to the six to eight month follow-up period to examine the changes in behaviour over time.

In the future when videotaping course participants, it may be worthwhile to videotape them in a controlled setting and a practical setting. In some situations improvements to the equipment and/or work environment made performing the job tasks easier (but also different from pre course measurement). Also participants should be randomly selected rather than selected based on interest and availability. However, this makes testing in a field setting much more time consuming and difficult.

Appendix F Knowledge Quiz and Subscales

Quiz of Back and Upper Limb Injury Prevention (Pre and Post Course Quiz are the Same)

Thank you for volunteering to participate in the Back and Upper Limb Injury Prevention course. The quiz on the following pages will help us evaluate the course. The questions will be asked before and after you take the course. All responses will be **confidential** and the data will be shown in summary format only. No one will be identified by name. Responding to each question is voluntary, but if the quiz is to give us a true evaluation of the course, everyone should complete and return their quiz.

Please fill out this page of the quiz that asks you to fill in the date and your name. Feel free to change your name, but be sure to keep **whatever name you use the same before and after the course**. If you do change your name, we suggest that you use a name that you will remember such as a nickname.

Please take the time to read the instructions for each section carefully.

When answering, place an "X" to indicate your response.

Date: _____

Name: _____

Pre-course Quiz

Part 1 starts by giving you two brief scenarios and asks how to minimize risk of injury. Please place an "X" in the box to indicate your response. If you are not sure of your answer, please indicate "I'm not sure".

Tom unloads 20 pound boxes from a truck first thing every morning at work. To minimize risk of injury he should

1. Get out of bed at least an hour before he starts work.

☐ True ☐ False ☐ I'm not sure

2. Contract torso muscles before he starts lifting.

☐ True ☐ False ☐ I'm not sure

3. Twist the spine to its extreme before lifting.

☐ True ☐ False ☐ I'm not sure

4. Keep loads close to his body.

☐ True ☐ False ☐ I'm not sure

5. Roll his shoulders forward while lifting.

☐ True ☐ False ☐ I'm not sure

Jessica has been driving for an hour with her daughter (6 months old). She stops after an hour at a rest station to take her daughter Susan out of her car seat. To minimize risk of injury she should

6. Lightly tense arm and back muscles before lifting.

☐ True ☐ False ☐ I'm not sure

7. Keep the normal curve while lifting.

☐ True ☐ False ☐ I'm not sure

8. Relax her back muscles while lifting.

☐ True ☐ False ☐ I'm not sure

Part 2 asks questions about concepts that will be discussed in the course. Please place an "X" in the box to indicate your response. If you are not sure of your answer, please indicate "I'm not sure".

9. Ligaments heal faster than muscles.

☐ True ☐ False ☐ I'm not sure

10. Muscles are under voluntary control.

☐ True ☐ False ☐ I'm not sure

11. Risk of injury is minimal if you handle materials immediately after getting out of bed.

☐ True ☐ False ☐ I'm not sure

12. Moving around after sitting for a long period of time allows the ligaments to return to normal length.

☐ True ☐ False ☐ I'm not sure

13. Staying in the same posture for a long time minimizes risk of injury.

☐ True ☐ False ☐ I'm not sure

14. Gently contracting torso muscles before handling loads increases the risk of low back injury.

☐ True ☐ False ☐ I'm not sure

15. Gently contracting torso muscles before handling materials reduces the risk of "surprise" loads on the tissues.

☐ True ☐ False ☐ I'm not sure

16. The spinal column is stabilized by gently contracting torso muscles.

☐ True ☐ False ☐ I'm not sure

17. Keeping the normal curve in the spine helps to distribute load evenly on the discs.

☐ True ☐ False ☐ I'm not sure

18. Sticking your butt out and bending your knees helps to keep the normal curve in the spine.

☐ True ☐ False ☐ I'm not sure

19. Twisting the spine to extremes will minimize the forces on facets.

☐ True ☐ False ☐ I'm not sure

20. Twisting when the trunk is also bent forward increases the likelihood of injury.

☐ True ☐ False ☐ I'm not sure

21. Keeping the shoulders parallel to the pelvis minimizes the risk of injury.

☐ True ☐ False ☐ I'm not sure

22. Regularly performing exercises that improve torso muscle endurance helps to increase stability of the spine.

☐ True ☐ False ☐ I'm not sure

23. Touching your elbows to your knees minimizes risk of low back injury when doing situps.

☐ True ☐ False ☐ I'm not sure

24. Working with hands above the head can pinch nerves and blood vessels in the shoulder.

☐ True ☐ False ☐ I'm not sure

25. A moment (torque) is the most important principle for understanding how back and upper limb injuries occur.

☐ True ☐ False ☐ I'm not sure

26. Disc compression increases when the low back moment is high.

☐ True ☐ False ☐ I'm not sure

27. Holding a load in the hands far away from the body decreases the shoulder moment.

☐ True ☐ False ☐ I'm not sure

Part 3 will begin by showing you 5 video clip examples. For each example indicate if the risk of injury in the example is high by placing an "X" in the box beside "High", "Low", or "I'm not sure". If you thought the risk was High, please place an "X" beside the injury risk factor(s) that apply for the video clip example.

Clip #1

The risk of **low back** injury in this example is

☐ High ☐ Low ☐ I'm not sure

Injury Risk Factors:
____ location of load
____ weight of load
____ moment (torque)
____ low back curve
____ twist
____ load handling after prolonged immobility

Clip #2

The risk of **low back** injury in this example is

☐ High ☐ Low ☐ I'm not sure

Injury Risk Factors:
____ location of load
____ weight of load
____ moment (torque)
____ low back curve
____ twist
____ load handling after prolonged immobility

Clip #3

The risk of **low back** injury in this example is

☐ High ☐ Low ☐ I'm not sure

Injury Risk Factors:
____ location of load
____ weight of load
____ moment (torque)
____ low back curve
____ twist
____ load handling after prolonged immobility

Clip #4

The risk of **low back** injury in this example is

☐ High ☐ Low ☐ I'm not sure

Injury Risk Factors:
____ location of load
____ weight of load
____ moment (torque)
____ low back curve
____ twist
____ load handling after prolonged immobility

Clip #5

The risk of **upper limb** injury in this example is

☐ High ☐ Low ☐ I'm not sure

Injury Risk Factors:
____ location of load
____ weight of load
____ moment (torque)
____ load handling after prolonged immobility

Subscales: True/False Quiz

Item	Possible Response True/False/I'm Not Sure * indicates the correct response
A. Subscale - Move around after prolonged immobility	
A1. Get out of bed one hour before work.	True * False
A2. Risk of injury is minimal if you handle materials immediately after getting out of bed.	True False *
A3. Moving around after sitting for a long period of time allows the ligaments to return to normal length.	True * False
A4. Staying in the same posture for a long time minimizes risk of injury.	True False *
B. Subscale - Avoid Twisting the spine to extremes	
B1. Twist the spine to its extreme to stretch the ligaments before lifting.	True False *
B2. Twisting the spine to extremes will minimize the forces on facets.	True False *
B3. Twisting when the trunk is also bent forward increases the likelihood of injury.	True * False
B4. Keeping the shoulders parallel to the pelvis minimizes the risk of injury.	True * False
C. Subscale - Lightly tense torso muscles	
C1. Contract torso muscles before he starts lifting.	True * False
C2. Lightly tense arm and back muscles before lifting.	True * False
C3. Gently contracting torso muscles before handling loads increases risk of low back injury.	True False *
C4. Gently contracting torso muscles before handling materials reduces the risk of "surprise" loads on the tissues.	True * False
C5. The spinal column is stabilized by gently contracting torso muscles.	True * False
D. Subscale - Keep the moment (torque) low at all joints	
D1. Keep loads close to the body.	True * False
D2. Working with hands above the head can pinch nerves and blood vessels in the shoulder.	True * False
D3. A moment (torque) is the most important principle for understanding how back and upper limb injuries occur.	True * False
D4. Disc compression increases when the low back moment is high.	True * False
D5. Holding a load in the hands far away from the body decreases the shoulder moment.	True False *

E. Subscale - Keep the normal curve in the spine.	
E1. Roll his shoulders forward while lifting.	True False *
E2. Keep the normal curve while lifting.	True* False
E3. Relax her back muscles while lifting.	True False *
E4. Keeping the normal curve in the spine helps to distribute load evenly on the discs.	True * False
E5 Sticking your butt out and bending your knees helps to keep the normal curve in the spine.	True * False
F. Subscale - Anatomy	
F1 Ligaments heal faster than muscles.	True False *
F2. Muscles are under voluntary control.	True * False
G. Subscale - Exercises	
G1. Regularly performing exercises that improve torso muscle endurance helps to increase stability of the spine.	True * False
G2. Touching your elbows to your knees minimizes risk of low back injury when doing situps.	True False *

Videoclips:

Item	**Possible Responses (in addition to I'm Not Sure)**
1. Risk of injury in clip one (moving crate to shelf) is:	High* Low
2. If risk is high, the injury risk factors include:	1. Location * 2. Weight 3. Moment * 4. Low Back Curve 5. Twist 6. Handling after prolonged immobility
3. Risk of injury in clip two (twist and move crate to shelf) is:	High * Low
4. If risk is high, the injury risk factors include:	1. Location 2. Weight 3. Moment 4. Low Back Curve 5. Twist * 6. Handling after prolonged immobility
5. Risk of injury in clip three (pick up nut & bolt from floor) is:	High * Low
6. If risk is high, the injury risk factors include:	1. Location * 2. Weight 3. Moment * 4. Low Back Curve * 5. Twist 6. Handling after prolonged immobility
7. Risk of injury in clip four (sit at computer for 2 hours) is:	High * Low
8. If risk is high, the injury risk factors include:	1. Location 2. Weight 3. Moment 4. Low Back Curve 5. Twist 6. Handling after * prolonged immobility
9. Risk of injury in clip five (put phone book on top shelf) is:	High * Low
10. If risk is high, the injury risk factors include:	1. Location * 2. Weight 3. Moment * 4. Handling after prolonged immobility

Appendix G
Impact Questionnaires Pre and Post

Back and Upper Limb Injury Prevention Course Evaluation

Pre Course Questionnaire

Please fill in today's date.

Date: _____/_____/_____
day month year

Thank you for participating in the evaluation of the Back and Upper Limb Injury Prevention course. Your time and effort are greatly appreciated.

While carefully completing this questionnaire, please remember:

- your answers are completely CONFIDENTIAL; a secret code is used to identify your questionnaire
- this completed questionnaire will be seen by RESEARCHERS ONLY
- every answer you give is VOLUNTARY; if you feel uncomfortable with a question, you may leave it blank

E. Background.

We would like to begin by asking you a few questions about your background.

1. Your sex (*check box)* ☐ MALE ☐ FEMALE

2. What is your date of birth? _____/_____/19_____
   DAY MONTH YEAR

3. How tall are you?_____FEET _____ INCHES or _____ CENTIMETERS

4. How much to you weigh? _____ POUNDS or _____ KILOGRAMS

5. a) Which language(s) are you most comfortable speaking?

   ☐ English ☐ French ☐ Other (please specify)_____

   b) Which language(s) are you most comfortable reading and writing?

   ☐ English ☐ French ☐ Other (please specify)_____

6. What is the highest level of education that you have completed? (*check box*)
   - ☐ NO FORMAL SCHOOLING
   - ☐ SOME PRIMARY SCHOOL
   - ☐ PRIMARY SCHOOL
   - ☐ SOME SECONDARY OR HIGH SCHOOL
   - ☐ COMPLETED SECONDARY OR HIGH SCHOOL
   - ☐ SOME COMMUNITY COLLEGE, TECHNICAL SCHOOL, CEGEP, OR NURSING
   - ☐ COMPLETED COMMUNITY COLLEGE, TECHNICAL COLLEGE, CEGEP , OR NURSING
   - ☐ SOME UNIVERSITY (NOT COMPLETED)
   - ☐ UNIVERSITY DEGREE (COMPLETED)

7. Do you have young children, care for older adults or disabled people? ☐ Yes (go to question 8) ☐ No (go to question 9)

8. If yes to question 7, do you provide physical care (bathing, lifting, etc.) for these people you care for? ☐ Yes☐ No

9. Do you consider yourself to be a physically active person?

   ☐ Very much so ☐ Moderately ☐ Not at all

10. Do you currently take part in any organized exercise classes, sports or exercise on your own?

    ☐ Yes (go to question 11) ☐ No (go to question 12)

11. If yes to question 10, list the types of exercise you most often do.

    _____

    _____

12. Have you ever had a back, shoulder or neck injury? ☐ Yes ☐ No ☐ Unsure

13. Have you ever experienced low back pain? ☐ Yes (go to question 14) ☐ No (go to question 15)

14. If yes, approximately when was the most recent episode?

_____

15. Have you ever had to miss work because of a back, neck or shoulder injury?

☐ Yes (go to question 16) ☐ No (go to question 17)

16. If yes to question 15, have you taken any Workplace Safety and Insurance Board rehabilitation programs?

☐ Yes ☐ No

17. What is your current job title?
Job title:_____

18. What are the main tasks that you do in your current job?

_____

19. Have you taken prior courses in injury prevention at work?

☐ Yes (go to question 20) ☐ No (go to question 21)

20. If yes to question 19, what was the content of this course(s)?

_____

21. To what extent does your job include the following physical demands?

a) lifting (light loads, maximum 5 pounds)

☐ Not at all ☐ To Some Extent ☐ To a Great Extent

b) lifting (medium loads, between 10 and 25 pounds)

☐ Not at all ☐ To Some Extent ☐ To a Great Extent

c) lifting (heavy loads, 50 pounds and over)

☐ Not at all ☐ To Some Extent ☐ To a Great Extent

d) bending or stooping (example: filing)

☐ Not at all ☐ To Some Extent ☐ To a Great Extent

e) pulling or pushing objects

☐ Not at all ☐ To Some Extent ☐ To a Great Extent

f) crouching or kneeling

☐ Not at all ☐ To Some Extent ☐ To a Great Extent

Now we'd like you to fill out a few survey instruments that have been used in similar research projects.

B. What are your expectations about the Back and Upper Limb Injury Prevention course? Please use the scales provided to circle the number that best matches your expectations about how the course will affect your work.

1. I expect that the Back and Upper Limb Injury Prevention course will:

1	2	3	4	5	6	7	8	9
Teach me nothing new								Teach me something new

2. I expect that the Back and Upper Limb Injury Prevention course will:

1	2	3	4	5	6	7	8	9
Not be of any use at Home & Work								Teach me useful principles for Home & Work

3. I expect that the Back and Upper Limb Injury Prevention course will:

1	2	3	4	5	6	7	8	9
Make no difference in the way I handle material at **work**								Result in a change in the way I handle material at **work**

4. I expect that the Back and Upper Limb Injury Prevention course will:

1	2	3	4	5	6	7	8	9
Make no difference in the way I handle material **at home**								Result in a change in the way I handle material at **home**

5) I expect that the Back and Upper Limb Injury Prevention course will:

1	2	3	4	5	6	7	8	9
Decrease communication at my company				Make no difference				**Increase communication** at my company

6) I expect that the Back and Upper Limb Injury Prevention course will:

1	2	3	4	5	6	7	8	9
Make no difference to the safety record of the organization								Greatly improve the safety record of the organization

C. The next few questions ask about your perceptions of your job. We will ask you about your job in this section. For each statement, please check the box with the one answer that best describes your situation.

5. My job requires that I learn new things.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

6. My job requires me to do things over and over again.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

7. My job requires me to be creative.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

8. My job allows me to make a lot of decisions on my own.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

9. My job requires a high level of skill.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

10. On my job I have very little freedom to decide how I do my work.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

11. I get to do a variety of different things on my job.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

12. I have a lot of say about what happens on my job.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

13. I have an opportunity to develop my own special abilities.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

14. My job requires me to think very fast.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

15. My job requires a lot of concentration.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

16. My job requires me to think about a lot of things.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

17. I have enough time to get the job done.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

18. I am free from conflicting demands that others make.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

19. My job security is good.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

20. My job requires a lot of physical effort.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

21. My work requires rapid and continuous physical activity.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

22. I am often required to move or lift heavy loads on my job.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

23. My supervisor is helpful in getting the job done.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

24. My supervisor cares about those under him/her.

☒ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

25. My supervisor pays attention to what I am saying.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☒ Disagree ☐ Strongly disagree

26. My supervisor is successful in getting people to work together.

☒ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

27. My fellow workers take a personal interest in me.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☒ Strongly disagree

28. My fellow workers are helpful in getting the job done.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

29. My fellow workers are supportive.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

30. My fellow workers are able to do their jobs well.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

31. How satisfied are you with your job?

☐ Very satisfied ☐ Somewhat satisfied ☐ Not too satisfied ☐ Not at all satisfied

D. The next few questions examine perceived influence or control of employees on the job. By influence we mean the degree to which you have freedom to determine yourself what you do at work. Please check the one box which indicates how much influence you have in each area.

1. How much influence do you have over the variety of tasks you perform?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

2. How much influence do you have over the order in which you perform tasks at work?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

3. How much influence do you have over the amount of work you do?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

4. How much influence do you have over the quality of the work that you do?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

5. How much influence do you have over the arrangement and decoration of your work area?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

6. How much influence do you have over the decisions concerning which individuals in your work unit do which tasks?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

7. How much influence do you have over the decisions as to when things will be done in your work unit?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

8. How much do you influence the policies, procedures and performance standards in your unit?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

9. How much influence do you have over the training of other workers in your work unit?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

10. How much influence do you feel you have over decisions concerning the future of your job?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

11. How much influence do you have over the availability of tools you need to do your work?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

E. Now we would like to ask you to think about any symptoms you may have had.

1. Have you ever had any pain or discomfort (aching, tingling) in your head/neck, shoulder/upper arm, forearm/hand, back or leg/lower limb?
   ☐ YES ☐ NO → If NO, go to Section F.
2. Have you had any pain or discomfort (aching/tingling) in your head/neck, shoulder/upper arm, forearm/hand, back, or leg/lower limb within the past 6 months? *(check box)*
   ☐ YES ☐ NO
3. Please complete a column in the table below for each area that bothers you.

		HEAD/ NECK	SHOULDER/ UPPER ARM	FOREARM/ HAND	BACK	LEG/ LOWER LIMB
In what month and year did you first notice your pain or discomfort? *(write in number)*		MO.___ YR.___	MO.___ YR.___	MO.___ YR.___	MO.___ YR.___	MO.___ YR.___
How often have you had separate episodes in the last year? *(check box)*	Pain is constant	☐	☐	☐	☐	☐
	Daily	☐	☐	☐	☐	☐
	One or more times a week	☐	☐	☐	☐	☐
	One or more times a month	☐	☐	☐	☐	☐
	Every 2-3 months	☐	☐	☐	☐	☐
	Every 6 months or more	☐	☐	☐	☐	☐
How long was each episode? *(check box)*	Less than 1 hour	☐	☐	☐	☐	☐
	1 hour to 1 day	☐	☐	☐	☐	☐
	More than 1 day to 1 week	☐	☐	☐	☐	☐
	More than 1 week to 1 month	☐	☐	☐	☐	☐
	More than 1 month to 5 months	☐	☐	☐	☐	☐
	More than 6 months	☐	☐	☐	☐	☐
How would you rate your pain or discomfort over the **last 7 days**? *(check box)*	None	☐	☐	☐	☐	☐
	Mild	☐	☐	☐	☐	☐
	Moderate	☐	☐	☐	☐	☐
	Severe	☐	☐	☐	☐	☐
	Unbearable	☐	☐	☐	☐	☐
In the **past 6 months**, how bad was your **worst** pain or discomfort? *(check box)*	None	☐	☐	☐	☐	☐
	Mild	☐	☐	☐	☐	☐
	Moderate	☐	☐	☐	☐	☐
	Severe	☐	☐	☐	☐	☐
	Unbearable	☐	☐	☐	☐	☐
In the **past 6 months**, on **average**, how intense was your pain or discomfort? *(check box)*	None	☐	☐	☐	☐	☐
	Mild	☐	☐	☐	☐	☐
	Moderate	☐	☐	☐	☐	☐
	Severe	☐	☐	☐	☐	☐
	Unbearable	☐	☐	☐	☐	☐
Prior to your current pain or discomfort, did you ever have an accident or sudden injury to this area? *(If yes, please indicate year.)* ☐ YES ☐ NO		YR.___	YR.___	YR.___	YR.___	YR.___
Do you think your pain or discomfort was caused or aggravated by your work? *(check box)*		☐ YES ☐ NO ☐ TO SOME EXTENT	☐ YES ☐ NO ☐ TO SOME EXTENT	☐ YES ☐ NO ☐ TO SOME EXTENT	☐ YES ☐ NO ☐ TO SOME EXTENT	☐ YES ☐ NO ☐ TO SOME EXTENT
Have you reported your pain or discomfort to your workplace? *(check box)*		☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO
If your pain or discomfort is in more than one area, please indicate which one has the **most** impact on you. *(check **one** box only)*		☐	☐	☐	☐	☐

F. For each statement below, please check the box with the one answer that best describes your workplace.

1. Safety is considered equally with production and quality goals in management thinking and day to day operations.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

2. Management is committed to keeping workers employed when injuries or disabilities occur.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

3. Management encourages employees to shut down an unsafe machine or stop the work process when an unsafe condition arises.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

4. Management encourages employees to promptly report physical symptoms arising from job tasks.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

5. Management encourages supervisors to provide "light duties" or reduced working hours for workers who are recovering from an injury.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

G. For the final part of this questionnaire, please open the envelope. You will find a set of pictures. Each picture is numbered. Using the following scale, please rate your confidence in doing each task so as to minimize risk of injury by choosing a corresponding number from the following rating scale:

0 %	10	20	30	40	50	60	70	80	90	100%
Not at all confident										Extremely confident

Go through one picture at a time and choose one of the percentage points on the scale from 0% which refers to not at all confident, to 100% which refers to extremely confident.

"How confident are you that you can minimize risk of back, shoulder and neck injury when you....

1. place a bottle on the floor? _____ %
2. retrieve a small tool from the floor? _____ %
3. push and pull a vacuum cleaner? _____%
4. push and pull a shopping cart? _____%
5. place or retrieve a 5-pound box between waist and eye-level while standing on a step-stool? _____%
6. place or retrieve a 5-pound can between your waist and overhead? _____%
7. lower a 10 pound milk crate from eye-level to the floor? _____ %
8. lower a 10-pound milk crate from a bench to the floor? _____%
9. lift a 10-pound milk crate from the floor to eye-level? _____ %
10. lift a 10-pound milk crate from the floor to a bench? _____%
11. load a 20-pound grocery bag into the trunk of an automobile? _____%
12. lower a 20-pound milk crate from eye-level to the floor? _____%
13. unload a 20-pound grocery bag from the trunk of an automobile? _____%
14. lift a 20-pound milk crate from the floor to eye-level? _____%

15. unload two 10-pound grocery bags from the trunk of an automobile? _____%
16. lift a 20-pound tool box from the floor to a bench? _____%
17. paint with a small brush at eye-level? _____%
18. drive nails with a hammer? _____%
19. wash dishes at a sink? _____%
20. trim shrubbery with a hedge trimmer? _____%
21. change a light-bulb overhead? _____%
22. install a face-plate on an electric outlet? _____%
23. cut a piece of lumber with a hand saw? _____%
24. pull a nail out of lumber with a claw hammer? _____%
25. pour liquid soap into a cup from a large container? _____%
26. use a dolley to move a large trash barrel? _____%
27. load or unload a dishwasher? _____%
28. dig in a garden with a spade-shovel? _____%
29. push open a heaving door? _____%
30. get into an automobile driver's seat? _____%
31. pull open a heavy door? _____%
32. get out of an automobile driver's seat? _____%
33. carry a 10-pound step-stool 50 feet? _____%
34. carry a 30-pound bucket 50 feet? _____%
35. carry a 20-pound sack of groceries for 100 feet? _____%

36. carry two 10-pound sacks of groceries fro 100 feet? _____%

37. climb a step-ladder? _____%

38. carry a 20-pound bucket up a step-ladder? _____%

39. sweep with a push-broom? _____%

40. sweep with a kitchen broom? _____%

41. lower a 50-pound milk crate from eye-level to the floor? _____%

42. lower a 50-pound tool box from a bench to the floor? _____%

43. lift a 50-pound milk crate from the floor to eye-level? _____%

44. lift a 50-pound tool box from the floor to a bench? _____%

45. lower a 100-pound milk crate from eye-level to the floor? _____%

46. lower a 100-pound milk crate from a bench to the floor? _____%

47. lift a 100-pound milk crate from the floor to eye-level? _____%

48. lift a 100-pound milk crate from the floor to a bench? _____%

49. paint with a small brush at eye level? _____%

50. place or retrieve a 5-pound can between waist and overhead? _____%

Thank you very much for completing this questionnaire. You are finished now. In about six weeks, we will send you another questionnaire like this. Your name will be entered into a draw for a prize worth $100 for sending it back in the postage paid envelope.

Back and Upper Limb Injury Prevention Course Evaluation

Post Course Questionnaire

Please fill in today's date.

Date: _____/_____/_____
day month year

Thank you for participating in the evaluation of the Back and Upper Limb Injury Prevention course. Your time and effort are greatly appreciated.

While carefully completing this questionnaire, please remember:

- your answers are completely CONFIDENTIAL; a secret code is used to identify your questionnaire
- this completed questionnaire will be seen by RESEARCHERS ONLY
- every answer you give is VOLUNTARY; if you feel uncomfortable with a question, you may leave it blank

Follow-up questions.

A. We have a few questions to ask you since we last saw you.

5. Over the past six weeks, have you had any injury or illness that has disrupted your work or normal pattern of actions?
☐ Yes ☐ No

6. Over the past six weeks, have you had a back, shoulder or neck injury? ☐ Yes ☐ No

7. Over the past six weeks, have you experienced low back pain? ☐ Yes (go to question 4) ☐ No (go to question 5)

8. If yes, approximately when was the most recent episode?

_____

9. Over the past six weeks, have you had to miss work because of a back, neck or shoulder injury?
☐ Yes (go to question 6) ☐ No (go to question 7)

10. If yes, have you taken any Workplace Safety and Insurance Board rehabilitation programs? ☐ Yes ☐ No

11. What do you remember from the Back and Upper Limb Injury Prevention course?

_____

_____

_____

12. Do you remember the back exercises that were demonstrated in the course and that everybody had a chance to try?

☐ Yes ☐ No

13. Have you had a chance to do the exercises? ☐ Yes (go to question 10) ☐ No (go to question 11)

14. If yes to question 9, how often have you done the exercises?

☐ A few times ☐ Several times ☐ Regularly

15. Have you ever looked at the hand-outs on the four exercises that you were given? ☐ Yes ☐ No

16. Did the course make any difference in how you physically do your job (eg., how you lift things)

☐ Yes ☐ No

17. Did the course make any difference in how you do things around the house (eg., how you lift a baby out of a car seat)

☐ Yes ☐ No

18. Do you think the Back and Upper Limb Injury Prevention course should be provided to all employees of your company?

☐ Absolutely yes ☐ Absolutely no ☐ It depends (please explain _____)

The Off-the-Job Safety component of the Waterloo Safe Communities Program includes a number of different courses such as Bike Safety, Fire Safety and Personal Protective Safety that are offered to you and your family.

19. Please check the additional courses that you would be interested in **if your company gave you time off work to take the course.**

☐ Bike Safety
☐ Recreational Safety
☐ Fire Safety
☐ Car Seat Safety
☐ Slips and Falls Safety
☐ Hazardous Household Safety
☐ Personal Protective Safety

20. Please check the additional courses that you would be interested in if your company advertised the course for you to take **on your own time.**

☐ Bike Safety
☐ Recreational Safety
☐ Fire Safety
☐ Car Seat Safety
☐ Slips and Falls Safety
☐ Hazardous Household Safety
☐ Personal Protective Safety

Now we'd like you to fill out a few survey instruments that have been used in similar research projects.

B. In the pre-course questionnaire you were asked about your expectations for the Back and Upper Limb Injury Prevention course. We wonder what your impressions are now that you've had the course. Please use the scales provided to circle the number that best matches your thoughts about how the course will affect your work.

1. The Back and Upper Limb Injury Prevention course:

1	2	3	4	5	6	7	8	9
Taught me nothing new								Taught me something new

2. The Back and Upper Limb Injury Prevention course:

1	2	3	4	5	6	7	8	9
Was not of any use at Home & Work								Taught me Useful Principles for Home & Work

3. The Back and Upper Limb Injury Prevention course:

1	2	3	4	5	6	7	8	9
Made no difference in the way I handle material at **work**								Resulted in a change in the way I handle material at **work**

4. The Back and Upper Limb Injury Prevention course:

1	2	3	4	5	6	7	8	9
Made no difference in the way I handle material **at home**								Resulted in a change in the way I handle material at **home**

5. The Back and Upper Limb Injury Prevention course:

1	2	3	4	5	6	7	8	9
Decreased communication at my company				Made no difference				Increased communication at my company

6. I expect that the Back and Upper Limb Injury Prevention course will:

1	2	3	4	5	6	7	8	9
Will make no difference to the safety record of the organization								Will greatly improve the safety record of the organization

C. The next few questions ask about your perceptions of your job. We will ask you about your job in this section. For each statement, please check the box with the one answer that best describes your situation.

1. My job requires that I learn new things.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

2. My job requires me to do things over and over again.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

3. My job requires me to be creative.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

4. My job allows me to make a lot of decisions on my own.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

5. My job requires a high level of skill.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

6. On my job I have very little freedom to decide how I do my work.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

7. I get to do a variety of different things on my job.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

8. I have a lot of say about what happens on my job.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

9. I have an opportunity to develop my own special abilities.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

10. My job requires me to think very fast.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

11. My job requires a lot of concentration.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

12. My job requires me to think about a lot of things.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

13. I have enough time to get the job done.

☐ Strongly agree ☐ Agree ☒ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

14. I am free from conflicting demands that others make.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

15. My job security is good.

☐ Strongly agree ☒ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

16. My job requires a lot of physical effort.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

17. My work requires rapid and continuous physical activity.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

18. I am often required to move or lift heavy loads on my job.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

19. My supervisor is helpful in getting the job done.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

20. My supervisor cares about those under him/her.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

21. My supervisor pays attention to what I am saying.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☒ Strongly disagree

22. My supervisor is successful in getting people to work together.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

23. My fellow workers take a personal interest in me.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

24. My fellow workers are helpful in getting the job done.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

25. My fellow workers are supportive.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

26. My fellow workers are able to do their jobs well.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

27. How satisfied are you with your job?

☐ Very satisfied ☐ Somewhat satisfied ☐ Not too satisfied ☐ Not at all satisfied

D. The next few questions examine perceived influence or control of employees on the job. By influence we mean the degree to which you have freedom to determine yourself what you do at work. Please check the one box which indicates how much influence you have in each area.

1. How much influence do you have over the variety of tasks you perform?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

2. How much influence do you have over the order in which you perform tasks at work?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

3. How much influence do you have over the amount of work you do?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

4. How much influence do you have over the quality of the work that you do?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

3. How much influence do you have over the arrangement and decoration of your work area?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

4. How much influence do you have over the decisions concerning which individuals in your work unit do which tasks?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

5. How much influence do you have over the decisions as to when things will be done in your work unit?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

6. How much do you influence the policies, procedures and performance standards in your unit?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

7. How much influence do you have over the training of other workers in your work unit?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

8. How much influence do you feel you have over decisions concerning the future of your job?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

9. How much influence do you have over the availability of tools you need to do your work?

☐ Very little ☐ Little ☐ A moderate amount ☐ Much ☐ Very much

E. Now we would like to ask you to think about any symptoms you may have had.

1. Have you ever had any pain or discomfort (aching, tingling) in your head/neck, shoulder/upper arm, forearm/hand, back or leg/lower limb?
   ☐ YES ☐ NO ➜ If NO, go to Section F.
2. Have you had any pain or discomfort (aching/tingling) in your head/neck, shoulder/upper arm, forearm/hand, back, or leg/lower limb within the past 6 months? *(check box)*
   ☐ YES ☐ NO
3. Please complete a column in the table below for each area that bothers you.

		HEAD/ NECK	SHOULDER/ UPPER ARM	FOREARM/ HAND	BACK	LEG/ LOWER LIMB
In what month and year did you first notice your pain or discomfort? *(write in number)*		MO.___ YR.___	MO.___ YR.___	MO.___ YR.___	MO.___ YR.___	MO.___ YR.___
How often have you had separate episodes in the last year? *(check box)*	Pain is constant	☐	☐	☐	☐	☐
	Daily	☐	☐	☐	☐	☐
	One or more times a week	☐	☐	☐	☐	☐
	One or more times a month	☐	☐	☐	☐	☐
	Every 2-3 months	☐	☐	☐	☐	☐
	Every 6 months or more	☐	☐	☐	☐	☐
How long was each episode? *(check box)*	Less than 1 hour	☐	☐	☐	☐	☐
	1 hour to 1 day	☐	☐	☐	☐	☐
	More than 1 day to 1 week	☐	☐	☐	☐	☐
	More than 1 week to 1 month	☐	☐	☐	☐	☐
	More than 1 month to 5 months	☐	☐	☐	☐	☐
	More than 6 months	☐	☐	☐	☐	☐
How would you rate your pain or discomfort over the **last 7 days?** *(check box)*	None	☐	☐	☐	☐	☐
	Mild	☐	☐	☐	☐	☐
	Moderate	☐	☐	☐	☐	☐
	Severe	☐	☐	☐	☐	☐
	Unbearable	☐	☐	☐	☐	☐
In the **past 6 months**, how bad was your **worst** pain or discomfort? *(check box)*	None	☐	☐	☐	☐	☐
	Mild	☐	☐	☐	☐	☐
	Moderate	☐	☐	☐	☐	☐
	Severe	☐	☐	☐	☐	☐
	Unbearable	☐	☐	☐	☐	☐
In the **past 6 months**, on **average**, how intense was your pain or discomfort? *(check box)*	None	☐	☐	☐	☐	☐
	Mild	☐	☐	☐	☐	☐
	Moderate	☐	☐	☐	☐	☐
	Severe	☐	☐	☐	☐	☐
	Unbearable	☐	☐	☐	☐	☐
Prior to your current pain or discomfort, did you ever have an accident or sudden injury to this area? *(If yes, please indicate year.)* ☐ YES ☐ NO		YR.___	YR.___	YR.___	YR.___	YR.___
Do you think your pain or discomfort was caused or aggravated by your work? *(check box)*		☐ YES ☐ NO ☐ TO SOME EXTENT	☐ YES ☐ NO ☐ TO SOME EXTENT	☐ YES ☐ NO ☐ TO SOME EXTENT	☐ YES ☐ NO ☐ TO SOME EXTENT	☐ YES ☐ NO ☐ TO SOME EXTENT
Have you reported your pain or discomfort to your workplace? *(check box)*		☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO
If your pain or discomfort is in more than one area, please indicate which one has the **most** impact on you. *(check one box only)*		☐	☐	☐	☐	☐

F. For each statement below, please check the box with the one answer that best describes your workplace.

1. Safety is considered equally with production and quality goals in management thinking and day to day operations.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

2. Management is committed to keeping workers employed when injuries or disabilities occur.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

3. Management encourages employees to shut down an unsafe machine or stop the work process when an unsafe condition arises.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

4. Management encourages employees to promptly report physical symptoms arising from job tasks.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

5. Management encourages supervisors to provide "light duties" or reduced working hours for workers who are recovering from an injury.

☐ Strongly agree ☐ Agree ☐ Neither agree or disagree ☐ Disagree ☐ Strongly disagree

G. For the final part of this questionnaire, please open the envelope. You will find a set of pictures. Each picture is numbered. Using the following scale, please rate your confidence in doing each task so as to minimize risk of injury by choosing a corresponding number from the following rating scale:

0 %	10	20	30	40	50	60	70	80	90	100%
Not at all confident										Extremely confident

Go through one picture at a time and choose one of the percentage points on the scale from 0% which refers to not at all confident, to 100% which refers to extremely confident.

"How confident are you that you can minimize risk of back, shoulder and neck injury when you....

1. place a bottle on the floor? %
2. retrieve a small tool from the floor? _____ %
3. push and pull a vacuum cleaner? _____%
4. push and pull a shopping cart? _____%
5. place or retrieve a 5-pound box between waist and eye-level while standing on a step-stool? _____%
6. place or retrieve a 5-pound can between your waist and overhead? _____%
7. lower a 10 pound milk crate from eye-level to the floor? _____ %
8. lower a 10-pound milk crate from a bench to the floor? _____%
9. lift a 10-pound milk crate from the floor to eye-level? _____ %
10. lift a 10-pound milk crate from the floor to a bench? _____%
11. load a 20-pound grocery bag into the trunk of an automobile? _____%
12. lower a 20-pound milk crate from eye-level to the floor? _____%
13. unload a 20-pound grocery bag from the trunk of an automobile? _____%
14. lift a 20-pound milk crate from the floor to eye-level? _____%
15. unload two 10-pound grocery bags from the trunk of an automobile? _____%
16. lift a 20-pound tool box from the floor to a bench? _____%
17. paint with a small brush at eye-level? _____%

16. lift a 20-pound tool box from the floor to a bench? _____%
17. paint with a small brush at eye-level? _____%
18. drive nails with a hammer? _____%
19. wash dishes at a sink? _____%
20. trim shrubbery with a hedge trimmer? _____%
21. change a light-bulb overhead? _____%
22. install a face-plate on an electric outlet? _____%
23. cut a piece of lumber with a hand saw? _____%
24. pull a nail out of lumber with a claw hammer? _____%
25. pour liquid soap into a cup from a large container? _____%
26. use a dolley to move a large trash barrel? _____%
27. load or unload a dishwasher? _____%
28. dig in a garden with a spade-shovel? _____%
29. push open a heaving door? _____%
30. get into an automobile driver's seat? _____%
31. pull open a heavy door? _____%
32. get out of an automobile driver's seat? _____%
33. carry a 10-pound step-stool 50 feet? _____%
34. carry a 30-pound bucket 50 feet? _____%
35. carry a 20-pound sack of groceries for 100 feet? _____%
36. carry two 10-pound sacks of groceries fro 100 feet? _____%
37. climb a step-ladder? _____%
38. carry a 20-pound bucket up a step-ladder? _____%

39. sweep with a push-broom? _____%

40. sweep with a kitchen broom? _____%

41. lower a 50-pound milk crate from eye-level to the floor? _____%

42. lower a 50-pound tool box from a bench to the floor? _____%

43. lift a 50-pound milk crate from the floor to eye-level? _____%

44. lift a 50-pound tool box from the floor to a bench? _____%

45. lower a 100-pound milk crate from eye-level to the floor? _____%

46. lower a 100-pound milk crate from a bench to the floor? _____%

47. lift a 100-pound milk crate from the floor to eye-level? _____%

48. lift a 100-pound milk crate from the floor to a bench? _____%

49. paint with a small brush at eye level? _____%

50. place or retrieve a 5-pound can between waist and overhead? _____%

Thank you very much for completing this questionnaire. You are finished now. Your name will be entered into a draw for a prize.

Appendix H
Repeated Measures Overall Knowledge Quiz Scores
Average Knowledge Scores Pre and Post course quiz by Company

Subscale (Maximum Score)	Pre Course Quiz mean ± s.d.	Post Course Quiz mean ± s.d.
Move around after prolonged immobility (4 items) Overall companies	70.57 ± 30.95	90.74 ± 19.68
i) hotel	54.86 ± 38.64	77.14 ± 28.68
ii) plumbing	77.50 ± 18.45	94.44 ± 11.02
iii) chicken processing	84.09 ± 16.45	95.45 ± 12.52
iv) paintbrush manufacturing	53.57 ± 33.18	83.48 ± 24.90
v) clothing manufacturing	77.78 ± 23.20	97.22 ± 8.33
vi) broiler service	71.43 ± 26.73	100.00 ± 0.00
vii) electrical utilities	83.14 ± 22.18	97.96 ± 6.88
Avoid twisting the spine to extremes (4 items) Overall companies	58.96 ± 34.72	84.49 ± 27.55
i) hotel	36.81 ± 34.06	70.00 ± 36.28
ii) plumbing	72.50 ± 29.93	100.00 ± 0.00
iii) chicken processing	54.54 ± 32.40	90.91 ± 19.74
iv) paintbrush manufacturing	41.52 ± 34.47	68.30 ± 35.19
v) clothing manufacturing	63.89 ± 33.33	91.67 ± 12.50
vi) broiler service	53.57 ± 33.63	89.28 ± 13.36
vii) electrical utilities	79.07 ± 23.60	96.51 ± 7.63
Lightly tense torso muscles (5 items) Overall Companies	44.51 ± 32.54	84.64 ± 23.04
i) hotel	27.78 ± 26.31	74.28 ± 26.82
ii) plumbing	50.00 ± 28.67	88.89 ± 17.64
iii) chicken processing	46.36 ± 29.20	84.54 ± 22.19
iv) paintbrush manufacturing	34.28 ± 29.96	72.14 ± 29.21
v) clothing manufacturing	42.22 ± 35.28	86.67 ± 17.32
vi) broiler service	60.00 ± 25.82	94.28 ± 9.76
vii) electrical utilities	56.05 ± 33.58	95.58 ± 9.41
Keep the moment (torque) low at all joints (5 items) Overall companies	49.47 ± 29.58	86.34 ± 22.27
i) hotel	31.67 ± 32.20	70.29 ± 28.85

Subscale (Maximum Score)	Pre Course Quiz mean ± s.d.	Post Course Quiz mean ± s.d.
ii) plumbing	54.00 ± 21.19	95.56 ± 8.82
iii) chicken processing	51.82 ± 25.94	88.18 ± 22.81
iv) paintbrush manufacturing	34.28 ± 26.34	77.86 ± 26.61
v) clothing manufacturing	53.33 ± 28.28	84.44 ± 16.67
vi) broiler service	68.57 ± 25.45	94.28 ± 15.12
vii) electrical utilities	63.72 ± 24.06	96.51 ± 7.63
Keep the normal curve in the spine (5 items) Overall companies	47.52 ± 28.06	84.64 ± 23.19
i) hotel	31.11 ± 24.58	62.86 ± 29.56
ii) plumbing	66.00 ± 18.97	95.56 ± 8.82
iii) chicken processing	55.45 ± 27.55	89.09 ± 16.01
iv) paintbrush manufacturing	35.36 ± 25.86	77.50 ± 26.16
v) clothing manufacturing	44.44 ± 26.03	80.00 ± 26.46
vi) broiler service	60.00 ± 25.82	91.43 ± 10.69
vii) electrical utilities	57.44 ± 26.17	95.81 ± 9.76
Anatomy (2 items) Overall companies	45.80 ± 37.62	81.03 ± 31.18
i) hotel	20.83 ± 32.46	64.28 ± 41.25
ii) plumbing	70.00 ± 34.96	88.89 ± 22.05
iii) chicken processing	50.00 ± 37.80	81.82 ± 29.05
iv) paintbrush manufacturing	34.82 ± 35.57	78.57 ± 34.19
v) clothing manufacturing	50.00 ± 43.30	66.67 ± 35.35
vi) broiler service	64.28 ± 37.80	78.57 ± 26.73
vii) electrical utilities	57.56 ± 33.88	90.12 ± 21.45
Exercises (2 items) Overall Companies	53.54 ± 35.41	80.13 ± 29.50
i) hotel	40.28 ± 31.21	64.29 ± 35.50
ii) plumbing	75.00 ± 35.35	94.44 ± 16.67
iii) chicken processing	52.27 ± 32.65	84.09 ± 28.39
iv) paintbrush manufacturing	33.04 ± 37.27	69.64 ± 33.95
v) clothing manufacturing	72.22 ± 26.35	83.33 ± 25.00

Subscale (Maximum Score)	Pre Course Quiz mean ± s.d.	Post Course Quiz mean ± s.d.
vi) broiler service	50.00 ± 28.87	78.57 ± 26.73
vii) electrical utilities	68.60 ± 28.74	90.70 ± 19.57
True/False/Not Sure Total Quiz (27 items) Overall companies	52.75 ± 23.85	85.23 ± 19.67
i) hotel	34.88 ± 23.64	69.73 ± 26.91
ii) plumbing	64.44 ± 15.14	94.24 ± 5.27
iii) chicken processing	56.56 ± 18.54	88.38 ± 16.22
iv) paintbrush manufacturing	38.36 ± 23.43	75.59 ± 22.83
v) clothing manufacturing	55.97 ± 19.11	85.60 ± 10.71
vi) broiler service	61.90 ± 19.68	91.53 ± 6.66
vii) electrical utilities	66.19 ± 16.35	95.52 ± 5.02
Videoclip Total (10 items) Overall companies	46.50 ± 20.86	60.18 ± 22.92
i) hotel	29.72 ± 18.59	38.28 ± 24.43
ii) plumbing	37.78 ± 10.93	54.44 ± 16.67
iii) chicken processing	44.00 ± 10.75	51.36 ± 24.55
iv) paintbrush manufacturing	33.57 ± 18.43	46.06 ± 17.15
v) clothing manufacturing	46.67 ± 8.66	64.44 ± 7.26
vi) broiler service	47.14 ± 28.11	54.28 ± 18.13
vii) electrical utilities	48.14 ± 14.83	61.74 ± 15.73
Overall Score (37 items) Overall companies	51.06 ± 20.61	76.87 ± 17.60
i) hotel	33.48 ± 19.04	61.35 ± 22.40
ii) plumbing	58.92 ± 12.40	83.48 ± 7.46
iii) chicken processing	52.33 ± 15.73	78.38 ± 16.89
iv) paintbrush manufacturing	33.57 ± 18.43	67.86 ± 20.16
v) clothing manufacturing	53.45 ± 15.09	79.88 ± 7.16
vi) broiler service	57.91 ± 11.97	81.47 ± 8.89
vii) electrical utilities	61.31 ± 13.54	86.39 ± 6.01

Appendix I

Repeated Measures True/False Rather than I'm Not Sure

Average Scores of "True/False" rather than "I'm Not Sure" Pre and Post course quiz by Company

Subscale (Maximum Score)	Pre Course Quiz mean ± s.d.	Post Course Quiz mean ± s.d.
Move around after prolonged immobility (4 items) Overall companies	85.05 ± 24.25	98.16 ± 9.44
i) hotel	69.44 ± 36.91	94.83 ± 16.88
ii) plumbing	88.89 ± 13.18	100.00 ± 0.00
iii) chicken processing	93.18 ± 13.76	98.86 ± 5.33
iv) paintbrush manufacturing	80.68 ± 25.78	96.36 ± 13.10
v) clothing manufacturing	86.11 ± 18.16	100.00 ± 0.00
vi) broiler service	78.57 ± 26.73	100.00 ± 0.00
vii) electrical utilities	90.12 ± 19.28	99.71 ± 2.70
Avoid twisting the spine to extremes (4 items) Overall companies	78.01 ± 27.76	94.76 ± 17.70
i) hotel	56.25 ± 39.87	87.50 ± 28.50
ii) plumbing	83.33 ± 21.65	100.00 ± 0.00
iii) chicken processing	70.24 ± 29.17	97.62 ± 10.91
iv) paintbrush manufacturing	74.28 ± 27.44	87.73 ± 25.77
v) clothing manufacturing	77.78 ± 23.20	97.22 ± 8.33
vi) broiler service	75.00 ± 38.19	100.00 ± 0.00
vii) electrical utilities	87.21 ± 18.69	99.41 ± 3.81
Lightly tense torso muscles (5 items) Overall Companies	64.28 ± 32.18	90.00 ± 24.82
i) hotel	47.69 ± 35.36	100.00 ± 0.00
ii) plumbing	73.33 ± 28.28	97.14 ± 7.17
iii) chicken processing	68.00 ± 27.83	87.41 ± 23.08
iv) paintbrush manufacturing	61.87 ± 32.27	97.78 ± 6.67
v) clothing manufacturing	48.89 ± 33.33	100.00 ± 0.00
vi) broiler service	71.43 ± 32.37	99.53 ± 3.05
vii) electrical utilities	69.52 ± 30.96	94.95 ± 15.75

Subscale (Maximum Score)	Pre Course Quiz mean ± s.d.	Post Course Quiz mean ± s.d.
Keep the moment (torque) low at all joints (5 items) Overall companies	63.42 ± 26.74	95.81 ± 13.75
i) hotel	48.70 ± 36.59	92.59 ± 20.11
ii) plumbing	62.50 ± 19.82	100.00 ± 0.00
iii) chicken processing	60.95 ± 24.88	98.09 ± 6.02
iv) paintbrush manufacturing	59.39 ± 28.93	90.00 ± 21.14
v) clothing manufacturing	66.67 ± 14.14	93.33 ± 10.00
vi) broiler service	71.43 ± 27.94	97.14 ± 7.56
vii) electrical utilities	68.60 ± 23.37	99.53 ± 3.05
Keep the normal curve in the spine (5 items) Overall companies	77.19 ± 28.48	97.05 ± 12.71
i) hotel	64.44 ± 38.56	91.20 ± 23.15
ii) plumbing	86.67 ± 14.14	97.78 ± 6.67
iii) chicken processing	83.00 ± 24.52	99.05 ± 4.36
iv) paintbrush manufacturing	74.05 ± 24.88	94.34 ± 17.71
v) clothing manufacturing	71.11 ± 28.48	100.00 ± 0.00
vi) broiler service	77.14 ± 31.47	100.00 ± 0.00
vii) electrical utilities	80.96 ± 27.21	99.30 ± 4.80
Anatomy (2 items) Overall companies	72.28 ± 35.95	94.81 ± 20.57
i) hotel	44.23 ± 40.81	88.46 ± 29.35
ii) plumbing	72.22 ± 36.32	100.00 ± 0.00
iii) chicken processing	68.18 ± 36.34	93.18 ± 23.38
iv) paintbrush manufacturing	71.59 ± 36.40	87.74 ± 30.86
v) clothing manufacturing	77.78 ± 26.35	100.00 ± 0.00
vi) broiler service	85.71 ± 37.80	100.00 ± 0.00
vii) electrical utilities	80.59 ± 30.95	100.00 ± 0.00
Exercises (2 items) Overall Companies	74.23 ± 33.07	91.71 ± 20.47
i) hotel	60.42 ± 36.05	90.38 ± 20.09
ii) plumbing	88.89 ± 22.05	100.00 ± 0.00
iii) chicken processing	61.90 ± 35.02	95.24 ± 15.04

Subscale (Maximum Score)	Pre Course Quiz mean ± s.d.	Post Course Quiz mean ± s.d.
iv) paintbrush manufacturing	61.84 ± 39.31	81.13 ± 29.78
v) clothing manufacturing	83.33 ± 25.00	88.89 ± 22.05
vi) broiler service	71.43 ± 39.34	92.86 ± 18.90
vii) electrical utilities	84.30 ± 25.74	97.09 ± 11.77
True/False/Not Sure Total Quiz (27 items) Overall companies	74.30 ± 20.93	97.19 ± 8.52
i) hotel	55.56 ± 32.38	93.30 ± 15.81
ii) plumbing	76.85 ± 16.88	100.00 ± 100.00
iii) chicken processing	74.27 ± 18.33	98.85 ± 3.28
iv) paintbrush manufacturing	70.37 ± 23.24	92.92 ± 12.08
v) clothing manufacturing	70.78 ± 14.63	98.56 ± 1.54
vi) broiler service	75.13 ± 27.69	99.69 ± 0.76
vii) electrical utilities	80.00 ± 14.59	99.65 ± 1.07
Videoclip Total (10 items) Overall companies	89.51 ± 20.78	97.18 ± 11.93
i) hotel	78.46 ± 28.80	87.69 ± 28.89
ii) plumbing	97.78 ± 6.67	100.00 ± 0.00
iii) chicken processing	87.27 ± 23.54	100.00 ± 0.00
iv) paintbrush manufacturing	84.08 ± 27.07	95.09 ± 9.53
v) clothing manufacturing	91.11 ± 14.53	100.00 ± 0.00
vi) broiler service	100.00 ± 0.00	100.00 ± 0.00
vii) electrical utilities	94.82 ± 11.19	100.00 ± 0.00
Overall Score (37 items) Overall companies	82.81 ± 15.21	96.71 ± 10.45
i) hotel	64.94 ± 26.72	96.12 ± 11.26
ii) plumbing	87.18 ± 9.08	100.00 ± 0.00
iii) chicken processing	82.40 ± 12.82	97.71 ± 6.57
iv) paintbrush manufacturing	78.86 ± 15.10	91.05 ± 18.04
v) clothing manufacturing	80.95 ± 9.72	97.12 ± 3.09
vi) broiler service	88.89 ± 14.67	98.94 ± 1.81
vii) electrical utilities	87.21 ± 9.78	99.33 ± 2.10

Appendix J

Item Difficulty and PPDI Index Analyses for True/False/Not Sure Items

Item	Response	Pretest Results (n=219)		Posttest Results (n=219)		PPDI	Rank
		% (n) Response	Item Difficulty	% (n) Response	Item Difficulty		
A. Subscale - Move around after prolonged immobility							
A1. Get out of bed one hour before work.	True* False Not Sure Missing	68(149/219) 16(36/219) 14(31/219) 1(3/219)	0.68	98(214/219) 2 (5/219) 0 (0/219) 0(0/219)	0.98	0.3	18
A2. Risk of injury is minimal if you handle materials immediately after getting out of bed.	True False* Not Sure Missing	10(22/219) 76(166/219) 10(22/219) 4(9/219)	0.76	6(14/219) 90(198/219) 2(5/219) 1(2/219)	0.9	0.14	26
A3. Moving around after sitting for a long period of time allows the ligaments to return to normal length.	True* False Not Sure Missing	64(140/219) 9(20/219) 22 (48/219) 5(11/219)	0.64	94(206/219) 4(8/219) 2(4/219) 0.5(1/219)	0.94	0.3	18
A4. Staying in the same posture for a long time minimizes risk of injury.	True False* Not Sure Missing	7(16/219) 75(165/219) 10(23/219) 7(15/219)	0.75	11(24/219) 85(186/219) 4(8/219) 0.5(1/219)	0.85	0.1	27
B. Subscale - Avoid Twisting the spine to extremes							
B1. Twist the spine to its extreme to stretch the ligaments before lifting.	True False * Not Sure Missing	20(45/219) 59(129/219) 16(35/219) 5(10/219)	0.59	12 (27/219) 84(184/219) 3 (6/219) 1(2/219)	0.84	0.31	15

Item	Response	Pretest Results (n=219)		Posttest Results (n=219)		PPDI	Rank
		% (n) Response	Item Difficulty	% (n) Response	Item Difficulty		
B2. Twisting the spine to extremes will minimize the forces on facets.	True False * Not Sure Missing	5(12/219) 54(118/219) 31(68/219) 10(21/219)	0.54	7(15/219) 85(187/219) 6(13/219) 2(4/219)	0.85	0.31	15
B3. Twisting when the trunk is also bent forward increases the likelihood of injury.	True * False Not Sure Missing	56(123/219) 12(26/219) 20(45/219) 11(25/219)	0.56	80(175/219) 11(25/219) 7(15/219) 2(4/219)	0.8	0.24	21
B4. Keeping the shoulders parallel to the pelvis minimizes the risk of injury.	True * False Not Sure Missing	69(152/219) 5(10/219) 17(37/219) 9(20/219)	0.69	90(198/219) 2(4/219) 7(15/219) 1(2/219)	0.9	0.21	22
C. Subscale - Lightly tense torso muscles							
C1. Contract torso muscles before he starts lifting.	True* False Not Sure Missing	53(117/219) 17(38/219) 26(57/219) 3(7/219)	0.53	96(210/219) 2 (4/219) 2 (4/219) .5(1/219)	0.96	0.43	5
C2. Lightly tense arm and back muscles before lifting.	True * False Not Sure Missing	50(110/219) 26(58/219) 19(42/219) 4(9/219)	0.5	90(198/219) 4(8/219) 5(10/219) 1(3/219)	0.9	0.4	8
C3. Gently contracting torso muscles before handling loads increases risk of low back injury.	True False * Not Sure Missing	19(41/219) 36(79/219) 38(83/219) 7(16/219)	0.36	21(46/219) 73(160/219) 5(10/219) 1(3/219)	0.74	0.38	10
C4. Gently contracting torso muscles before handling materials reduces the risk of "surprise" loads on the tissues.	True * False Not Sure Missing	49(107/219) 5(12/219) 38(83/219) 8(17/219)	0.49	85(187/219) 5(12/219) 9(19/219) 0.5(1/219)	0.85	0.36	12

Item	Response	Pretest Results (n=219)		Posttest Results (n=219)		PPDI	Rank
		% (n) Response	Item Difficulty	% (n) Response	Item Difficulty		
C5. The spinal column is stabilized by gently contracting torso muscles.	True * False Not Sure Missing	36(80/219) 8(17/219) 47(104/219) 8(18/219)	0.36	80(176/219) 10(22/219) 8(18/219) 1(3/219)	0.8	0.44	4
D. Subscale - Keep the moment (torque) low at all joints.							
D1. Keep loads close to the body.	True * False Not Sure Missing	84(184/219) 3(6/219) 8(17/219) 5(12/219)	0.84	97(211/219) 1(2/219) 1(3/219) 1(3/219)	0.96	0.12	25
D2. Working with hands above the head can pinch nerves and blood vessels in the shoulder.	True * False Not Sure Missing	51(112/219) 4(9/219) 34(74/219) 11(24/219)	0.51	91(200/219) 2(4/219) 5(10/219) 2(5/219)	0.92	0.41	7
D3. A moment (torque) is the most important principle for understanding how back and upper limb injuries occur.	True * False Not Sure Missing	31(67/219) 1(3/219) 55(121/219) 13(28/219)	0.31	91(199/219) 0 (0/219) 7(15/219) 2(5/219)	0.91	0.6	1
D4. Disc compression increases when the low back moment is high.	True * False Not Sure Missing	31(69/219) 6(13/219) 50(110/219) 12(27/219)	0.31	87(190/219) 3(7/219) 7(16/219) 3(6/219)	0.87	0.56	2
D5. Holding a load in the hands far away from the body decreases the shoulder moment.	True False * Not Sure Missing	18(40/219) 52(114/219) 17(38/219) 12(27/219)	0.52	24(52/219) 70(154/219) 4(8/219) 2(5/219)	0.7	0.18	23
E. Subscale - Keep the normal curve in the spine.							

Item	Response	Pretest Results (n=219)		Posttest Results (n=219)		PPDI	Rank
		% (n) Response	Item Difficulty	% (n) Response	Item Difficulty		
E1. Roll his shoulders forward while lifting.	True False • Not Sure Missing	18 (40/219) 48(105/219) 30 (65/219) 4(9/219)	0.48	19(42/219) 75(164/219) 5(11/219) 1(2/219)	0.75	0.27	20
E2. Keep the normal curve while lifting.	True * False Not Sure Missing	49(107/219) 27(60/219) 18(39/219) 6(13/219)	0.49	92(202/219) 4(9/219) 2(4/219) 2(4/219)	0.92	0.43	5
E3. Relax her back muscles while lifting.	True False * Not Sure Missing	40(88/219) 36(80/219) 20 (43/219) 4(8/219)	0.36	22(48/219) 73(161/219) 3(7/219) 1(3/219)	0.73	0.37	11
E4. Keeping the normal curve in the spine helps to distribute load evenly on the discs.	True * False Not Sure Missing	61(133/219) 8(17/219) 22(48/219) 10(21/219)	0.61	92(201/219) 3(7/219) 4(8/219) 1(3/219)	0.92	0.31	15
E5. Sticking your butt out and bending your knees helps to keep the normal curve in the spine.	True * False Not Sure Missing	45(99/219) 25(54/219) 21(47/219) 9(19/219)	0.45	95(208/219) 1(2/219) 3(7/219) 1(2/219)	0.95	0.5	3
F. Subscale - Anatomy							
F1. Ligaments heal faster than muscles.	True False * Not Sure Missing	10(22/219) 50(110/219) 35(76/219) 5(11/219)	0.5	10(21/219) 82(179/219) 7(15/219) 2(4/219)	0.82	0.32	14
F2. Muscles are under voluntary control.	True * False Not Sure Missing	42(93/219) 32(70/219) 19(41/219) 7(15/219)	0.42	81(178/219) 13(29/219) 4(9/219) 4(9/219)	0.81	0.39	9
G. Subscale - Exercises							

Item	Response	Pretest Results (n=219)		Posttest Results (n=219)		PPDI	Rank
		% (n) Response	Item Difficulty	% (n) Response	Item Difficulty		
G1. Regularly performing exercises that improve torso muscle endurance helps to increase stability of the spine.	True * False Not Sure Missing	76(166/219) 2(4/219) 14(30/219) 9(19/219)	0.76	94(207/219) 0.5(1/219) 5(10/219) 0.5(1/219)	0.94	0.18	23
G2. Touching your elbows to your knees minimizes risk of low back injury when doing situps.	True False * Not Sure Missing	24(52/219) 32(70/219) 33(72/219) 11(25/219)	0.32	16(36/219) 68(148/219) 12(27/219) 4(8/219)	0.68	0.36	12

*** denotes a correct response**

Item Discrimination Index for Knowledge Quiz

Item	Item Discrimination Index -Pre	Item Discrimination Index -Post
A. Subscale - Move around after prolonged immobility		
A1. Get out of bed one hour before work.	0.26	0.26
A2. Risk of injury is minimal if you handle materials immediately after getting out of bed.	0.40	0.40
A3. Moving around after sitting for a long period of time allows the ligaments to return to normal length.	0.34	0.34
A4. Staying in the same posture for a long time minimizes risk of injury.	0.50	0.50
B. Subscale - Avoid twisting the spine to extremes		
B1. Twist the spine to its extreme to stretch the ligaments before lifting.	0.35	0.35
B2. Twisting the spine to extremes will minimize the forces on facets.	0.42	0.42
B3. Twisting when the trunk is also bent forward increases the likelihood of injury.	0.50	0.49
B4. Keeping the shoulders parallel to the pelvis minimizes the risk of injury.	0.63	0.63
C. Subscale - Lightly tense torso muscles		
C1. Contract torso muscles before he starts lifting.	0.42	0.42
C2. Lightly tense arm and back muscles before lifting.	0.25	0.25
C3. Gently contracting torso muscles before handling loads increases risk of low back injury.	0.38	0.38
C4. Gently contracting torso muscles before handling materials reduces the risk of "surprise" loads on the tissues.	0.53	0.53
C5. The spinal column is stabilized by gently contracting torso muscles.	0.41	0.41
D. Subscale - Keep the moment (torque) low at all joints		
D1. Keep loads close to the body.	0.44	0.44

Item	Item Discrimination Index -Pre	Item Discrimination Index -Post
D2. Working with hands above the head can pinch nerves and blood vessels in the shoulder.	0.51	0.51
D3. A moment (torque) is the most important principle for understanding how back and upper limb injuries occur.	0.28	0.28
D4. Disc compression increases when the low back moment is high.	0.22	0.21
D5. Holding a load in the hands far away from the body decreases the shoulder moment.	0.44	0.44
E. Subscale - Keep the normal curve in the spine		
E1. Roll his shoulders forward while lifting.	0.29	0.29
E2. Keep the normal curve while lifting.	0.13	0.13
E3. Relax her back muscles while lifting.	0.31	0.31
E4. Ligaments heal faster than muscles.	0.47	0.47
E5. Sticking your butt out and bending your knees helps to keep the normal curve in the spine.	0.14	0.14
F. Subscale - Anatomy		
F1. Regularly performing exercises that improve torso muscle endurance helps to increase stability of the spine.	0.52	0.52
F2. Touching your elbows to your knees minimizes risk of low back injury when doing situps.	0.35	0.35
F. Subscale - Exercises		
F1. Muscles are under voluntary control.	0.30	0.30
F2. Keeping the normal curve in the spine helps to distribute load evenly on the discs.	0.53	0.52

Item Difficulty and PPDI Index Analyses for Video Clips

Item	Response	Pretest Results (n=219)		Posttest Results (n=219)		PPDI	Rank
		% (n) Response	Item Difficulty	% (n) Response	Item Difficulty		
1. Risk of injury in clip one (moving crate to shelf) is:	High* Low Not Sure	76(167/219) 17(38/219) 5(11/219)	0.76	82(179/219) 15(34/219) 1(3/219)	0.82	0.1	8
2. If risk is high, the injury risk factors include:	1. Location * 2. Weight 3. Moment * 4. Low Back Curve 5. Twist 6. Handling after prolonged immobility	62(136/219) 22(49/219) 28(62/219) 21(47/219) 10(22/219) 5(11/219)	0.21	75(165/219) 36(79/219) 55(121/219) 16(36/219) 8(18/219) 4(8/219)	0.47	0.26	2
3. Risk of injury in clip two (twist and move crate to shelf) is:	High * Low Not Sure	74(162/219) 20(44/219) 5(11/219)	0.74	81(178/219) 15(33/219) 2(4/219)	0.81	0.1	7
4. If risk is high, the injury risk factors include:	1. Location 2. Weight 3. Moment 4. Low Back Curve 5. Twist * 6. Handling after prolonged immobility	22(48/219) 18(39/219) 27(60/219) 11(24/219) 74(163/219) 4(8/219)	0.74	27(60/219) 26(57/219) 25(55/219) 5(10/219) 84(184/219) 4(8/219)	0.84	0.1	6
5. Risk of injury in clip three (pick up nut & bolt from floor) is:	High * Low Not Sure	47(103/219) 53(117/219) 12(27/219)	0.47	53(117/219) 42(93/219) 3(6/219)	0.53	0.1	8

Item	Response	Pretest Results (n=219)		Posttest Results (n=219)		PPDI	Rank
		% (n) Response	Item Difficulty	% (n) Response	Item Difficulty		
6. If risk is high, the injury risk factors include:	1. Location * 2. Weight 3. Moment * 4. Low Back Curve * 5. Twist 6. Handling after prolonged immobility	19(41/219) 6(13/219) 20(43/219) 41(89/219) 3(6/219) 3(6/219)	0.05	23(51/219) 2(5/219) 36(78/219) 60(132/219) 2(4/219) 1(2/219)	0.11	0.1	8
7. Risk of injury in clip four (sit at computer for 2 hours) is:	High * Low Not Sure	66(144/219) 24(52/219) 9(19/219)	0.66	84(183/219) 11(24/219) 2(4/219)	0.84	0.18	4
8. If risk is high, the injury risk factors include:	1. Location 2. Weight 3. Moment 4. Low Back Curve 5. Twist 6. Handling after * prolonged immobility	13(29/219) 14(31/219) 12(27/219) 14(30/219) 6(13/219) 68(149/219)	0.68	19(42/219) 17(38/219) 12(27/219) 3(6/219) 7(16/219) 81(178/219)	0.81	0.13	5
9. Risk of injury in clip five (put phone book on top shelf) is:	High * Low Not Sure	28(62/219) 47(102/219) 22(48/219)	0.28	59(129/219) 32(70/219) 6(14/219)	0.59	0.31	1
10. If risk is high, the injury risk factors include:	1. Location * 2. Weight 3. Moment * 4. Handling after prolonged immobility	37(82/219) 15(34/219) 13(29/219) 6(13/219)	0.09	60(131/219) 26(58/219) 38(84/219) 6(13/219)	0.28	0.19	3

* denotes the most correct answer.
For the risk factors, all correct answers were required for the answer to be considered correct.

Item Discrimination Indices for Video Clips

Item	Item Discrimination Index -Pre	Item Discrimination Index - Post
1. Risk of injury in clip one (moving crate to shelf) is:	0.30	0.30
2. If risk is high, the injury risk factors include:	0.18	0.18
3. Risk of injury in clip two (twist and move crate to shelf) is:	0.31	0.31
4. If risk is high, the injury risk factors include:	0.52	0.52
5. Risk of injury in clip three (pick up nut & bolt from floor) is:	0.03	0.03
6. If risk is high, the injury risk factors include:	0.08	0.08
7. Risk of injury in clip four (sit at computer for 2 hours) is:	0.16	0.16
8. If risk is high, the injury risk factors include:	0.42	0.42
9. Risk of injury in clip five (put phone book on top shelf) is:	0.05	0.05
10. If risk is high, the injury risk factors include:	0.10	0.10

Appendix K

Responses Pre and Post Course All Companies

Company	Pre Course	Post Course		Test Statistic Chi-square Significance
		Incorrect	Correct	
A. Subscale - Move around after prolonged immobility				
A1. Get out of bed one hour before work.	**Incorrect**	4	66	61.134 <.0001
	Correct	1	148	
A2. Risk of injury is minimal if you handle materials immediately after getting out of bed.	**Incorrect**	15	37	19.114 <.0001
	Correct	7	160	
A3. Moving around after sitting for a long period of time allows the ligaments to return to normal length.	**Incorrect**	10	69	58.681 <.0001
	Correct	3	137	
A4. Staying in the same posture for a long time minimizes risk of injury.	**Incorrect**	22	32	8.205 0.004
	Correct	12	153	
B. Subscale - Avoid Twisting the spine to extremes				
B1. Twist the spine to its extreme to stretch the ligaments before lifting.	**Incorrect**	24	66	39.803 <.0001
	Correct	10	119	
B2. Twisting the spine to extremes will minimize the forces on facets.	**Incorrect**	28	73	60.052 <.0001
	Correct	4	114	
B3. Twisting when the trunk is also bent forward increases the likelihood of injury.	**Incorrect**	35	62	38.085 <.0001
	Correct	9	113	
B4. Keeping the shoulders parallel to the pelvis minimizes the risk of injury.	**Incorrect**	16	51	36.161 <.0001
	Correct	5	147	
C. Subscale - Lightly tense torso muscles				
C1. Contract torso muscles before he starts lifting.	**Incorrect**	5	98	84.79 <.0001
	Correct	4	112	
C2. Lightly tense arm and back muscles before lifting.	**Incorrect**	15	93	74.707 <.0001
	Correct	6	105	

Company	Pre Course	Post Course		Test Statistic Chi-square Significance
		Incorrect	Correct	
C3. Gently contracting torso muscles before handling loads increases risk of low back injury.	Incorrect	42	97	58.580 <.0001
	Correct	15	65	
C4. Gently contracting torso muscles before handling materials reduces the risk of "surprise" loads on the tissues.	Incorrect	26	87	68.817 <.0001
	Correct	6	100	
C5. The spinal column is stabilized by gently contracting torso muscles.	Incorrect	38	101	82.579 <.0001
	Correct	6	74	
D. Subscale - Keep the moment (torque) low at all joints.				
D1. Keep loads close to the body.	Incorrect	6	29	21.806 <.0001
	Correct	2	182	
D2. Working with hands above the head can pinch nerves and blood vessels in the shoulder.	Incorrect	18	89	81.275 <.0001
	Correct	2	110	
D3. A moment (torque) is the most important principle for understanding how back and upper limb injuries occur.	Incorrect	19	133	128.067 <.0001
	Correct	1	66	
D4. Disc compression increases when the low back moment is high.	Incorrect	26	124	110.633 <.0001
	Correct	4	65	
D5. Holding a load in the hands far away from the body decreases the shoulder moment.	Incorrect	44	61	18.549 <.0001
	Correct	21	93	
E. Subscale - Keep the Normal Curve in the Spine				
E1. Roll his shoulders forward while lifting.	Incorrect	39	75	39.967 <.0001
	Correct	16	89	
E2. Keep the normal curve while lifting.	Incorrect	12	100	84.152 <.0001
	Correct	5	102	
E3. Relax her back muscles while lifting.	Incorrect	54	84	68.360 <.0001
	Correct	5	76	

Company	Pre Course	Post Course		Test Statistic Chi-square Significance
		Incorrect	Correct	
E4. Keeping the normal curve in the spine helps to distribute load evenly on the discs.	Incorrect	13	73	57.551 <.0001
	Correct	5	128	
E5. Sticking your butt out and bending your knees helps to keep the normal curve in the spine.	Incorrect	10	109	101.225 <.0001
	Correct	2	98	
F. Subscale - Anatomy				
F1. Ligaments heal faster than muscles.	Incorrect	30	80	52.900 <.0001
	Correct	10	99	
F2. Muscles are under voluntary control.	Incorrect	32	93	69.861 <.0001
	Correct	8	86	
G. Subscale - Exercises				
G1. Regularly performing exercises that improve torso muscle endurance helps to increase stability of the spine.	Incorrect	12	42	37.209 <.0001
	Correct	1	164	
G2. Touching your elbows to your knees minimizes risk of low back injury when doing situps.	Incorrect	64	85	64.446 <.0001
	Correct	7	63	
E. Subscale - Videoclips				
1. Risk of injury in clip one (moving crate to shelf) is:	Incorrect	23	29	2.128 0.145
	Correct	18	149	
2. If risk is high, the injury risk factors include:	Incorrect	109	64	39.945 <.0001
	Correct	9	37	
3. Risk of injury in clip two (twist and move crate to shelf) is:	Incorrect	31	26	5.297 0.021
	Correct	11	151	
4. If risk is high, the injury risk factors include:	Incorrect	28	28	11.429 0.001
	Correct	7	156	
5. Risk of injury in clip three (pick up nut & bolt from floor) is:	Incorrect	68	48	1.735 0.188
	Correct	35	68	

Company	Pre Course	Post Course		Test Statistic Chi-square Significance
		Incorrect	Correct	
6. If risk is high, the injury risk factors include:	**Incorrect**	190	18	Binomial Distribution 0.011
	Correct	5	6	
7. Risk of injury in clip four (sit at computer for 2 hours) is:	**Incorrect**	29	46	27.245 <.0001
	Correct	7	137	
8. If risk is high, the injury risk factors include:	**Incorrect**	37	33	19.184 <.0001
	Correct	5	144	
9. Risk of injury in clip five (put phone book on top shelf) is:	**Incorrect**	78	79	47.868 <.0001
	Correct	12	50	
10. If risk is high, the injury risk factors include:	**Incorrect**	153	47	30.189 <.0001
	Correct	6	13	

Appendix L

Pre and Post Course Self Efficacy Item Analysis by Company

Sort Item: How confident are you that you can minimize risk of back, shoulder and neck injury when you...		Hotel N=21 Mean (Standard Deviation)	Broiler Service N=5 Mean (Standard Deviation)	Clothing Warehouse N=7 Mean (Standard Deviation)	Plumbing N=7 Mean (Standard Deviation)	Chicken Processing N=16 Mean (Standard Deviation)	Electrical Utilities N=48 Mean (Standard Deviation)	Overall N=103 Mean (Standard Deviation)
1. Place a bottle on the floor	Pre	68.57 (29.71)	76.67 (40.41)	90.00 (8.16)	94.00 (8.94)	70.00 (35.96)	85.45 (21.83)	79.69 (26.93)
	Post	74.76 (27.13)	82.00 (26.83)	91.43 (9.00)	90.00 (10.00)	94.31 (10.90)	86.67 (23.55)	85.68 (22.35)
2. Retrieve a small tool from the floor	Pre	73.81 (29.41)	76.67 (40.41)	90.00 (8.16)	86.00 (20.74)	73.81 (32.69)	88.52 (17.80)	82.46 (24.56)
	Post	78.57 (27.44)	84.00 (26.08)	91.43 (9.00)	90.00 (10.00)	93.06 (14.45)	91.46 (13.68)	88.62 (18.24)
3. Push and pull a vacuum cleaner	Pre	66.24 (33.88)	76.67 (40.41)	84.29 (18.13)	80.00 (23.45)	79.38 (27.20)	82.73 (22.96)	78.34 (26.83)
	Post	69.52 (30.90)	90.00 (14.14)	91.43 (9.00)	82.00 (10.95)	91.81 (11.63)	89.38 (13.90)	85.48 (19.67)
4. Push and pull a shopping cart	Pre	76.19 (28.72)	76.67 (40.41)	85.71 (19.02)	84.00 (18.17)	78.13 (31.88)	88.64 (18.87)	83.33 (24.44)
	Post	69.52 (35.14)	90.00 (14.14)	90.00 (12.91)	84.00 (15.17)	94.94 (8.13)	93.75 (9.59)	88.03 (20.49)
5. Place or retrieve a 5-pound box between waist and eye	Pre	64.95 (31.23)	73.33 (30.55)	68.57 (34.85)	80.00 (20.00)	73.13 (32.40)	87.09 (17.90)	77.95 (26.66)
	Post	70.25 (25.78)	86.00 (21.91)	85.00 (19.36)	82.00 (13.04)	91.19 (10.83)	88.54 (17.65)	84.64 (19.87)
6. Place or retrieve a 5-pound box between waist and eye	Pre	67.95 (31.81)	73.33 (30.55)	77.14 (18.90)	84.00 (18.17)	75.00 (29.89)	85.11 (20.67)	78.78 (25.46)
	Post	64.74 (31.16)	84.00 (26.08)	79.29 (25.24)	80.00 (14.14)	88.69 (14.03)	86.15 (17.51)	81.59 (22.35)
7. Lower a 10 pound milk crate from eye-level to the floor	Pre	68.38 (31.26)	73.33 (30.55)	75.71 (20.70)	82.00 (17.89)	69.38 (31.30)	80.23 (21.94)	75.38 (25.86)
	Post	64.76 (19.90)	84.00 (23.02)	68.57 (24.10)	80.00 (14.14)	88.69 (12.53)	84.27 (19.02)	79.65 (20.30)

Sort Item: How confident are you that you can minimize risk of back, shoulder and neck injury when you...		**Hotel N=21** Mean (Standard Deviation)	**Broiler Service N=5** Mean (Standard Deviation)	**Clothing Warehouse N=7** Mean (Standard Deviation)	**Plumbing N=7** Mean (Standard Deviation)	**Chicken Processing N=16** Mean (Standard Deviation)	**Electrical Utilities N=48** Mean (Standard Deviation)	**Overall N=103** Mean (Standard Deviation)
8. Lower a 10-pound milk crate from a bench to the floor	Pre	65.14 (32.52)	76.67 (25.17)	77.14 (19.76)	86.00 (13.42)	66.87 (30.49)	84.77 (17.45)	76.75 (25.17)
	Post	70.71 (20.27)	88.00 (16.43)	79.29 (24.57)	88.00 (13.04)	91.19 (10.83)	88.12 (17.97)	84.40 (18.93)
9. Lift a 10-pound milk crate from the floor to eye-level	Pre	58.95 (34.63)	80.00 (20.00)	74.29 (19.02)	84.00 (15.17)	60.67 (34.53)	81.25 (20.26)	72.66 (27.75)
	Post	60.95 (26.82)	88.00 (17.89)	68.57 (27.95)	80.00 (12.25)	88.69 (13.05)	86.67 (17.70)	80.19 (22.34)
10. Lift a 10-pound milk crate from the floor to a bench	Pre	61.71 (32.68)	80.00 (20.00)	78.57 (18.64)	88.00 (13.04)	69.33 (30.81)	80.11 (21.25)	74.64 (26.09)
	Post	61.43 (29.71)	86.00 (19.49)	72.86 (27.36)	86.00 (13.42)	89.94 (12.60)	88.85 (16.02)	82.00 (22.63)
11. Load a 20-pound grocery bag into the trunk of an automobile	Pre	58.38 (31.83)	73.33 (23.09)	68.57 (27.34)	82.00 (17.89)	60.33 (36.33)	77.50 (24.67)	70.01 (29.00)
	Post	57.62 (26.44)	82.00 (24.90)	78.57 (15.74)	78.00 (13.04)	89.31 (14.31)	84.58 (15.70)	78.91 (21.37)
12. Lower a 20-pound milk crate from eye-level to the floor	Pre	55.43 (33.82)	70.00 (26.46)	62.86 (25.63)	80.00 (18.71)	64.33 (30.52)	76.02 (24.37)	68.67 (28.33)
	Post	52.86 (29.86)	86.00 (29.49)	65.71 (26.37)	80.00 (12.25)	85.69 (14.11)	81.98 (19.34)	75.55 (24.47)
13. Unload a 20 pound grocery bag from the trunk of an automobile	Pre	54.62 (33.31)	73.33 (23.09)	68.57 (26.73)	80.00 (21.21)	66.33 (32.76)	75.45 (24.70)	69.07 (28.72)
	Post	58.57 (25.94)	80.00 (27.39)	73.33 (17.80)	78.00 (13.04)	88.06 (15.96)	81.67 (18.60)	77.12 (22.15)

Sort Item: How confident are you that you can minimize risk of back, shoulder and neck injury when you...		**Hotel N=21** Mean (Standard Deviation)	**Broiler Service N=5** Mean (Standard Deviation)	**Clothing Warehouse N=7** Mean (Standard Deviation)	**Plumbing N=7** Mean (Standard Deviation)	**Chicken Processing N=16** Mean (Standard Deviation)	**Electrical Utilities N=48** Mean (Standard Deviation)	**Overall N=103** Mean (Standard Deviation)
14. Lift a 20-pound milk crate from the floor to eye-level	Pre	50.81 (33.78)	73.33 (23.09)	58.57 (27.95)	82.00 (16.43)	65.67 (30.99)	76.02 (23.71)	67.76 (28.82)
	Post	58.10 (25.62)	86.00 (19.49)	65.71 (28.78)	78.00 (13.04)	84.00 (14.21)	80.83 (20.79)	75.73 (23.07)
15. Unload two 10-pound grocery bags from the trunk of an automobile	Pre	58.90 (34.11)	73.33 (23.09)	71.43 (24.10)	88.00 (13.04)	66.67 (34.78)	80.00 (21.67)	72.81 (28.00)
	Post	61.90 (25.42)	88.00 (16.43)	74.29 (16.44)	78.00 (13.04)	90.56 (12.85)	83.65 (16.88)	79.55 (20.40)
16. Lift a 20-pound tool box from the floor to a bench	Pre	45.57 (35.16)	73.33 (23.09)	60.00 (28.28)	88.00 (13.04)	66.67 (34.78)	80.34 (21.58)	69.18 (30.58)
	Post	64.29 (26.94)	80.00 (28.28)	66.43 (27.19)	88.00 (13.04)	87.44 (14.32)	84.79 (15.57)	79.65 (21.36)
17. Paint with a small brush at eye-level	Pre	66.67 (34.54)	76.67 (40.41)	87.14 (11.13)	84.00 (15.17)	72.00 (32.56)	87.27 (18.97)	79.79 (26.62)
	Post	72.14 (32.04)	90.00 (14.14)	92.86 (12.54)	84.00 (15.17)	92.44 (11.21)	91.75 (13.18)	87.43 (19.84)
18. Drive nails with a hammer	Pre	58.62 (35.74)	70.00 (36.06)	82.86 (20.59)	88.00 (13.04)	78.67 (27.48)	87.61 (19.41)	78.91 (27.46)
	Post	69.05 (30.32)	90.00 (14.14)	90.00 (15.28)	88.00 (13.04)	96.19 (7.16)	92.71 (14.10)	87.83 (20.17)
19. Wash dishes at a sink	Pre	75.50 (30.69)	66.67 (41.63)	90.00 (12.91)	88.00 (13.04)	76.67 (35.39)	87.61 (19.63)	82.82 (25.63)
	Post	75.24 (26.39)	86.00 (13.42)	97.14 (7.56)	86.00 (13.42)	93.69 (13.57)	92.38 (11.79)	88.75 (17.36)
20. Trim shrubbery with a hedge trimmer	Pre	66.50 (27.96)	70.00 (36.06)	79.29 (25.24)	84.00 (11.40)	70.00 (35.05)	82.56 (19.50)	76.51 (25.46)
	Post	69.52 (27.11)	86.00 (19.49)	85.00 (22.55)	80.00 (14.14)	92.44 (12.87)	86.04 (15.78)	83.27 (19.91)

Sort Item: How confident are you that you can minimize risk of back, shoulder and neck injury when you...		**Hotel N=21** Mean (Standard Deviation)	**Broiler Service N=5** Mean (Standard Deviation)	**Clothing Warehouse N=7** Mean (Standard Deviation)	**Plumbing N=7** Mean (Standard Deviation)	**Chicken Processing N=16** Mean (Standard Deviation)	**Electrical Utilities N=48** Mean (Standard Deviation)	**Overall N=103** Mean (Standard Deviation)
21. Change a light-bulb overhead	Pre	65.62 (30.77)	70.00 (36.06)	87.14 (7.56)	84.00 (18.17)	75.00 (17.95)	86.70 (17.95)	79.56 (25.20)
	Post	67.86 (30.52)	94.00 (8.94)	97.14 (7.56)	84.00 (11.40)	93.06 (11.35)	89.17 (18.75)	85.92 (21.72)
22. Install a face-plate on an electric outlet	Pre	66.24 (36.99)	70.00 (36.06)	84.29 (21.49)	84.00 (18.17)	74.00 (31.58)	88.75 (18.27)	80.27 (27.44)
	Post	69.52 (32.01)	92.00 (13.04)	94.29 (9.76)	88.00 (10.95)	93.69 (8.01)	93.75 (11.60)	88.42 (19.68)
23. Cut a piece of lumber with a hand saw	Pre	59.45 (35.53)	60.00 (34.64)	71.43 (26.73)	88.00 (13.04)	70.36 (32.13)	83.64 (19.27)	74.99 (27.73)
	Post	66.19 (28.92)	88.00 (21.68)	78.57 (27.34)	88.00 (13.04)	92.44 (10.60)	89.27 (14.40)	84.16 (20.51)
24. Pull a nail out of lumber with a claw hammer	Pre	57.67 (33.37)	70.00 (36.06)	74.29 (23.70)	84.00 (11.40)	73.73 (32.27)	84.55 (17.58)	75.65 (26.78)
	Post	62.86 (28.31)	92.00 (13.04)	90.00 (11.55)	86.00 (13.42)	92.44 (10.60)	88.96 (15.30)	84.21 (20.68)
25. Pour liquid soap into a cup from a large container	Pre	66.80 (33.16)	73.33 (46.19)	82.86 (18.90)	88.00 (13.04)	70.33 (33.19)	87.56 (17.23)	79.53 (26.31)
	Post	67.00 (29.75)	88.00 (17.89)	92.86 (11.13)	88.00 (10.95)	94.94 (8.91)	90.31 (15.96)	86.38 (20.55)
26. Use a dolley to move a large trash barrel	Pre	62.90 (32.64)	73.50 (27.77)	80.00 (18.26)	90.00 (12.25)	74.33 (31.33)	88.14 (17.53)	79.32 (25.92)
	Post	72.86 (24.52)	86.00 (21.91)	82.86 (26.28)	82.00 (14.83)	92.44 (9.95)	89.17 (16.90)	85.38 (19.59)
27. Load or unload a dishwasher	Pre	73.50 (27.77)	60.00 (34.64)	87.14 (7.56)	82.00 (21.68)	72.00 (36.88)	87.21 (19.80)	80.65 (25.61)
	Post	70.24 (27.13)	88.00 (17.89)	92.86 (12.54)	84.00 (11.40)	94.31 (10.90)	87.92 (19.32)	85.43 (20.78)

Sort Item: How confident are you that you can minimize risk of back, shoulder and neck injury when you...		Hotel N=21 Mean (Standard Deviation)	Broiler Service N=5 Mean (Standard Deviation)	Clothing Warehouse N=7 Mean (Standard Deviation)	Plumbing N=7 Mean (Standard Deviation)	Chicken Processing N=16 Mean (Standard Deviation)	Electrical Utilities N=48 Mean (Standard Deviation)	Overall N=103 Mean (Standard Deviation)
28. Dig in a garden with a spade-shovel	Pre	62.86 (30.02)	60.00 (20.00)	68.57 (21.16)	85.00 (11.18)	69.00 (31.63)	78.52 (22.63)	72.58 (25.92)
	Post	63.33 (25.95)	92.00 (8.37)	85.00 (8.66)	84.00 (8.94)	88.69 (14.03)	86.15 (17.78)	81.95 (20.34)
29. Push open a heaving door	Pre	63.81 (31.54)	80.00 (20.00)	71.43 (22.58)	85.00 (14.14)	71.00 (33.92)	84.42 (20.85)	76.60 (26.65)
	Post	63.33 (27.26)	88.00 (16.43)	94.29 (11.34)	82.00 (14.83)	94.31 (10.27)	88.65 (14.32)	84.35 (20.23)
30. Get into an automobile driver's seat	Pre	77.50 (30.59)	70.00 (36.06)	78.57 (23.40)	84.00 (11.40)	74.67 (31.59)	87.16 (19.27)	81.76 (24.76)
	Post	69.29 (29.51)	86.00 (21.91)	95.71 (7.87)	84.00 (13.42)	94.94 (7.26)	91.98 (12.02)	87.34 (19.23)
31. Pull open a heavy door	Pre	60.00 (31.94)	80.00 (20.00)	75.71 (23.70)	84.00 (15.17)	68.00 (34.53)	83.41 (18.20)	75.16 (26.39)
	Post	65.71 (23.57)	90.00 (14.14)	91.43 (12.15)	80.00 (14.14)	92.44 (9.95)	88.65 (15.04)	84.35 (18.76)
32. Get out of an automobile driver's seat	Pre	71.90 (30.92)	70.00 (36.06)	77.14 (22.89)	84.00 (11.40)	74.67 (32.48)	85.68 (19.93)	79.68 (25.45)
	Post	65.95 (31.37)	94.00 (8.94)	95.71 (7.87)	84.00 (13.42)	94.31 (8.88)	90.83 (12.85)	86.41 (20.32)
33. Carry a 10-pound step-stool 50 feet	Pre	60.52 (36.45)	63.33 (35.12)	72.86 (24.98)	87.00 (13.96)	69.33 (33.48)	85.00 (18.96)	75.64 (28.27)
	Post	64.76 (27.86)	88.00 (16.43)	84.29 (26.37)	88.00 (13.04)	93.69 (9.53)	91.04 (13.87)	85.28 (20.76)
34. Carry a 30-pound bucket 50 feet	Pre	47.43 (35.70)	70.00 (10.00)	57.14 (25.63)	79.00 (12.45)	61.67 (32.39)	73.75 (25.01)	64.96 (29.78)
	Post	55.48 (24.59)	84.00 (21.91)	68.57 (24.62)	82.00 (14.83)	88.06 (12.17)	79.06 (22.09)	75.28 (23.58)

Sort Item: How confident are you that you can minimize risk of back, shoulder and neck injury when you...		Hotel N=21 Mean (Standard Deviation)	Broiler Service N=5 Mean (Standard Deviation)	Clothing Warehouse N=7 Mean (Standard Deviation)	Plumbing N=7 Mean (Standard Deviation)	Chicken Processing N=16 Mean (Standard Deviation)	Electrical Utilities N=48 Mean (Standard Deviation)	Overall N=103 Mean (Standard Deviation)
35. Carry a 20-pound sack of groceries for 100 feet	Pre	52.48 (35.45)	83.33 (15.28)	60.00 (27.69)	79.00 (21.33)	63.33 (36.97)	81.59 (21.78)	70.60 (30.28)
	Post	66.43 (28.25)	86.00 (19.49)	78.57 (21.93)	84.00 (15.17)	89.94 (11.49)	86.35 (17.16)	82.15 (20.94)
36. Carry two 10-pound sacks of groceries for 100 feet?	Pre	54.76 (32.94)	70.00 (26.46)	71.43 (25.45)	87.00 (13.96)	67.86 (34.90)	83.07 (21.19)	73.40 (28.54)
	Post	63.10 (27.32)	90.00 (14.14)	85.71 (21.49)	86.00 (13.42)	90.56 (12.32)	87.71 (17.62)	82.98 (21.51)
37. Climb a step-ladder?	Pre	58.33 (36.97)	70.00 (36.06)	78.57 (89.00)	89.00 (12.45)	75.71 (33.45)	85.34 (22.40)	77.07 (29.37)
	Post	65.95 (34.55)	94.00 (8.94)	88.57 (15.74)	90.00 (12.25)	96.19 (7.16)	89.79 (19.29)	86.02 (23.50)
38. Carry a 20-pound bucket up a step-ladder?	Pre	43.38 (32.51)	70.00 (10.00)	48.57 (29.68)	79.00 (15.97)	61.07 (36.59)	73.64 (24.79)	63.31 (30.67)
	Post	52.38 (30.15)	88.00 (15.43)	59.29 (25.24)	82.00 (14.83)	85.88 (15.56)	76.67 (25.52)	72.74 (26.94)
39. Sweep with a push-broom?	Pre	65.50 (35.17)	63.33 (28.87)	85.71 (9.76)	88.00 (13.04)	75.71 (34.80)	84.43 (21.22)	78.66 (27.20)
	Post	69.29 (29.25)	88.00 (17.89)	91.43 (12.15)	80.00 (18.71)	94.94 (9.63)	87.92 (17.22)	85.04 (20.79)
40. Sweep with a kitchen broom?	Pre	70.00 (35.24)	63.33 (28.87)	91.43 (6.90)	87.00 (13.96)	76.43 (33.65)	87.27 (18.97)	81.45 (26.13)
	Post	71.43 (27.80)	84.00 (30.50)	94.29 (9.76)	80.00 (18.71)	96.81 (5.99)	91.88 (12.01)	87.64 (19.10)
41. Lower 50-pound milk crate from eye-level to the floor?	Pre	35.33 (34.63)	70.00 (10.00)	40.00 (35.59)	74.00 (23.02)	54.29 (36.73)	62.95 (30.06)	54.60 (33.64)
	Post	48.57 (22.42)	80.00 (28.28)	41.43 (43.75)	68.00 (39.62)	75.00 (26.52)	68.09 (27.58)	63.86 (29.87)

Sort Item: How confident are you that you can minimize risk of back, shoulder and neck injury when you...		**Hotel N=21** Mean (Standard Deviation)	**Broiler Service N=5** Mean (Standard Deviation)	**Clothing Warehouse N=7** Mean (Standard Deviation)	**Plumbing N=7** Mean (Standard Deviation)	**Chicken Processing N=16** Mean (Standard Deviation)	**Electrical Utilities N=48.** Mean (Standard Deviation)	**Overall N=103** Mean (Standard Deviation)
42. Lower a 50-pound tool box from a bench to the floor?	Pre	35.57 (34.25)	76.67 (15.28)	42.86 (32.51)	78.00 (13.04)	55.71 (37.15)	65.00 (29.03)	56.46 (33.18)
	Post	52.86 (24.32)	82.00 (24.90)	55.71 (41.17)	76.00 (42.78)	77.13 (26.15)	70.74 (28.48)	67.81 (29.70)
43. Lift a 50-pound milk crate from the floor to eye-level?	Pre	33.43 (34.74)	76.67 (15.28)	37.14 (74.00)	74.00 (23.02)	54.29 (37.36)	63.30 (28.91)	54.33 (33.53)
	Post	48.57 (22.87)	78.00 (22.80)	49.29 (41.68)	66.00 (39.12)	70.00 (31.99)	67.34 (27.95)	63.07 (29.82)
44. Lift a 50 pound tool box from the floor to a bench?	Pre	39.14 (36.21)	80.00 (20.00)	40.00 (32.15)	80.00 (14.14)	55.71 (39.36)	66.14 (29.33)	57.79 (34.04)
	Post	50.48 (22.47)	80.00 (23.45)	47.14 (41.52)	76.00 (42.78)	72.75 (32.30)	69.79 (27.68)	65.49 (30.21)
45. Lower a 100 pound milk crate from eye-level to the floor?	Pre	31.50 (36.60)	53.33 (32.15)	17.14 (29.84)	49.00 (38.79)	37.86 (39.45)	49.55 (31.67)	41.56 (34.91)
	Post	37.62 (33.00)	66.00 (32.09)	21.43 (33.88)	50.00 (38.08)	53.12 (32.81)	49.79 (33.96)	46.63 (34.21)
46. Lower a 100-pound milk crate from a bench to the floor?	Pre	31.90 (35.86)	63.33 (25.17)	22.86 (32.00)	55.00 (36.40)	39.64 (39.64)	52.50 (32.18)	44.26 (35.13)
	Post	40.00 (33.17)	68.00 (32.71)	27.14 (39.46)	62.00 (44.94)	57.19 (30.22)	52.77 (34.67)	50.25 (34.92)
47. Lift a 100-pound milk crate from the floor to eye-level?	Pre	30.95 (35.48)	56.67 (28.87)	15.71 (30.47)	49.00 (38.79)	38.71 (38.41)	46.59 (32.76)	40.07 (34.82)
	Post	37.14 (34.08)	72.00 (31.14)	21.43 (33.88)	48.00 (37.01)	55.00 (30.33)	48.62 (33.78)	46.49 (34.15)
48. Lift a 100 pound milk crate from the floor to a bench?	Pre	31.90 (35.58)	66.67 (25.17)	21.43 (35.32)	55.00 (36.40)	42.07 (39.73)	50.12 (33.53)	43.43 (35.74)
	Post	38.57 (33.36)	74.00 (27.93)	27.14 (39.46)	62.00 (44.94)	57.50 (29.78)	52.02 (34.54)	49.95 (34.94)
49. Paint with a small brush at eye level?	Pre	70.95 (28.62)	66.67 (41.63)	87.14 (11.13)	86.00 (15.17)	75.71 (31.80)	86.36 (21.36)	80.74 (25.20)
	Post	69.76 (30.68)	82.00 (34.93)	83.86 (37.29)	82.00 (13.04)	92.44 (11.79)	88.67 (16.90)	84.23 (23.38)

Sort Item: How confident are you that you can minimize risk of back, shoulder and neck injury when you...		**Hotel N=21** Mean (Standard Deviation)	**Broiler Service N=5** Mean (Standard Deviation)	**Clothing Warehouse N=7** Mean (Standard Deviation)	**Plumbing N=7** Mean (Standard Deviation)	**Chicken Processing N=16** Mean (Standard Deviation)	**Electrical Utilities N=48** Mean (Standard Deviation)	**Overall N=103** Mean (Standard Deviation)
50. Place or retrieve a 5-pound can between waist and overhead?	Pre	65.71 (35.72)	70.00 (36.06)	87.14 (9.51)	86.00 (15.17)	72.14 (34.46)	87.73 (18.91)	79.79 (27.24)
	Post	67.86 (31.57)	90.00 (14.14)	90.71 (10.18)	88.00 (10.95)	93.69 (8.81)	91.17 (14.64)	86.48 (20.54)

Appendix M

Focus Group Protocol

Phase	Specifics
Preparation	1. Make confirmation calls 24-48 hours ahead. 2. Purchase refreshments, tapes and name tags. 3. Check tape recorder and batteries.
Set-up	1. Arrive 30 minutes ahead of scheduled start time to set-up. 2. Bring tape recorder, 14 name tags, 14 copies of consent forms, background questionnaire.
Welcoming	1. Introductions of facilitator and recorder. 2. Make light conversation, especially if from different companies. 3. Allow 15 to 20 minutes for settling in and refreshments. 4. Give everyone a name tag with pseudonyms.
Beginning the session	1. Facilitator makes formal introductions, explains general purpose of the project, their role and that of the moderator. 2. Facilitator hands out consent forms for participation and audiotaping. 3. Recorder makes a seating plan. Turn on tape with permission.
Setting the ground rules. (everyone is seated)	1. Facilitator establishes the ground rules: "We ask that you speak one at a time so that we don't miss anything." "There are no right or wrong answers. All comments are valuable." "It is okay to disagree–everyone has different opinions."
Follow the script	1. Facilitator begins with icebreaker question, followed by transitional questions, key questions, and summary questions. 2. For each question on the script, the recorder notes the name of each speaker and the beginning of their comment. 3. Facilitator monitors the time and coverage of the script.
Administer background form.	1. Facilitator hands out a form and pen to each person, saying: "Now take a few minutes to complete the checklist to give us a general description of the people taking part in the discussion sessions." 2. Facilitator produces brief summary of session's main points while participants complete the background questionnaire.

Closure and follow-up consent	1. Facilitator summarizes the main points of the discussion and asks whether people have anything to add. 2. Facilitator explains follow-up for verification and hands out consent form for telephone follow-up. 3. Participants are thanked. (Adapted from Myers, 1999)

Focus Group Script for Process Evaluation of the Back and Upper Limb Injury Prevention (BULIP) Course

Samples	**Participants in BULIP course**
Purpose of evaluation project	To explore why they participated in the BULIP course, reactions to the program and whether it changed the company climate.
Ice breaker: Round robin questions everyone answers	Let's go around the table, give us your name and give us the number of years you have worked at your company.
Introductory question: To introduce the topic.	Have any of you ever taken any courses before that deal in any way with how to prevent injury on the job or at home? (Prompt, If yes–what courses have you taken? When did you take them?, through this company or another (work related?))
Transition questions: To move the conversation to key questions.	Why did you sign up for the course? If required...ask "If this course was not required would you have signed up for it and under what conditions?" Was the length okay? (Too long, too short, just right?) Was the fee okay? ($5) Would you be willing to pay a $5 (or $20) fee to take this course? Now that you've gone through this course would you recommend this course to others? Why or Why not?

Samples	**Participants in BULIP course**
Key questions: in-depth examination.	What were your general impressions of the course? (Prompt...clear & understandable or too technical) What component of the course did you like best? (Prompt...lecture, practice session, anatomy, principles, examples) (or did you like all components equally?) Why? What were your impressions of each component? 1) lecture 2) video 3) practice 4) examples (e.g. silly putty, torque wrench) What was the main thing that you got out of the course? Do you think this course should be offered as is to your co-workers? (Prompt: elaborate: why or why not) Did you learn anything that you think you can apply at work or home? In what ways, if any, does your company address injury prevention at work? (Hold seminars, put up posters, training, H&S committee) If we had to cut the course into 2 hours, what would you take out of the course? Is there anything that could be added to the course to make it better?
Summary questions	These are the main points that came out of the discussion today...Do you agree? Is there anything you would like to add?

Background Questionnaire for Focus Group

Date Completed:

We would like to begin by asking you a few questions about your background.

2. Your sex (*check box)* ☐ MALE ☐ FEMALE

3. What is your date of birth? _____/_____/19_____
DAY MONTH YEAR

3. a) Which language(s) are you most comfortable speaking?

☐ English ☐ French ☐ Other (please specify)_____

b) Which language(s) are you most comfortable reading and writing?

☐ English ☐ French ☐ Other (please specify)_____

4. What is the highest level of education that you have completed? (*check box*)

☐ NO FORMAL SCHOOLING
☐ SOME PRIMARY SCHOOL
☐ PRIMARY SCHOOL
☐ SOME SECONDARY OR HIGH SCHOOL
☐ COMPLETED SECONDARY OR HIGH SCHOOL
☐ SOME COMMUNITY COLLEGE, TECHNICAL SCHOOL, CEGEP, OR NURSING PROGRAM
☐ COMPLETED COMMUNITY COLLEGE, TECHNICAL COLLEGE, CEGEP , OR NURSING PROGRAM
☐ SOME UNIVERSITY (NOT COMPLETED)
☐ UNIVERSITY DEGREE (COMPLETED)

4. Do you have young children, care for older adults or disabled people? ☐ Yes (go to question 6) ☐ No (go to question 7)

5. If yes to question 5, do you provide physical care (bathing, lifting, etc.) for these people you care for? ☐ Yes ☐ No

6. Do you consider yourself to be a physically active person?

☐ Very much so ☐ Moderately ☐ Not at all

7. Do you currently take part in any organized exercise classes, sports or exercise on your own?

☐ Yes (go to question 9) ☐ No (go to question 10)

8. If yes to question 8, list the types of exercise you most often do.

_____

_____

9. Have you ever had a back, shoulder or neck injury? ☐ Yes ☐ No ☐ Unsure

10. Have you experienced low back pain since the course? ☐ Yes (go to question 12) ☐ No (go to question 13)

11. If yes, approximately when was the most recent episode?

_____

12. Since we last saw you, have you had to miss work because of a back, neck or shoulder injury?

☐ Yes (go to question 14) ☐ No (go to question 15)

13. If yes to question 13, have you taken any Workplace Safety and Insurance Board rehabilitation programs?

☐ Yes ☐ No

14. What is your current job title?
Job title:_____

15. What are the main tasks that you do in your current job?

_____

16. Have you taken prior courses in injury prevention at work?

☐ Yes (go to question 18) ☐ No (turn page)

17. If yes to question 17, what was the content of this course(s)?

_____

18. To what extent does your job include the following physical demands?
a) lifting (light loads, maximum 5 pounds)

☐ Not at all ☐ To Some Extent ☐ To a Great Extent

b) lifting (medium loads, between 10 and 25 pounds)

☐ Not at all ☐ To Some Extent ☐ To a Great Extent

c) lifting (heavy loads, 50 pounds and over)

☐ Not at all ☐ To Some Extent ☐ To a Great Extent

d) bending or stooping (example: filing)

☐ Not at all ☐ To Some Extent ☐ To a Great Extent

e) pulling or pushing objects

☐ Not at all ☐ To Some Extent ☐ To a Great Extent

f) crouching or kneeling

☐ Not at all ☐ To Some Extent ☐ To a Great Extent

Focus Group Sample Characteristics

Injury History and Ethnic Backgound. The majority (95%, n=37) of focus group participants spoke and wrote English. One participant was more comfortable speaking and writing Chinese, while another was more comfortable speaking and writing Arabic. The percentage of focus group participants with a lifetime history of back, shoulder or neck injury ranged by company from 40% to 100% (mean across companies was 67%).

Education Level. The majority of course participants had finished secondary school, completed some college courses or a college diploma (n=24, 61%). Only seven (18%) participants had completed some university or completed a university degree. A greater proportion (n=4, 29%) of those in management had some or completed university compared to frontline staff members (n=3, 12%) in the sample.

Education Level by Gender, Injury Status and Total Sample

Education	Gender (Male) (n=26)	Gender (Female) (n=13)	Injury (Yes) (n=26)	Injury (No) (n=13)	Frontline (n=25)	Manage ment (n=14)	Total (n=39)
Less than High School	2 (8%)	2 (15%)	0 (0%)	4 (31%)	2 (8%)	2 (14%)	4 (10%)
Completed High School	6 (23%)	3 (33%)	8 (31%)	1 (11%)	8 (32%)	1 (7%)	9 (23%)
Some/Completed College	13 (50%)	6 (46%)	14 (54%)	5 (38%)	12 (48%)	7 (50%)	19 (49%)
Some/Completed University	5 (19%)	2 (40%)	4 (15%)	3 (23%)	3(12%)	4 (29%)	7 (18%)

Risk Factors for Shoulder, Back or Neck Injury. The table below presents the total sample, gender and injury breakdowns for items related to risk factors for shoulder, back or neck injury. Thirteen (33%) focus group participants reported providing physical care for children, older adults or people with a disability. Most of the sample (n=38, 97%) indicated that they considered themselves a physically active person "very much so" or "moderately" and

about half (51%) currently take part in a structured exercise class such as aerobics, karate and kung fu exercises. Although 17 (44%) focus group participants had experienced low back pain since course completion, only two (5%) focus group participants had missed work because of their injuries. Front-line staff reported low back pain significantly more often than management staff (χ^2=4.36, p=0.037) after completing the course. None of the sample reported participating in WSIB rehabilitation programs, but about half (n=20, 51%) of the sample had taken prior injury prevention courses at work such as First Aid, Propane Handling, WHMIS, Forklift Training, Ergonomic Training, Hazard Awareness, Electrical Awareness and Electric Shock.

Risk Factors for Shoulder, Back or Neck Injury by Gender, Injury Status and Total Sample

Variable	Gender (Male) (n=26)	Gender (Female) (n=13)	Injury (Yes) (n=26)	Injury (No) (n=13)	Total (n=39)
Care for Young Children or Elderly					
Yes	11(42%)	4 (31%)	10 (38%)	5 (38%)	15 (38%)
No	14 (54%)	8 (36%)	15 (58%)	7 (54%)	22 (56%)
Provide physical care for child/elderly?					
Yes	10 (38%)	3 (33%)	8 (31%)	5 (38%)	13 (33%)
No	1 (4%)	1 (11%)	2 (8%)	0 (0%)	2 (5%)
Physical Active Person					
Very Much So	13 (50%)	3 (33%)	9 (35%)	7 (54%)	16 (41%)
Moderately	13 (50%)	9 (69%)	17 (65%)	5 (38%)	22 (56%)
Not at all	0 (0%)	1 (11%)	0 (0%)	1 (11%)	1 (3%)
Currently Take Part in Exercise Class?					
Yes	15 (58%)	5 (38%)	15 (58%)	5 (38%)	20 (51%)
No	10 (38%)	7 (54%)	11 (42%)	6 (46%)	17 (44%)
Back Pain Since Course					
Yes	12 (46%)	5 (38%)	14 (54%)*	3 (33%)*	17 (44%)
No	14 (54%)	8 (61%)	12 (46%)*	10(77%)*	22 (56%)
Miss Work Due To Injury since course?					
Yes	0 (0%)	2 (15%)	2 (8%)	0 (0%)	2 (5%)
No	26 (100%)	11 (85%)	24 (92%)	13 (100%)	37 (95%)
Taken any WSIB rehab programs?					
Yes	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0 %)
No	26 (100%)	13 (100%)	26 (0%)	13(100%)	39(100%)
Taken Prior Injury Prev. Courses?					
Yes	15 (60%)	5 (38%)	13 (50%)	7 (54%)	20 (51%)
No	11 (42%)	8 (61%)	13 (50%)	6 (46%)	19 (49%)

Job Description and Tasks. The job titles and tasks of focus group participants are presented in Table 4.6. Their tasks varied depending on their company and job. Participants also characterized their jobs by describing the lifting required for their job. Most focus group participants (n=37, 95%) reported that their jobs required lifting light loads (5 pound loads) and medium loads (10 to 25 pounds) "to some extent" or "to a great extent". Front-line staff reported lifting medium loads to a greater extent in their jobs (n=18, 72%) than management

(n=5, 37%) (χ^2=6.78, p=0.034). The majority of males reported lifting heavy loads "to some extent" (n=21, 81%), while over half (n=7, 54%) of females reported that their job did not require lifting heavy loads "at all" (χ^2=4.87, p=0.027). The majority of females reported that their jobs required bending or stooping (e.g., filing) either "not at all" (n=3, 23%), "to some extent" (n=5, 38%) and "to a great extent" (n=5, 38%), while males reported that their jobs required bending or stooping "to some extent" (n=14, 54%) or "to a great extent" (n=12, 46%) (χ^2=6.54, p=0.038). The majority of focus group participants reported being required to pull or push objects (n=22, 56%) and crouch or kneel (n=20, 51%) "to some extent"on the job.

Number of Years with the Company. Participants were asked the number of years they worked with their company. Focus group participants had worked at their companies from under a year to 25 years with an average of 9 years.

Focus Group Site, Job Titles and Tasks

Site	Job Title	Tasks
Chicken* Processing Plant	Foreperson (n=1) Assistant Leadhand (n=1) Millwright Supervisor (n=1) Leadhand (n=1)	Organize, Delegate Supervise Room, Pull Skids, Make Sauce Supervise, Repair, Install Equipment Supervise to Ensure Product Gets Made Quickly, Make Work Easy for Worker
Clothing Warehouse	Warehouse Coordinator (n=1) Warehouse Administrator (n=1) Receiving Coordinator (n=1)	Data entry, Lift products, Organize products Contact with stores, Data entry, Lift products Organize products received to inventory, stores, damage control
Hotel	Laundry Attendant (n=1) Cook (n=1) General Cleaning (n=1) Housekeeper (n=1)	Lift Laundry, Sort & Fold Cook Clean and Wash Washrooms Vacuum, Mop, Clean Washrooms, Dust
Hotel	Mini-Bar Attendant (n=1) Housekeeper (n=1) Housekeeper/Mini-Bar (n=1) Facilities/Maintenance (n=1) Public Area Cleaning (n=1)	Stock Bars, Order Stock, Bill Customers, Load Cart Clean room, Make Beds and Clean Washrooms Clean Rooms and Washrooms, Make Beds, Stock Bars Garden, Paint, Refinish, Decorate, Assist When Needed Vacuum, Wash Windows, Lift Garbage, Clean Washrooms
Paintbrush Manufact-uring	Shipping (n=5)	Fill Out Orders, Lift, Load Trucks, Unload Trucks, Put Stock Away
Paintbrush* Manufact-uring	Customer Service Manager (n=1) Financial Manager (n=1) Purchaser (n=1) Customer Service (n=1) Customer Service (n=1) Vice President (n=1)	Customer Satisfaction Account for Company Financing Contracts, Maintain Control of Inventory Customer Service Customer Service Ensure Company Organization
Electrical Utilities	Lineperson (n=7) Forester (n=1)	Line maintenance, Bucket work, Pole Climbing Trim and Remove Trees
Electrical * Utilities	Manager of Operations (n=1) Metre Shop Foreman (n=1) Fleet Supervisor (n=1) Distribution Engineering Supervisor (n=1)	Plan, Resource Allocation, Code Review & Compliance Coordinate & Oversee All Jobs Related to Power Measurement and Revenue Engineering Design, Office/field, computer work, administration work

*Focus groups conducted with management personnel

Job Demands by Gender, Injury Status and Total Sample

Variable	Gender (Male) (n=26)	Gender (Female) (n=13)	Injury (Yes) (n=26)	Injury (No) (n=13)	Total (n=39)
To what extent does your job include the following demands?					
i) Lifting light loads					
Not at all	1 (4%)	1 (11%)	1 (4%)	1 (11%)	2 (5%)
To some extent	7 (27%)	7 (54%)	10 (38%)	4 (31%)	14 (36%)
To a great extent	18 (69%)	5 (38%)	15 (58%)	8 (61%)	23 (59%)
ii) Lifting medium loads					
Not at all	1 (5%)	1 (11%)	2 (8%)	1 (11%)	2 (5%)
To some extent	16 (61%)	10 (77%)	17 (65%)	9 (69%)	26 (67%)
To a great extent	9 (35%)	2 (15%)	7 (27%)	4 (31%)	11 (28%)
iii) Lifting heavy loads					
Not at all	5 (19%)*	7 (54%)*	8 (31%)	4 (31%)	12 (31%)
To some extent	21 (81%)*	6 (46%)*	18 (69%)	9 (69%)	27 (69%)
To a great extent	0 (0%)*	0 (0%)*	0 (0%)	0 (0%)	0 (0%)
iv) Bending or stooping					
Not at all	0 (0%)*	3 (23%)*	1 (4%)	2 (15%)	3 (8%)
To some extent	14 (54%)*	5 (38%)*	12 (46%)	7 (54%)	19 (49%)
To a great extent	12 (46%)*	5 (38%)*	13 (50%)	4 (31%)	17 (44%)
v) Pulling or pushing objects					
Not at all	3 (11%)	3 (23%)	5 (19%)	1 (11%)	6 (15%)
To some extent	16 (61%)	6 (46%)	13 (50%)	9 (69%)	22 (56%)
To a great extent	7 (27%)	4 (31%)	8 (31%)	3 (23%)	11 (28%)
vi) Crouching or kneeling					
Not at all	3 (11%)	3 (23%)	5 (19%)	1 (11%)	6 (15%)
To some extent	15 (58%)	5 (38%)	13 (50%)	7 (54%)	20 (51%)
To a great extent	8 (31%)	5 (38%)	8 (31%)	5 (38%)	13 (33%)

* Significant difference, $p<.05$

Appendix N

Verification Process and Script for Focus Group Follow-up

Introductory Remarks:

Hello _____, this is Jennifer Yessis from the University of Waterloo. I conducted the discussion group on the Back and Upper Limb Injury Prevention course that you took part in at _____ on _____. At the time, you gave us permission to call you. We are calling a few people from each of the groups that took part in our project. The purpose of these follow-up calls is to tell you some of the main findings and to see whether you would like to add anything to provide suggestions that we may use in our report to the course developers. This will only take 10 to 15 minutes of your time.

Is this a convenient time for you to talk? ___ Yes (then proceed) ___ No (find out when might be a good time within the next few days) and arrange the call _____

Permission to Tape Record:

Before we begin, I wonder whether you would mind if I tape recorded our conversation? I don't want to miss any of your comments and it will save me having to take notes as we talk. Rest assured that whether or not we tape this interview, your comments will be kept totally confidential. At the end of the study all the tapes will be erased. I will check with you again at the end of your interview today, and if you change your mind I can erase this tape immediately.

Do I have permission to tape this brief interview?

Person agrees: _____ Person objects (reason if given) _____

Interview Date: _____ Person's Name:_____

From Group: _____ Tape Label:_____

Note for Interviewer: Use a standard sheet to record date of interview, person's real name (and pseudonym), time (beginning and end of interview); permission to tape; and notes/comments for each section (critical since they may ask you to erase the tape at the end).

Interview Portion

Introduction:

Thank you for agreeing to this interview. Now, let's begin. Each discussion group, including the one you took part in, was about your impressions of the *Back and Upper Limb Injury Prevention* program offered by the University of Waterloo. To refresh your memory about the course that you participated in...

The course was four hours in length, with an emphasis on five principles to prevent back and upper limb injures: move around after sitting in one place for a number of hours, before handling objects lightly tense the torso muscles, keep the moment low (close to your body), don't twist the body to extremes and keep the normal curve in the spine. You were also shown and given a hand-out for four exercises to strengthen and stretch the back muscles.

Now let me tell you about some of the findings that came out of the various discussion groups.

Recommend Course to Others:

Most participants indicated they would recommend the course to others.

Based on what you remember of your group 's comments, do you agree? (Prompt why?)

General Impressions:

In general, participants had positive comments about the *Back and Upper Limb Injury Prevention* course. Most of the focus group participants found the course clear and understandable due to the variety of formats used, the course content, presentation style and instructor.

However, at several of the companies there were course participants who had difficulty understanding English, and it was mentioned by several participants that those who don't understand English may have had trouble following the course.

What do you think?

Do you have any suggestions for improving the course for those who have trouble with the English language?

Course Additions:

In the focus group, you were asked if there was anything that could be added to the course to make it better. The biggest change suggested was adding a larger section on the upper limb. However, not all focus groups or individuals within groups agreed with this suggestion.

Do you recall discussing this in your focus group?
In your group, people were_____ (insert: in favour, not in agreement)
Do you still feel this way?
(Prompt..Would you recommend adding a larger component on the upper limb? Why?)

Another suggestion was following up the four hour course with a short refresher course after a period of time had passed to remind people of the principles discussed in the course.

Would you recommend a refresher course?

Are there any other suggestions that you have for making the course better?

Behaviour Change:

Since the discussion group, have you looked at the exercise sheet you received in the course?

Have you done the exercises at all?

Have you made any changes to what you do at home and work? (Prompt: What changes have you made?)

What are some barriers that prevent you from making changes at home and work?

Work Environment:

Some people indicated that some of their work environment equipment had changed since the course.

Has your company made any changes to your work environment since the focus group session? (Prompt: why were changes made, who initiated the recommendations, why?)

Themes:

Many people felt that management's participation in the course was important to its success.

Would you agree with this? (Prompt: why?)

Some people felt that those who had previously had a back injury were more likely to change their handling practices and do the exercises than those who had not been injured previously.

Do you agree with this? (Prompt: why?)

Final Comments:
Do you have any other comments, thoughts that you would like to add?

Ending:
We have finished our interview. I just want to make sure that you are okay with us using the tape recording to assist in analysing the findings. We will be interviewing about 16 people and will summarize the findings across everyone. No individual will ever be identified in our reports. Are you okay with this? Make notes of anyone who has concerns and assure them that this tape will be erased immediately.

Thank Them

We really appreciate you taking part in the discussion group and this telephone interview. The comments made by yourself and others have been very helpful and will provide constructive feedback to the developers of the *Back and Upper Limb Injury Prevention* course.

Thank you and good bye.

End here unless they spontaneously request a copy of the findings (see below on how to respond).

If they ask for a copy of the report or findings, say that, "unfortunately no findings can be released until the reports go through the Safe Communities internal review process. Once that process is completed, we hope that the findings will be presented at a Quarterly Meeting. I will certainly pass on a list containing your name and the names of other persons who are interested in receiving a summary of the report to the Safe Communities Program...but that is all we can do at this point."

Person said they want a copy of the results _____

Time interview began: _____ Time interview completed: _____

Interviewer's comments/remarks:

_____

_____

Appendix O

Interview Guide for Company Contact

General Company Information

General Information:

1. Name of company

2. Does this company have multiple plants or facilities?

    1. No
    2. Yes Please indicate which specific plant(s) or facility(s) your responses refer to.

3. When was the company established?

4. What is the type of ownership?

5. What is the address?

6. What is the phone number

7. What is the type of business?

8. What is the type of ownership of your company?
    1. Family, individually owned enterprise or partnership
    2. A corporate enterprise: shares closely held
    3. A corporate enterprise: shares widely held
    4. Subsidiary of a larger corporation
    5. A franchise

9. What is the type of industry?

10. What is the average number of employees who work in the company?

11. Is the company a member of any safety organization other than the Waterloo Safe Communities Program? If yes. What?

12. Number of employees at this facility:

	1995	1996	1997	1998	1999
Full time					
Part time					

Temporary or Contract

13. Is any of your workforce at this facility represented by a union or an employees' association?
    Union
    Employees' Association
    Neither

    Approximately what percent of this workforce is unionized?
    What unions are represented? Number of Members

14. How often do union and management achieve a cooperative working relationship here?

Never		Occasionally		Sometimes		Usually		Always
1	2		3		4		5	

15. Approximate total number of grievances in 1999.

16. Did any of these grievances concern health and safety?

17. How many lost time injuries did you have in 1998 and 1999?

18. How many no lost time injuries did you have in 1998 and 1999?

19. What was the duration of the lost time injuries on average in 1998 and 1999?

General Safety Questions
The next set of questions are general questions about health and safety in your workplace.

20. What do you think are the three main causes of accidents in this workplace?

    _____
    _____
    _____

21. In what ways, if any, does your company address injury prevention for workplace issues?

_____
_____
_____
_____

22. In what ways, if any, does your company address injury prevention for Off-the-Job issues?

_____

_____

_____

_____

Safety Programs

23. From whom do workers directly receive safety training and safety information? (circle as many as apply)
    1. Worker's supervisor
    2. Safety personnel
    3. Fellow workers
    4. Plant management
    5. Plant medical personnel
    6. Union representatives
    7. Other (please specify)

24. Does your company have its own safety manual or code of safety rules?
    1. Yes
    2. No

25. In your plant who is considered to be **primarily** responsible for the safety of employees? (circle only one)
    1. Employee him/herself
    2. Employee's supervisor
    3. Plant management
    4. Safety personnel
    5. Union
    6. Other (please specify)

26. Are safety figures, reports, achievements included on the agenda of plant management meetings? (circle only one)
    1. Yes, on a regularly scheduled basis
    2. Yes, on an occasional basis
    3. Yes, only as needed
    4. No
    5. Other (please specify)

25. Which of the following groups participate formally in the development of safety programs and practices?
    1. Workers
    2. Supervisors
    3. Union Representatives
    4. Management
    5. Other (please specify)

26. Which of the following does this company use as incentives to worker safety: (circle as many as apply)
    1. Safety attitude and behaviour included in worker performance evaluation
    2. Running tally of accident free hours
    3. Recognition awards (e.g. certificates, medals, dinners, etc.)
    4. Cash awards or prizes
    5. Publicity of outstanding safety performance
    6. Other (please specify)

27. Which of those circled in question 26 do you consider most effective? (write 1 after most effective, 2 after second most effective and 3 after third most effective, etc.)

28. Which of the following is used in promoting job safety (circle as many as apply)
    1. posters/signs/slogans
    2. pamphlets
    3. displays/exhibits
    4. safety contests between departments or work groups
    5. safety contests between plants
    6. other (please specify)

29. Which of those circled in question 28 do you consider most effective? (write 1 after most effective, 2 after second most effective and 3 after third most effective, etc)

30. Does your company have a formal safety training program (i.e. written procedures describing how the safety training is to be carried out)?

31. Which of the following techniques of safety training do you employ?
    1. Lecture
    2. Demonstration
    3. Group discussions
    4. Literature/manuals
    5. movies/slides
    9. Other (please specify)
32. Which of those techniques circled in question 31 do you consider most effective? Place a 1 after the most effective, a 2 after the second most effective and a 3 after the third most

effective, etc..

33. In safety training, do you make use of information from:
    1. National Safety Council
    2. Local Safety Council
    3. Professional association
    4. Trade association
    5. Union
    6. Insurance carrier
    7. Governmental agency
    8. Other (specify) _____

The next set of questions ask specifically about the Waterloo Safe Communities Program and the Back and Upper Limb Injury Prevention Course.

34. Why did you decide to participate in the Waterloo Safe Communities Program?

_____
_____
_____
_____

35. What programs, if any, have you participated in to date for the Waterloo Safe Communities Program?

_____
_____
_____

36. What were your expectations for the Waterloo Safe Communities Program?

_____
_____
_____
_____

37. Were your expectations met?

_____
_____
_____
_____

38. Why did you participate in the Back and Upper Limb Injury Prevention course?

39. What were your expectations for the BULIP course?

40. Would you recommend this course to other companies (prompt why or why not)?

41. Did you change anything in your company as a result of the BULIP course?

42. Did you notice any changes in individual behaviours as a result of the BULIP course?

We are now at the end of the interview. Did you have any other comments about what you said today?

Thanks again for your time.

Appendix P

Characteristics of Companies Involved in the Back and Upper Limb Injury Prevention course.

	Broiler Service	Chicken Processing	Clothing Warehouse	Electrical Utilities	Hotel	Paintbrush Manufacturing	Plumbing
Age of Company	150 years	14 years	54 years	22 years	25 years	21 years	20 years
Type of Ownership	partnership/ corporation	privately owned	privately owned	currently commission with Board of Directors, changing to for profit business under the Business Corp. Act	privately owned, Board of Directors with shareholders (1 major shareholder - Bingeman)	privately owned (family business)	privately owned
Type of Industry	broiler service and repair sales/service	chicken processing	head office/ warehouse, retail store: children's clothing	electrical	service sector (hotel)	paintbrush manufacturing	plumbing (also gas fitting, steam fitting)
Average # of Employees	22	140-150 110-120 - plant	21 10-warehouse 6- office 5-retail	125average 134current	200	75	15 - 18 (winter) 20 - 28 (summer)
Unionized	Yes*	No	No	Yes**	No	No	No
Employee Association/ Safety Association	No	No	No	Electrical Utilities and Safety Assoc.	No	Employee Advocacy Council	No
Full Time, Hourly	-100% full time -65% hourly (unionized)	-80% full time -3 shifts -85% hourly	-65% full time -75% hourly	-90% full time, hourly -75% unionized	-50% full time - 90%hourly	-2 shifts (non-rotating) -100% full time -90% hourly	-100% full time -90%hourly

*Union - International Association of Aeronatics and Machinery

**Union - International Brotherhood of Electrical Workers

Safety Characteristics and Programs by Company

	Broiler Service	Chicken Processing	Clothing Warehouse	Electrical Utilities	Hotel	Paintbrush Manufacturing	Plumbing
Causes of injury	1.faulty machinery 2.carelessness of individual 3. lack of training	1.lack of training/ education 2.not thinking carefully 3. layout of work environment	1. carelessness 2. lack of space 3. problems with lifting	1.lack of understanding, communication 2.choice of equipment to use 3.old habits haven't been replaced	1.slips/falls 2.kitchen injuries due to carelessness 3. lack of training	1. employees not following procedure 2. cuts/ scrapes 3. back/shoulder	1.lack of training 2.environment they are working in 3.working too quickly
Worker training	Outsource	Outsource	Outsource	Outsource Health and Safety - coaching and raising awareness	Outsource	Outsource Health and Safety Coordinator	Outsource Owner of company
Who is responsible for safety	Management ultimately, but everyone responsible	Management	Operations Manager	General Manager, but everyone should be responsible	Management, but individuals also responsible	Everybody, but ultimately Health and Safety Coordinator	Owner of company
Safety Incentives	None	None	None	Awards every 5 years for employees Milestone awards (group-reach milestone)	None	None	None
Components of Safety Program	-Joint Health & Safety -Training -Post info	-Joint Health and Safety -Training -Post info	-Safety reps -Monthly safety inspections -Training -Post info	-Joint Health & Safety -Promotion (posters, signs) -Safety meetings -Job planning -Crew visits and audits -safety memos, reminders -hazard bulletins -Training	-Joint Health & Safety -Safety memos -Training -Post Info including posters -Newsletters	-Joint Health & Safety -Training -Post info -Posters -Employee Handbook -Newsletter	-Training -Safety meetings -Post info -Safety memos
Off-the-Job safety	-give employees info -promote via bulletin	-promote via bulletin boards	-offer training such as First Aid, Back & Upper Limb -promote other courses	-promote via safety bulletin boards and safety meetings -give info to take home	-promote in newsletter -post info	-promote in newsletter	-promote by giving flyers to employees

Appendix Q

Summary of Company Contacts' Expectations of Back Course

	Broiler Service	Chicken Processing	Clothing Warehouse	Electrical Utilities	Hotel	Paintbrush Manufacturing	Plumbing
Why you joined WSCP	-business contact -financial incentive	-business contact -financial incentive	-financial incentive -training	-financial incentive -promote safety	-financial incentive -worthwhile program	-improve health and safety	-safety -financial incentive -concept
Programs Involved	-Forklift -First Aid -post off-the-job	-First Aid	-First Aid -post off-the-job	-Young Worker Awareness Program (YWAP) -Quarterly Mtgs	-Return to Work -Accident Investigation -Car Seat Safety	-WHMIS -Accident Investigation	-First Aid -WHMIS -post off-the-job
Expectations for WSCP	-financial incentive -training -help with safety program	-networking -financial incentive	-training -networking	-financial incentive -provide expertise	-networking -promote h&s -financial incentive	-training	-training -networking
WSCP Met Expectations	-Pretty much -programs coming out now -need more advance notice	-Yes	-Yes	-Yes -do not know about $ yet -help with YWAP	-more networking -better organization -more training -advance notice	-Yes -didn't expect rebate	-Not really -want more training -so many companies -follow-up of questions
Why participate in BULIP course	-lifting big part of job -want them to learn to lift properly	-timing -cost -needed training	-most common injury -cost -give employees "best foot forward"	-most common injury -proactive	-staff who do lifting -cost	-cost -common injury	-most common injury
Expectations for BULIP	-Raise awareness -Change lifting practices	-teach techniques for lifting	-Change lifting practices -lower injuries	-raise awareness, improve back strength -no promotion of one product	-raise awareness about back injuries -lower injuries	-raise awareness of back injuries	-give staff info and raise awareness
BULIP Met Expectation	-Yes -Think they got something out of it -positively received	-Yes -some impressed, some overwhelmed	-Yes	-Yes -best he's seen	-Exceeded -specific to W.Inn with video -thorough	-Yes -content and examples excellent	-Yes -feedback from staff positive
Recommend	Think so	Think so	Yes	Yes best he's seen	Yes	Yes	Did not attend
Change to Company	No	No	Yes	No	Yes	No	

Appendix R

Consent Forms for Qualitative Methods

Focus Group Information Sheet

You are being asked to take part in a project by the University of Waterloo to discuss your experiences taking the Back and Upper Limb Injury Prevention course. We are asking for your feedback, along with the feedback of others who have experienced the course in order to better understand how to improve the course in the future. Today's discussion session will last about 1.5 hours. The discussion will be led by a facilitator (Jennifer Yessis) and a recorder (Trisha Gavin) who are graduate students in the Department of Health Studies and Gerontology at the University of Waterloo. They are working under the supervision of Professor Stephen McColl.

Your participation is completely voluntary. Everyone will be given pseudonyms (false names) at the beginning to protect confidentiality. You choose if, and when to make comments during the discussion. Feel free not to make any comments if you prefer. At the end of the session you will be asked to complete a background questionnaire. No names will be put on this form. The information will be summarized across all the groups to provide a general description of the participants taking part. We will be asking for the permission of all participants to audio-tape each session.

The results of the discussions, forms, tapes and follow-up comments will be kept totally confidential. No individual will ever be identified in the results.

You will be given this cover page to take home. Should you have any questions or concerns resulting from your participation in this study, please contact Dr. Sykes at (519) 888-4567, Ext. 6005, or questions about the study, please contact Dr. Stephen McColl at the University of Waterloo (519) 885-1211 Ext. 2720.

This project has been fully endorsed and supported by the Waterloo Safe Communities Program. The Office of Research Ethics at the University of Waterloo has reviewed and provided ethics clearance for this project.

Consent for Focus Group Participation

I feel that the purpose of this project has been explained to my satisfaction. I have had the opportunity to ask questions and they have been answered to my satisfaction.

I agree to take part in today's group discussion. I understand that I may choose when and if to make comments. Similarly, I can choose whether or not to complete the checklist at the end of the session.

Participant's name (print):_____

Participant's signature:_____

Date: _____

Consent to Audiotape

We will also be asking your permission to audiotape the discussion session. The reason for audiotaping is so we do not miss any of the valuable comments that people make. The tapes allow us to go back and analyse the conversation more completely. Specific comments may be quoted in the reports, but no individuals will ever be identified. The tapes will be kept secured and destroyed following analysis.

The reasons for audiotaping the discussion session have been explained to my satisfaction. I understand that everyone in the group has to agree before audiotaping will take place. By signing below, I am consenting to the audiotaping.

Participant's name (print):_____

Participant's signature:_____

Date: _____

Consent for Follow-up Verification

Thank you for taking part in the discussion group today. The information provided will assist the Waterloo Safe Communities Program in improving course offerings, if needed. When we analyse the information, we will look for themes or issues arising from each group, and then summarize the findings across groups.

To ensure that we have accurately recorded the main issues that emerged from each session, we would like to contact a few of the participants in each group two to four weeks from now. A 10 - 15 minute follow-up by telephone will be conducted by Jennifer Yessis, the facilitator of today's session. The purposes of the interview will be: 1) see if participants agree with the major points we felt emerged from the discussion (verify the findings), and 2) see whether participants have any further thoughts to add.

Giving your permission allows us to contact you by phone two to four weeks from now. If your consent form is selected at random, you will be contacted by Jennifer Yessis. If you still agree at that time, we will set up a convenient time for the 15 minute conversation. We may not contact you at all, and we certainly would only contact you once. If you do not wish to participate or participation is inconvenient, no further calls will take place. These forms will be kept secured and destroyed once you have been contacted or we determine we have a sufficient number of respondents. Your name and number will not be given out to anyone or used for any purpose apart from this project.

The purpose of this follow-up has been explained to my satisfaction and I have had the opportunity to ask questions. By signing below, I give my permission for the facilitator to call me at the number below to arrange a 15 minute follow-up by phone. I understand that I may not agree at that time to the interview. Should I refuse, no further contact will be made and this form will be destroyed.

Printed name: _____ Phone Number: _____

Signature: _____ Date: _____

Most convenient days to call: ☐ Mon ☐ Tues ☐ Wed ☐ Thurs ☐ Fri

Best time period to call: ☐ morning ☐ afternoon ☐ early evening

Consent for Interview

I understand that I am being asked to take part in a 30 minute interview to discuss the Back and Upper Limb Injury Prevention Course and its impact in my workplace. I understand that I can decline to answer any questions. My participation in this interview is totally voluntary and in no way will affect the services I now receive from the Waterloo Safe Communities Program or may receive in the future. The information from both the interview and background questionnaire will be summarized. No one individual or company will be identified in the results.

This project has been reviewed and approved for ethics through the Office of Human Research and Animal Care at the University of Waterloo. If you have any questions or concerns resulting from your participation in this study, please contact this Office at (519) 888-1211, Ext. 6005.

Thank you for your help in this project. If at any time you have questions about this study, please feel free to contact either myself at (519) 888-1211, Ext. 6018 or Professor Stephen McColl at (519) 888-1211, Ext. 2720.

Participant's name (print): _____

Participant's signature: _____

Date: _____

We need the permission of all participants to audiotape the interview session. The reason for audiotaping is so we do not miss any of the valuable comments that you make. The tapes allow us to go back and analyse the information more completely. Specific comments may be quoted in the reports, but no individuals will ever be identified. The tapes will be kept secured and destroyed following analysis.

The reasons for audiotaping the discussion session have been explained to my satisfaction. I understand that everyone in the group has to agree before audiotaping will take place. By signing below, I am consenting to the audiotaping.

Participant's name (print): _____

Participant's signature: _____

Date: _____