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Essential characteristics of preventive educational programs targeting the industrial and service worker populations

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ESSENTIAL CHARACTERISTICS OF PREVENTIVE EDUCATIONAL PROGRAMS TARGETING THE INDUSTRIAL AND SERVICE WORKER POPULATIONS

By

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An Abstract

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Abstract

Background: Work related injuries are prevalent in the United States, affecting an estimated 80% of the adult population (Waddell, 1987). These injuries often lead to painful back disorders and cost employers a significant amount of money each year. Educational programs have been developed to decrease work-related injury incidence and cost of treatment. Many programs educate individuals after an injury, taking a tertiary prevention approach, while other programs focus on secondary prevention for populations at risk for injury (Daltroy et al, 1996). The Occupational Safety and Health Administration (OSHA) is currently proposing standardized prevention guidelines since none of these existing programs consistently demonstrate effective prevention of injury (Schneider, 1999).

Purpose: The purpose of this literature review is to identify essential characteristics of successful worker education programs. This organized data will minimize trial and error attempts when developing an effective injury prevention program to comply with OSHA standards.

Method: Literature databases were used to identify articles that meet the established inclusion criteria of reporting program effectiveness, utilizing a secondary or tertiary prevention approach, educating industrial and service worker groups, and being published after 1985. A matrix chart method, using specific categories and number coding, was used to organize the data when reviewing the literature. The data is analyzed for identification of effective program trends by utilizing frequency analysis, sorting, and charting.

Results: A visually observed trend suggests that including the characteristics of active learning and of a meaningful environment may increase the success of worker education programs to prevent injury and promote safe behaviors. Statistical results do not support this trend.

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A Thesis Presented to the Faculty

of the School of Health Sciences and Human Performance

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CERTIFICATE OF APPROVAL

This is to certify that the Thesis of

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Chapter 1

Introduction

Back disorders are prevalent in the United States, affecting an estimated 80% of the adult population (Waddell, 1987). Many work-reported injuries (15-25%) are related to back pain (Daltroy, Iverson, Larson, Lew, & Wright et al., 1997). This back pain is often a result of a person using improper body mechanics, lifting an extremely heavy object, or using unsafe equipment.

Health care costs to treat these injuries are significant. The Occupational Safety and Health Administration (OSHA) estimates that work-related musculoskeletal disorders cost the economy between 45-60 billion dollars per year (Herman, 2000). The workers' compensation insurance coverage to treat the injury often requires care from physicians, occupational therapists, and physical therapists. Additional costs are incurred to cover absent workers and to hire new personnel while the worker is recuperating from the injury.

Responding to high injury incidence and costs, educational programs and back schools have been developed to decrease back injury incidence and cost of treatment. A variety of educational approaches have been used in an attempt to develop a successful program (Daltroy et al., 1997). In the past, many of these programs have educated individuals to prevent re-injury, taking a tertiary prevention approach (Daltroy et al., 1997; Rankin & Stallings, 1996).

Thirty years after the implementation of the first back school, back pain and injuries are still the leading cause of all injuries reported at work (Daltroy et al., 1997). In response to this, OSHA has proposed mandatory guidelines for employers to implement ergonomic programs to control incidence rates (Schneider, 1999; National

Report of Subacute Care, 1999). This prevention approach identifies workers at risk for injury and attempts to change worker behavior and the environment before the initial injury or re-injury occurs (Rankin & Stallings, 1996).

This study examines the characteristics of educational programs developed specifically for the industrial and service worker population. Secondary prevention programs that educate populations at risk for injury to prevent illness and injury are investigated. This study reviews tertiary prevention programs that educate populations previously injured and prevent re-injury. A study of the literature is prerequisite to determine which worker program characteristics are essential in the development of a preventive back injury educational program that effectively changes worker behavior.

Problem

Numerous approaches to educating workers are reported in the literature. In the past, education focused on tertiary prevention of injuries. Nevertheless, secondary prevention programs have recently been implemented and researched. The research results for both the secondary and tertiary prevention programs report the use of various approaches and characteristics in the programs. Because of these inconsistent program approaches and characteristics, it is difficult to determine if effective trends exist.

The inconsistent data make it difficult to gather information to develop an effective program that will comply with OSHA's draft guidelines. An effective worker prevention program would be difficult to develop since essential program characteristics are not identified clearly in the literature. This leads to trial and error interventions when developing a worker prevention program.

Background

In response to the high incidence of back injury and rising costs of workers compensation, educational programs were developed in attempt to control the injury rate. In 1970, Zachrisson-Forssell created the first back school in Sweden (Schenk, Doran, & Stachura, 1996). Since then, many other educational programs have been designed to decrease the frequency of back injuries (Linton & Kamwendo, 1987).

Traditional back education programs were developed by employers to educate workers after the initial back injury or pain symptom. The implementation of the education program depended on the employer's discretion. Currently, OSHA is working to enact a mandate for employers to implement prevention programs for identified high-risk worker populations. OSHA is now holding public hearings for comments and suggestions on the proposed standard that will require employers to focus on the individuals and environments at risk to avoid initial injuries (OSHA, 2000)

Purpose

The purpose of this study is to review past research on worker education to identify effective characteristics of secondary and tertiary worker education programs. A matrix method and the statistical program *SPSS* are used to organize the literature for identification of effective trends in secondary and tertiary programs that prevent work-related injuries. Research results of educational programs will help identify effective program components and eliminate unnecessary trial and error approaches when implementing a program to change the behavior and habits of workers.

Significance of literature review

The review of literature is a necessary step in developing an effective prevention program for the population of workers. Because of the extensive number of educational programs offered throughout the world, examining only a few articles or conducting a survey would not have given sufficient representation of the education programs offered to the working population. The research findings from the literature can be applied to the educational training of the adult worker for the development of prevention programs.

The OSHA standard to reduce work-related musculoskeletal disorders (WMSD) will require employers to provide preventive education for at-risk or previously injured employees (Schneider, 1999; National Report of Subacute Care, 1999). Many employers will need professional consultation to implement and comply with the standard. Employment opportunities will be created to develop individualized secondary prevention programs which can change employee behaviors and adapt the work environment. The profession of occupational therapy can seize this opportunity to promote the profession's domain of health promotion and preventive practice.

Chapter 2

Purpose of Literature Review

The purpose of this literature review is to examine available research regarding work related injuries. Identification of work related injuries, cost of treating the injuries, and types of prevention programs begin the review process. The contribution of back schools in initiating injury prevention programs is notable and reviewed in detail. The review then targets prevention programs including goals, participants, content, methods involving OSHA standards and adult learning theories, and research results on the effectiveness of the educational programs.

This review is linked to the methodology for setting the inclusion criteria and deriving appropriate categories to study. The inclusion criteria and categories shape the systematic matrix method review of the available literature. The categories that are reviewed may lead to uncovering effective characteristics of prevention education

Work Related Injuries and Back Pain

Back pain affects an estimated 80% of the American population at one time in their life (Waddell, 1987). This pain, usually due to back injury, ranges greatly in severity of symptoms. One end of the spectrum is slight discomfort after performing a task. The other extreme is suffering from intense pain requiring constant bed rest or surgical repair of the injury.

Back injury and pain often result from a soft tissue strain in the back or herniation of a vertebral disc (Trombly, 1995). Lifting and bending cause increased load on the vertebral column, which leads to a higher chance of disability (Amosun & Falodun, 1991). It is not clear if pain and injury to the back occurs after one incident or if it results after several incidences of using improper body mechanics.

Amosun and Falodun (1991) report that one of the most common causes of low back pain is from lifting different objects. Lifting is performed during many activities of daily living. Some examples include: lifting a laundry basket, picking up a newspaper from the ground, moving a garbage can, picking up a child, or lifting an object at work.

Movements involving the back are performed frequently in the workplace and lead to back injuries and pain (Amosun & Falodun, 1991). Back injuries account for approximately 15-25 percent of the injuries that are reported and covered by workers' compensation every year in the United States (Daltroy et al., 1997). Common causes of injury at work include: maintaining a static posture, repeated lifting, twisting while lifting, vibration exposure, and working in an unsafe environment (Baker, 1998; Trombly, 1995).

High incidences of back injury and pain are reported in a number of service and industrial professions. This worker population includes automotive workers, industrial factory workers, nursing aides, custodians, coal mine workers, postal workers, loggers, and maintenance workers (Baker, 1998; Daltroy et al., 1997; Brooks, 1995; Ryan, Krishna, & Swanson, 1995; Linton & Kamwendo, 1987). The incidence of injury rises with increased repetition and lifting heavier loads. However, back injury and pain can also result from lifting a light object, such as reaching for a broom on the floor (Brooks, 1995).

Health Care Costs for Treating Work Related Injuries

Each year, approximately twelve million adults in the United States seek health care for back pain and injury (Waddell, 1998). The pain suffered from back injury is reported as being the fifth most common reason that individuals visit their physician

(Waddell, 1998). These numbers and the cost of health care to treat work related injuries continue to rise dramatically each year.

Workers suffering from work related back injury usually receive treatment from the company appointed physician. The physician then refers the worker to a professional for rehabilitation treatment that may include pain management, physical agent modalities, strengthening exercise, conditioning, and patient education. The physician may also refer the worker to a work hardening program for return to work (Daltroy, 1997).

Brown, Sirles, Hilyer, and Thomas (1992) reported that 16 billion dollars per year were spent in the United States to cover "expenditures for lost work time, medical care, and workers' compensation resulting from back injury"(p.1224). This estimate includes not only medical treatment costs, but also the cost of hiring new employees to replace the injured workers. Each year the cost of health care continues to increase to cover treatment of back pain from work related injuries (Lindqvist, Timpka, Schelp, & Ahlgren, 1999; Guo, Tanaka, Cameron, Seligman, Behrens, Ger, et al., 1995).

Back Schools

Back schools were developed in response to the rising cost of workers' compensation and health care costs for employers. Di Fabio (1995) described back schools as interventions that include "patient education for proper bending and lifting activities (body mechanic instructions) and implementation of a passive or active back exercise program" (p. 866). Most back schools include a lecture on the anatomy and function of the spine, demonstration of the proper lifting technique, and exercises to perform to strengthen the back (Di Fabio, 1995).

The first back school was developed in 1969 in Sweden (Zachrisson-Forssell, 1980). This back school was followed by schools in Canada, the United States, and Australia (Hall, 1980; Kennedy, 1980; Mattmiller, 1980; Trombly, 1995). These schools target different populations. For example, the Canadian back school addresses chronic low back pain (LBP) clients while the California back school educates clients suffering from acute pain (Trombly, 1995). In spite of the variety, the common tie is that each back school targets populations that have previously been injured (Zachrisson-Forssell, 1980; Hall, 1980; Kennedy, 1980; Mattmiller, 1980).

Although there are established back education programs, many employers provide unique education programs developed specifically for their facility (van Poppel, Koes, van der Ploeg, Smid, & Bouter, 1998; Daltroy et al., 1997; Leclaire, Esdaile, Suissa, Rossignol, Prouix, Dupuis, et al., 1996). For individualized services, employers hire professionals to educate workers on injury prevention. These services usually include education and environmental modification (Daltroy et al., 1997).

Many of the programs in review are developed and implemented by physical therapists (Baker, 1998; Daltroy et al., 1997; Schenk et al., 1996; Di Fabio, 1995; Linton & Kamwendo, 1987). Traditionally, physical therapists conduct back schools because they have extensive knowledge of the anatomy of the back and kinesiology of movement. Occupational therapists, orthopedic surgeons, and nurses are also involved in educating individuals on back safety (Leclaire et al., 1996; Coleman & Hansen, 1994; McCauley, 1990; Carlton, 1987). An occupational therapist's contribution to the development and implementation of the educational program includes knowledge of anatomy and

kinesiology, theoretical background of learning, meaning and purpose, and practical application of environmental modification.

Professionals choose a frame of reference or model of practice to follow during the planning, implementation, and follow-up of the program. Some programs are planned following general ergonomic principles; however, specific principles established by the Canadian, Australian, Swedish, or Californian back schools have not been incorporated by most employers (Schenk et al., 1996; Coleman & Hansen, 1994; Gundewall, Liljeqvist, & Hansson, 1993; Zachrisson-Forssell, 1980; Hall, 1980; Kennedy, 1980; Mattmiller, 1980)

A number of studies have been conducted on the effectiveness of back schools in meeting set goals (van Poppel et al., 1998; Leclaire et al., 1996; Feldstein, Valanis, Vollmer, Stevens, & Overton, 1993; Donchin, Woolf, Kaplan, & Floman, 1990). Program and participant characteristics vary per study making concluding results difficult to organize into trends. There is research on various programs that indicate that worker educational programs are successfully changing behaviors (Schenk et al., 1996; Chavalinitikul, Nopteepkangwan, & Kanjanopas, 1995; Ryan et al., 1995; Coleman & Hansen, 1994). Other research studies claim that the programs are not effective in meeting set goals (van Poppel et al., 1998; Daltroy et al., 1997; Leclaire et al., 1996).

Historically, back schools taught a population that had already suffered from a back injury or pain. Both chronic and acute back problems were addressed in education programs. However, OSHA's guidelines may influence the trend to move toward using education as a secondary prevention measure (Schneider, 1999; Pope, Andersson, Frymoyer, & Chaffin, 1991; Linton & Kamwendo, 1987). Along with tertiary prevention

of educating previously injured workers, OSHA proposes that prevention programs also target the workers that are at risk for an injury. Therefore, those who have never suffered from previous injury should be included in injury prevention programs (Schneider, 1999).

Prevention Programs

Because work related injuries are widespread, it is obvious that prevention measures are needed. Andersson (1984) described the following prevention approaches; "designing the job for the worker, selecting the right worker for the right job; and teaching the worker the right work method" (p. 211). He organized the injury prevention approaches into three classical prevention categories identified as primary, secondary, and tertiary.

Andersson described primary prevention as a "measure taken to prevent the clinical manifestation of a disease before it occurs" (1984, p. 211). A noted example of primary prevention is providing immunization to children (Andersson, 1984). This population provided with the primary prevention approach has not been identified as being at risk for any specific disease or disorder.

Primary prevention is addressed in only one identified research article (Lindqvist et al., 1999). A program in Sweden educated all community members of the worker population on injury prevention (Lindqvist et al., 1999). This prevention approach is not commonly identified in the literature as an approach utilized by industrial or service worker employers.

Secondary prevention is described as a "measure taken to arrest the development of a disease while it is still in the early, asymptomatic stage" (Andersson, 1984, p. 211). A secondary prevention approach to educating workers would be to identify high-risk

work task, behaviors, and environments. Education and environmental modification would then be implemented before an injury occurs.

Andersson's definition of tertiary prevention states that it is a "measure taken to minimize the consequences of a disease (or injury) once it has become clinically manifest" (1984, p. 211). The use of tertiary prevention would be implemented when educating an individual who had previously suffered from a work-related injury. The education would focus on minimizing the chance of re-injury through education and modifying the work environment.

The majority of the programs discussed in this literature review address secondary and tertiary prevention approaches (van Poppel et al., 1998; Gundewall et al., 1993; Carlton, 1987). The researched educational programs focus on specific populations that targeted previously injured workers and workers at high risk for injury (Versloot, Rozenman, van Son, & van Akkerveeken, 1992; Brown et al., 1992; McCauley, 1990; Walsh & Schwartz, 1990; Linton, Bradley, Jensen, Spangfort, & Sundell, 1989).

Goals of the Educational Programs

The goals of the educational programs also vary. Few studies actually examine the frequency of back injuries even if the overall main goal is to reduce the incidence of injury (Daltroy et al., 1997). Goals set for the studies include increasing knowledge of the musculoskeletal system, strengthening muscles, increasing use of safe behaviors, and decreasing absentee rate (Baker, 1998; Brown, 1992; Versloot et al., 1992; Linton & Kamwendo, 1987).

Goal achievement is often measured directly following intervention of the education program. For example, in a study by Schenk et al. (1996), the post-test is a 12

question multiple choice, true and false written exam that tests knowledge one week after the material is presented. In other cases follow-up on achieving goals of behavior change is assessed at 48, 96, or 288 weeks after the intervention (Baker, 1998; Daltroy et al., 1997; Ryan et al., 1995; Coleman & Hansen, 1994; Versloot et al., 1992). The assessments used include self-reported behavior change, written questionnaire, skilled observation, visual evaluation, or analysis of workers' compensation information (Daltroy et al., 1997; Ryan et al., 1995; Coleman & Hansen, 1994; Versloot et al., 1992).

Education Program Participants

The population of participants included in the educational programs includes workers with and without previous back injury, employees with or without previous knowledge of back care, and patients suffering from chronic or acute back pain (Baker, 1998; Daltroy et al., 1997; Schenk et al., 1996; Di Fabio, 1995; Brown et al., 1992; Versloot et al., 1992; Amosun & Falodun, 1991; McCauley, 1990; Linton & Kamwendo, 1987). Programs serve various occupation labels, education levels, ages, and genders (Daltroy et al., 1997; Schenk et al., 1996; Klaber Moffett, Chase, Portek, & Ennis, 1986).

Variation is apparent in the selection criterion for employees to participate in the study. The three noted inclusion tactics were mandatory employee enrollment, voluntary employee enrollment, and individual referral to the educational program from a professional (Leclaire et al., 1996; Coleman & Hansen, 1994; Brown et al., 1992; Amosun & Falodun, 1991). The selection criterion is determined by the employer and the professional developing the program.

Employees are referred by physicians, therapists, or employers to attend the injury prevention programs. These referrals are made on an individual basis to attend group

educational programs to increase the likelihood of return to work (Leclaire et al., 1997; Amosun & Falodun, 1991). The reviewed studies that include referred workers use tertiary prevention approaches that educate previously injured workers (Leclaire et al., 1997; Amosun & Falodun, 1991).

Content of Education Programs

Some similarities are noted when examining the content of the programs. The reviewed educational programs contain education on anatomy of the back and spine. Also included in all programs is information regarding correct body mechanics and posture when performing work tasks (Baker, 1998; Daltroy et al., 1997; Schenk et al., 1996; Di Fabio, 1995; Brown et al., 1992; Versloot et al., 1992; Amosun & Falodun, 1991; McCauley, 1990; Linton & Kamwendo, 1987; Snook, 1984).

There are programs that include motivation and incentives to meet goals of changing behaviors by providing reinforcement of the concepts. Other programs do not address motivation (van Poppel et al., 1998; Baker, 1998; Daltroy et al., 1997; Versloot et al., 1992; McCauley, 1990; Sulzer-Azaroff, Loafman, Merante, & Hlavacek, 1990; Wollenberg, 1989). The incentives in the studies vary from tangible rewards such as an employee luncheon to the employer providing positive verbal reinforcement when the employee performs safe behaviors (van Poppel et al., 1998; McCauley, 1990; Sulzer-Azoroff, 1990).

The inclusion of motivational aspects into the education program also varies per study. Some of the voluntary, mandatory, and referral enrollment programs incorporate motivational factors (van Poppel et al., 1998; Linton et al., 1989). Motivation is not consistently addressed in the mandatory enrollment or referral programs where

participants do not have a choice in attending the program (Ryan et al., 1995; Amosun & Falodun, 1991). The literature on voluntary programs also does not consistently report on motivational factors (Leclaire et al., 1997; Versloot et al., 1992).

Methods of Education Programs

A variety of approaches are used during the presentation of the back educational programs. Snook (1984) describes the cognitive, psychomotor, and affective learning that can be applied to preventive educational programs. Cognitive learning is provided in a classroom as an informational lecture. Prepackaged back school programs that provide slide presentations and handouts can be considered a cognitive learning approach (Snook, 1984). An obstacle course or kinesthetic movement is considered psychomotor learning while affective learning involves motivation to use new behaviors. The affective learning approach concentrates on selling the ideas to each employee so they are motivated enough to continually use the new method to develop safe habits (Snook, 1984).

In regard to teaching style, some programs simply use one type of media while others utilize a combination of approaches. Use of media in the programs include posters, videos, films, and slides. Some programs require participants to perform the new behaviors (McCauley, 1990) while others verbally suggest during a lecture that body mechanics need to be altered (Schenk et al., 1996). Most of the programs studied use verbal and visual means to teach. Incorporation of kinesthetic, "doing" activities varies in each back school.

The environment utilized in each study also varies. The main approaches use a traditional classroom, simulated work tasks, or on the job training at the real work station (Gundewall et al., 1993; Donchin et al., 1990; McCauley, 1990; Carlton, 1987).

Combinations of the three mentioned environments are also used in various programs (Daltroy et al., 1997).

The method involved in following up with education reinforcement also varies greatly. Some programs present the information in one session and learning is not reinforced (Schenk et al., 1996; Gundewall et al., 1993). However, educational programs have been researched that do include follow up reinforcement education (Daltroy et al., 1997; Leclaire et al., 1996).

There is variation in the number of sessions, frequency, duration, and total time of the back school sessions. For example, custodial workers participating in a study by McCauley (1990) received 1 hour of group back school training along with two 10-15 minute reinforcing visits at the work site, over a period of 2 weeks. In contrast, a study by Linton et al. (1989) provides training and feedback for 200 hours over 5 weeks. Although differing regarding time commitment, both of these programs report success in changing behavior (McCauley, 1990; Linton et al., 1989).

OSHA- Minimizing Injury through Education and Training

As previously described, various education and training techniques have been used to minimize injury. As a method to prevent injury OSHA is attempting to protect worker's safety by promoting the implementation of injury prevention programs.

Concerned with the prevention of back injury and pain is the Occupational Safety and Health Administration of the United States Department of Labor Department. The agency's mission is " to assure so far as possible every working man and woman in the nation safe and healthful working conditions" (OSHA, 1999). Its mission is to save lives, prevent injury, illness, and promote the health of workers in the United States. Currently,

OSHA is working to mandate standards on the training and education for working populations (OSHA, 2000).

OSHA is implementing an ergonomics rule so employers work to decrease the incidence and severity of injury among worker populations (OSHA, 2000). It is not expected that work injuries, specifically back injury and pain, will be completely eliminated from the work place. Nevertheless, emphasis on prevention from OSHA and education programs will help manage the problem (Pope et al., 1991).

The purpose of the new OSHA ergonomics rule is to decrease incidence of employee injury. OSHA reports that the proposed standard will prevent 300,000 injuries at 1.9 million general industry sites (OSHA, 2000). To accomplish this, employers must organize and implement a program to identify and control at-risk situations. The standard is geared to prevention of "workplaces in general industry" and targets jobs such as manual handling and manufacturing production jobs that are high risk for injury and injury incidence is high (Kent, 2000; Schneider, 1999). The standard identifies the basic obligation, management leadership and employee participation, hazard identification and information, job hazard analysis and control, training, medical management, and program evaluation (Schneider, 1999, p. 413).

The standard's basic obligations include such tasks as assessing environment, task, and person involved at the worksite. It also includes implementation of a program that may involve worker education and environmental modification. Each implemented program must also be evaluated on the effectiveness of preventing injury (Schneider, 1999).

Drafts of the OSHA standard have been released to the public and hearings are currently being held on the proposed standard (Schneider, 1999). Marthe Kent, head of OSHA's regulatory program, made the following statement,

> OSHA is proud to welcome you here today because we believe that publishing a final rule addressing ergonomic hazards in the workplace will do more to help American workers and fulfill OSHA's Congressional mandate than any other single action this agency could take (OSHA, 2000, p.2).

OSHA is committed to implementing the standard as soon as possible to prevent any further unnecessary injuries (OSHA, 2000).

OSHA heard approximately 1,100 individuals testify between March 13, 2000 and May 12, 2000. These public forums were in Washington, D.C., Chicago, Illinois, and Portland Oregon (OSHA, 2000). Once the public statements have been considered, the final ruling is expected to take one to two years to pass before employers must comply with the standard (Schneider, 1999).

If the proposed standard passes, the employers will be expected to establish effective prevention programs to meet set guidelines (Schneider, 1999). A main component of meeting the standard's guidelines will be to provide education to employees (Schneider, 1999). In addition, environmental modification will most likely be incorporated into the program to further prevent injury and promote the safety of the employees (OSHA, 2000).

Adult Learning in Educational Programs

The ultimate goal of each educational program is to educate the participants to use safe behavior and prevent injury but a variety of different learning methods are

implemented to reach this common goal. Each of the programs did focus on the adult working population (van Poppel et al., 1998; Schenk et al., 1998; Daltroy et al., 1997; Ryan et al., 1995; Brown et al., 1992). One prominent approach to an adult style of learning is Malcolm Knowles' theory of adult learning (Knowles, 1978). He states that applying adult learning conditions and principles when developing educational programs will promote effective teaching and learning styles leading to a successful outcome.

The review of previously established programs has shown that each program utilizes a different model of practice to reach this goal. Malcolm Knowles (1978) theorized that learning and teaching theories should be incorporated into planning and implementing for effective learning. Knowles (1978) identifies specific conditions of learning and principles of teaching that help facilitate learning and behavior change.

Conditions of learning. In reference to adult learning, Malcolm Knowles (1978) lists seven conditions for learning to occur. The conditions are noted below.

1. The learners feel a need to learn.
2. The learning environment is characterized by physical comfort, mutual trust and respect, mutual helpfulness, freedom of expression, and acceptance of differences.
3. The learners perceive the goals of a learning experience to be their goals.
4. The learners accept a share of the responsibility for planning and operating a learning experience, and therefore have a feeling of commitment toward it.
5. The learners participate actively in the learning process.
6. The learning process is related to and makes use of the experience of the learners.

7. The learners have a sense of progress toward their goals. (p. 77-79)

Applying Knowles' conditions of learning to worker educational programs with adult participants, could lead to more effective learning and behavior change. According to Knowles (1978), applying the learning theory when planning to implement a program will increase the likelihood of influencing employees to use preventive behaviors. These seven conditions are applied to educational programs as described below.

The condition of "the learners feel a need to learn" (Knowles, 1978, p. 77), should be incorporated into the selection criterion of each educational program. Voluntary enrollment of employees meets this condition because only employees who feel the program is beneficial are included (van Poppel et al., 1998; Schenk et al., 1998; Coleman & Hansen, 1994). Mandatory enrollment may lead to a program not complying with this condition of learning (Daltroy et al., 1997; Ryan et al, 1995; Brown et al., 1992). In the case of mandatory enrollment, it appears that attention should be paid to creating a program where employees recognize the benefit from performing work tasks safely.

Another important condition to include in the educational process in order for learning to occur is that "the learning environment is characterized by physical comfort, mutual trust and respect, mutual helpfulness, freedom of expression, and acceptance of differences" (Knowles, 1978, p. 77). The learning environment helps with the process of learning. Different environments are used when implementing each of the reviewed educational programs. The specific reason for choosing a certain environment for each program is not always included in the reviewed articles.

The third condition, "the learners perceive the goals of a learning experience to be their goals" (Knowles, 1978, p. 78), can also apply to the selection criterion of mandatory

versus voluntary enrollment in the program. However, this condition can be utilized when designing the program. The content of the program can meet this condition by including specific references and examples of employee workstations and specific tools used. Reviewed studies meet this condition by including the workstation and work tools in a simulated work environment (van Poppel et al., 1998; Chavalinitikil et al., 1995; Coleman & Hansen, 1994; McCauley, 1990). The employees are able to relate the presented information regarding the actual work environment or tools and apply the information to their own personal work tasks.

An example of the condition, "the learners accept a share of the responsibility for planning and operating a learning experience and therefore have a feeling of commitment toward it" (Knowles, 1978, p. 78), is included in the study by Sulzer-Azaroff et al. (1990). The program included an employee team approach to education with tangible rewards if the employees used safe behaviors. This approach appears to lead to responsibility and commitment of each employee for their individual behavior. Each employee is responsible for the other employee's commitment because the tangible reward would not be attained if one individual consistently used unsafe behavior (Sulzer-Azaroff et al., 1990).

"The learners participate actively in the learning process," (Knowles, 1978, p. 78) is a condition that was included in many of the reviewed studies. Examples are the teaching styles that utilized kinesthetic learning by practicing proper body mechanic techniques during the program (Leclaire et al., 1996; Feldstein et al., 1993; Donchin et al., 1990; McCauley, 1990; Carlton, 1987). The kinesthetic approach actively includes

the employee in the program leading to active learning and safe performance of specific tasks.

It is assumed that only participating actively by cognition is not considered active learning. This is based on a study reporting that a mouse that walks through the maze learns the correct path better than the mouse that is pulled through the maze on a wagon (Glickstein, 1999). Similarly, if a person watches someone performing a safety body movement and cognitively absorbs the information enough to write it down, they may not necessarily be able to physically perform the correct movement.

Another condition Knowles (1978) includes in his learning theory addresses "the learning process related to and makes use of the experience of the learners" (p. 78). For the learning process, relating to previous experience of the learner would be through goals, environment, and teaching style. Prepackaged educational programs do not necessarily meet this need because they do not address individualized experiences of the learner. This suggests that it is appropriate that programs be individualized for specific jobs.

The last condition, "the learners have a sense of progress toward their goals" (Knowles, 1978, p. 79), was also utilized in a study by Sulzer-Azaroff et al. (1990). This program uses visual chart measurements to track the progress of consistently using safe behaviors. Each week the chart is updated to reinforce the use of safe body mechanics and promote progression (Sulzer-Azaroff et al., 1990).

Principles of teaching. The conditions of learning are also incorporated into 16 principles of teaching. Knowles (1978) suggests these principles be used in education. Therefore, these principles should be included in the worker educational program for

learning and preventive behavior change to occur. The 16 principles are reviewed and only a select few are noted to be reported sporadically throughout the worker education program literature. These select principles of teaching applying to worker educational programs are identified as the following:

1. The teacher accepts the learner as persons of worth and respects their feelings and ideas.
2. The teacher gears the presentation of his or her own resources to the levels of experience of the learners.
3. The teacher helps the learners apply new learning to their experience, and thus make the learning more meaningful and integrated (Knowles, 1978, p. 77-79).

The first noted principle, "the teacher accepts the learner as persons of worth and feelings and ideas" (Knowles, 1978, p. 77), should be included in each educational program. With this theory, the educational program should not consist solely of a lecture environment with the professional speaking at the employees. Although the employees may not have completed formal education regarding body mechanics or environmental modification, they may have immeasurable knowledge from personal experience. Therefore, it is appropriate for the professional planning and implementing the program to use the employees as resources. Opportunity for feedback should also be provided during the entire educational process.

Another principle, "the teacher gears the presentation of his or her own resources to the levels of experience of the learners" (Knowles, 1978, p. 78) applies to the employee's work experience or level of education. A few research articles include demographics on years of experience or education level (Daltroy et al., 1997; McCauley,

1990; Walsh & Schwartz, 1990; Wollenberg, 1989). However, this information is included to show that the control and experimental groups were similar demographically rather than to gear the education to that level.

This principle suggests that it would be appropriate to individualize the program regarding demographics such as education level or work experience. The teaching style and environment may change when educating a group of employees who did not complete high school versus individuals that have a college degree. The reviewed literature on worker educational programs does not address this principle of adapting the presentation content or method to fit the level of the learner.

The last noted principle, "the teacher helps the learner apply new learning to their experience, and thus makes the learning more meaningful and integrated" (Knowles, 1978, p. 79) addresses generalization of knowledge and the application to all work tasks. Realistically, every situation cannot be practiced or discussed during the educational program. On the other hand, the teacher can help employees develop problem solving skills to generalize and apply the knowledge. For instance, safely lifting a garbage can can be applied to safely lift other objects.

The conditions of learning and principles of teaching may be addressed in the reviewed educational programs but not reported in the articles. The research does not report focusing on adult learning but some techniques may have been utilized. If the goal of the program is for the employee to learn safe behaviors to prevent injury, then it is appropriate to use the conditions of learning and principles of teaching to develop the prevention program.

Results of Education Programs

The results of achieving set goals varied per study. Behavior change is either significant or does not occur. Methods used to measure behavior change vary from skilled observation at the workstation to written questionnaires to analysis of worker compensation statistics (Brown et al., 1992; McCauley, 1990; Wollenberg, 1989).

The programs that are effective are able to show during reassessment that significant difference in behavior did occur, indicating that learning did take place. The education results are difficult to compare because of the variation in learning and behavior changes that were measured in short-term and long-term follow-up research. The follow-up research varies per research study ranging from a 1 to 288 week time lapse between intervention and reassessment.

The results are also difficult to interpret because group design varied so greatly. Some programs had one experimental group without a control group while others provide three separate intervention techniques along with a control group (Walsh & Schwartz, 1990; Sülzer-Azaroff et al., 1990).

Summary

Reading the literature on characteristics for education programs and OSHA standards identified characteristics that are frequently used when developing worker prevention programs. Determining the characteristics that promote learning and change behavior will help when implementing an educational program.

A methodology is needed to uncover what characteristics are needed for learning to occur. Looking for the answers in past research is the first step. A more specific method of reviewing the literature is needed to determine the characteristics necessary for

an occupational therapist to develop an individualized, effective prevention program tailored to an identified population. The method to determine these characteristics is discussed in the following chapter.

Chapter 3

Methodology

The following methodology to determine effective characteristics of preventive education programs included a research article search, screening with inclusion criteria, determining categories, and using a matrix method to compare the programs. Results of the collected data were analyzed with visual comparison and chi-square statistics. When warranted, further statistical analyses were completed on each notable trend.

A review of the literature on preventive worker education was performed by searching Medline and Cinahl databases and relevant articles reference lists. Using the key words *injury prevention, worker,* and *education* resulted in 1,238 articles. Inclusion criteria were established due to the large amount of research on prevention educational programs for the worker population. The research articles included in the review met the following criteria:

1. Research results were provided on the program's effectiveness. A description of the program alone would not provide enough information on the effectiveness of changing behaviors.
2. The research addressed a secondary or tertiary educational program. It was assumed that primary prevention education for workers not at risk was not a priority for most employers.
3. The research addressed education of an industrial or service worker population. Job tasks that include frequent heavy lifting often result in back pain or injury.
4. The research addressed the education of a group of workers opposed to treatment and education of an individual worker. Results of group studies can be applied to group education programs in the worksite.

5. Research studies published after 1985 because the majority of the research meta-analyses regarding work related injuries was published before or during 1985. The information from the meta-analyses conducted before 1985 was used as a reference on which to develop the list of program characteristics to review.

6. The research article provided a detailed discussion of program characteristics that were evaluated. Twenty-three different categories of program components were selected by the author for evaluation: each article accepted for inclusion in this study provided information on at least 15 characteristics.

A matrix method was established using 23 program categories, Knowles' (1978) seven conditions of learning, and number coding to systematize the data for analysis (Gerrard, 1999). Four main categories of general, participants, program, and conditions of learning were used to organize the data. The categories were organized under each of these headings after reviewing the research articles and meta-analyses included in this literature review (chapter 2). Each included category was addressed multiple times for program or participant characteristics in the reviewed studies.

Twelve of the categories were not appropriate to code or to group due to the varied responses. Instead of a number code, specific data was entered into the twelve categories. If data was not included in the research article the category was left blank.

The inclusion criteria were set to review research that was relevant to the identification of essential characteristics of preventive worker education programs. The criteria narrow the search so the results would focus on education of employees in industrial and service jobs. Sixty-five research studies were reviewed and forty-five studies were excluded because they did not meet the inclusion criteria (Appendix A).

Twenty research articles (Appendix B) met the inclusion criteria. The research was then reviewed to identify essential characteristics of effective educational programs.

The research data were entered into a chart using the computer program *Statistical Package for Social Sciences (SPSS).* The categories were identified along the top, horizontal axis while each study was listed in the numbered, left, vertical axis. The 23 categories were divided into three general areas of *General Characteristics, Participant (Worker) Characteristics,* and *Program Characteristics* for organization purposes. The following categories were used to run frequencies and identify clustering and trends when reviewing each study. Refer to Appendix C for specific coding and explanation of each category.

General Characteristics

- Researcher name
- Year that study was published
- Prevention approach used in the design of the program

Participant (Worker) Characteristics

- Occupation label of participants involved in education program
- Number of participants involved in education program
- Specific age of participants
- Gender of participants
- Percentage of participants with a pre-existing injury
- Years of education participants completed prior to education program

Program Characteristics

- Professionals involved in planning or implementing the education program
- Teaching style used during the education program
- Number of educational sessions used during program
- Frequency that participants attended sessions during the education program
- Duration of session time during implementation of educational program
- Total time used for education of participants
- Group design used for the study
- Environment used during program presentations
- Motivational factor to change behavior included in the program
- Follow- up education reinforcement included in program
- Number of weeks between intervention and when behavior was reassessed
- Type of behavior change measure included in study
- Inclusion of a Professional using skilled observation of body mechanics at work station
- Significant positive preventive behavior was observed during reassessment

The selected studies were then analyzed utilizing Knowles' conditions of learning (1978). Knowles' principles of teaching were not categorized and coded because of the lack of information on teaching style specifics. The small amount of information available would not lead to significant findings regarding essential principles for learning to occur. However, each of the seven conditions of learning were categorized and coded as follows,

- The learners feel a need to learn (Knowles, 1978, p.77).

    1. Voluntary enrollment, the employees chose to attend the program

    2. Mandatory enrollment, the employees were required to attend the program and the injured individual received referral from physician, therapist, or employer to attend program for return to work

- The learning environment was characterized by physical comfort, mutual trust and respect, mutual helpfulness, freedom of expression, and acceptance of differences (Knowles, 1978, p. 77).

    1. Yes, a comfortable environment was used (identifiable equipment utilized, feedback opportunities given to increase comfort)
    2. No

- The learners perceive the goals of a learning experience to be their goals (Knowles, 1978, p. 77).

    1. Together the professional teacher and participants set goals as a team
    2. Only the professional set goals

- The learner accepts a share of the responsibility for planning and operating a learning experience, and therefore has a feeling of commitment toward it (Knowles, 1978, p. 78).

    1. The participants were committed to meeting set goals
    2. No commitment mentioned

- The learners participate actively in the learning process (Knowles, 1978, p. 78).

    1. Kinesthetic, "doing" learning was included in program
    2. Kinesthetic, "doing" learning was not included in program

- The learning process is related to and makes use of the experience of the learners (Knowles, 1978, p. 78).
    1. The program included simulated activities or actual work station activities
    2. The program did not include simulated activities or actual work station activities
- The learners have a sense of progress toward their goals (Knowles, 1978, p. 79).
    1. The participant was involved in updates, verbally or visually, on progress toward meeting set goals.
    2. There was no sense of progress toward goals.

Frequencies were run on each of the seven categories of Knowles' conditions of learning. Using the number coding and categories, these data were entered into the *SPSS* chart. (1978). Categories with clustering were then sorted and cross tabulated with the category "the behavior changed was significant" and the "behavior change was not significant." The results of the cross tabulations were graphed to visually show the clustering of each of the cross tabulation charts. The charts suggest trends for characteristics that may be essential when developing a preventive worker educational program.

Chapter 4

Results

After the data were collected, frequency statistics, sorting, visual clustering, and chi-square statistics were used for data analysis.

Frequency statistics

Using *SPSS*, frequency statistics were run for each coded category to identify any one characteristic used consistently during each worker education program. Reported program characteristics vary so greatly that the outcome frequencies did not suggest a trend in using a specific characteristic in a similar educational experience.

Sorting and Visual Clustering

Using *SPSS*, the codes were sorted to identify any visual clustering or trends of significant behavior change. Each category was sorted and compared against the category of reported significant behavior change. When presented in *SPSS* format (Appendix D), a notable clustering of two categories was observed when compared to the category of a measured significant behavior change. Visually comparing the categories of active learning and the use of a meaningful environment suggested a possible trend of these individual characteristics having a positive influence on significantly changing behaviors in educational programs.

Cross Tabulation

Cross tabulations were run on the two characteristics in which a visual clustering was notable. Figure 1 reports the results of cross tabulating the effect of active learning on significant behavior change. The inclusion of active learning results in 10 studies that reported behavior changes and 5 studies that did not result in a behavior change. When using other teaching techniques such as a lecture, five studies report a notable, positive

behavior change. Statistically manipulating the numbers did not result in a significant difference in changing behavior between programs that included active learning and programs that did not.

The cross tabulation represented by a bar graph- Figure 1 did not suggest that the use of active learning through kinesthetic practice and participation was a sole characteristic needed to influence a significant positive behavior change in the worker population. The inclusion of active learning may positively influence changing behavior but a significant trend was not apparent.

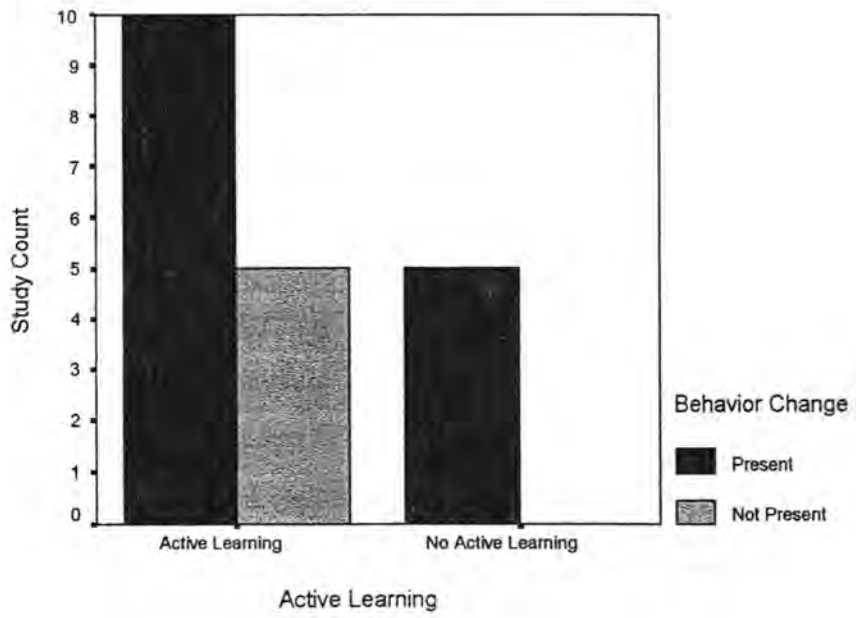

Figure 1. The number of studies that reported behavior change included or excluded active learning.

Cross tabulating of the use of a meaningful environment showed that 11 studies use environments that attached meaning to the education such as simulated activities or work station training, or a combination of both with a classroom environment component. The nine remaining studies used only a classroom lecture environment. This environment did not attach meaning to material or promote learning. The environment's influence on behavior change was reported in Figure 2.

The numbers represented in Figure 2 did not report a significant difference when observing the influence of the use of a meaningful environment in a worker educational program [$x^2(1)=2.22$,p ns]. The cross tabulation possibly suggests that using a meaningful environment may positively influence the behavior change but no conclusions can be made.

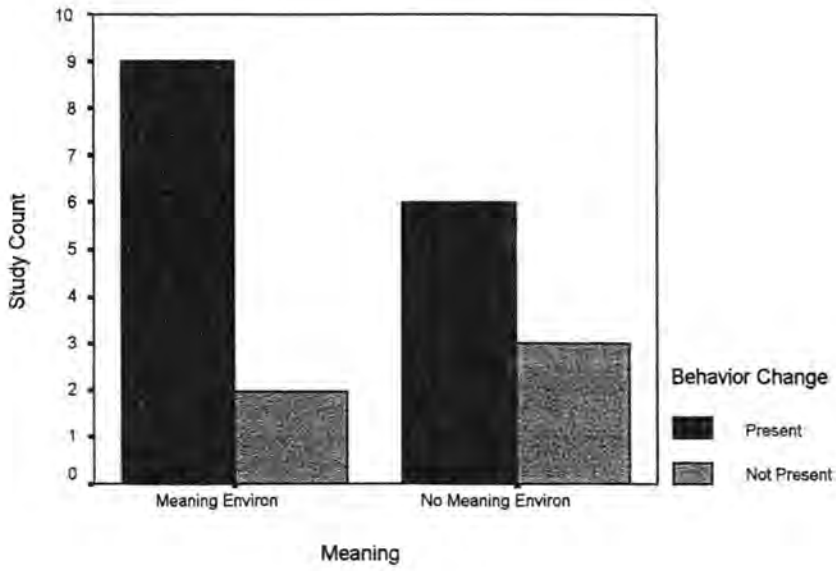

Figure 2. The number of studies that reported behavior change that included or excluded the use of a meaningful environment.

The characteristics were then clustered to include both active learning and a meaningful environment. The sorting and clustering visually suggest a trend that programs including these two characteristics may lead to a significant positive behavior change in the worker population. Figure 3 suggests that the success of changing behavior and preventing injury may increase when both active learning and a meaningful environment were included in a worker educational program. However, no significant difference was found when statistically comparing the studies that included both characteristics and studies that did not [$x^2(1)=.606$, p ns].

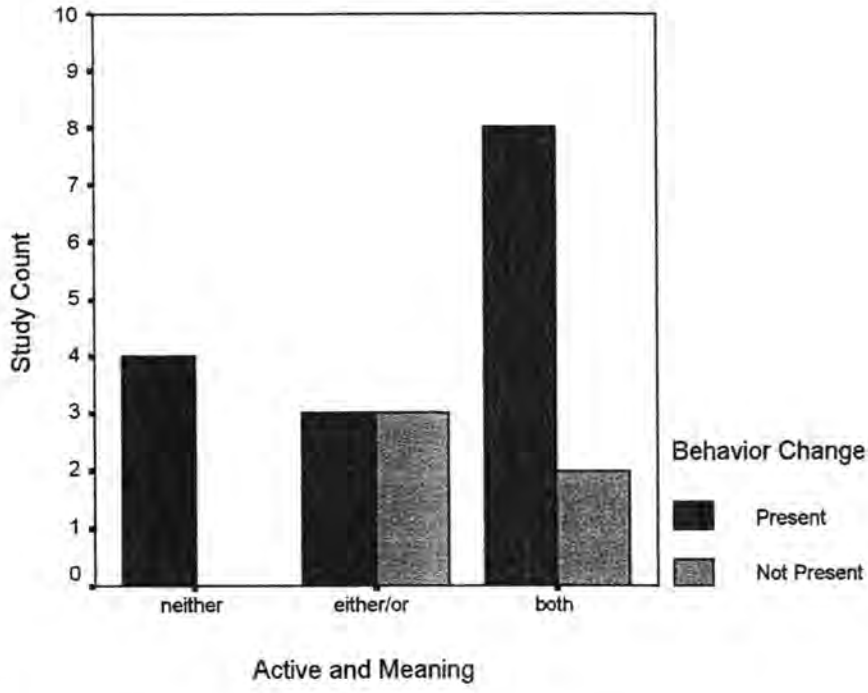

Figure 3. The number of studies that reported behavior change when active learning and a meaningful environment were not used, one was used, or both were used.

Further Analysis

The figures may suggest a trend but no significant difference was found statistically, chi-square analysis was utilized. Chi-square statistics were run on the cross tabulations that suggest a significant difference in including or excluding certain characteristics. The two characteristics of including active learning and using a meaningful environment were tested to see if chi-square findings would support the visual trend found by sorting and clustering. Findings of the chi-squares statistics, however, were unremarkable (Appendix E).

Chapter 5

Discussion

The focus on researching worker injury prevention programs was chosen because of interest in the controversy over the rising statistical numbers of workers' injuries and the number of implemented prevention programs each year. OSHA currently is addressing a mandatory prevention program of all employers due to these rising statistics. However, based on past research, it was unclear to what extent the program will decrease the number of injuries that occur in the workplace each year. Rather than blindly developing a prevention program as a researcher, it merits a review of the literature to systematically analyze a number of studies and pool the results.

After methodically organizing and coding the literature information gathered for this extensive literature review, frequency analysis, sorting, and charting were used to determine if a trend existed. The following sections discuss the utilized methodology, limitations of the study, and how the information can be used in the occupational therapy profession.

Discussion of Methodology

After the literature review, the large amount of information already gathered and reported in professional journals was felt to be a source of information that required a more thorough investigation before attempting to design a program to prevent injury. Methodologically reviewing the literature with a matrix method of coding category and characteristics was used to organize the different teaching techniques. A limitation of the methodology includes the possibility that an important category or characteristic may not have been included in this review. This may be due to the presentation of information in the research article or due to human error.

The research on worker educational programs differs in content, goals, and method, making comparison difficult. Therefore, it was difficult to use the literature to answer the specific question of which characteristics were essential when developing a preventive educational program. In an attempt to control some of these variables a set of strict criteria was established, limiting the inclusion of specific studies. Controlling the inclusion and exclusion of studies results in fewer variables. Nevertheless, the number of remaining variables made it difficult to compare past research and was considered a limitation of this study.

Reviewing past prevention programs through the literature narrows the available information to what was specifically reported in journal articles. Because of this, only information reported in journal articles could be coded in the *SPSS* chart. Making subjective assumptions about programs was avoided to prevent collection of subjective data and to promote the use of only objective data.

It is a possibility that the reviewed studies did include certain characteristics in the educational program but did not include this information in the program content and written results. This was an issue that was considered before implementing the established methodology. It was decided that an overall representation of prevention educational programs would be achieved best by reviewing journal articles.

Discussion of Results

The results of a visual trend were congruent with Knowles' (1978) conditions that active learning and a meaningful environment were essential components in order for learning to occur. Active learning and the use of meaningful environments, the two conditions of learning that were included in the worker educational programs may

influence behavior. This suggests that including Knowles' other conditions of learning as well as his principles of learning may lead to an increased chance of changing behaviors and effectively preventing injury. This may also limit the number of trial and error attempts at preventing injury.

Limitations

After reviewing the methodology and results, limitations were revealed that possibly influenced the results of determining essential characteristics of worker prevention programs. As with any research study, limitations influence the results based on decisions made about specific methodology. The major limitations are discussed below.

A limitation of this review involves the number of reviewed studies that were included in the statistical analysis. Strict inclusion criteria were established to minimize the number of variables. Even with the strict criteria set, the variables of the program characteristics still vary so that some studies were difficult to compare. Also, the strict criteria may have limited the inclusion too much for any significant trend to be identified.

Increasing the inclusion of studies may increase the likelihood of showing significant differences in which characteristics were essential and which were not. The split of studies that show a significant behavior change (15) and those that do not (5) does not provide an equal baseline from which to draw the trends. This unequal distribution of research results was a limitation. This unequal representation may be due to the fact that researchers finding successful results are more likely to pursue publication.

Another limitation was that research studies were not controlled regarding specific variables. For example, the group design was mixed and includes studies that

were experimental group comparison, with no control group. Other studies have only one experimental group and performed pre- and post-tests to show significance difference in behavior. If enough articles were obtained that utilize the same group design, then this variable could be controlled. Other variables such as the type of measurement used to evaluate behavior change or the time lapse between the education and the evaluation of behavior may be controlled with additional research studies.

Practical Application of the Results

Although the results of the review do not show a significant difference statistically, it is still helpful in drawing attention to the inconsistent techniques and approaches currently being used in prevention programs. It is reported in some journal articles that past research is not conclusive, but the inconsistency of the results was not evident until this literature review. Examination of the raw data of this review reveals the studies are so variable that it is difficult for other professionals to draw information from them.

Information is needed for developing effective prevention educational programs to comply with the OSHA standard. With the implementation of the OSHA standard, employers will be expected to present a program that will be evaluated on its effectiveness in prevention. Programs developing by trial and error will not be acceptable by OSHA's standards. Occupational therapists will need to plan and implement a program that successfully changes behavior. OSHA expects each employer to show that their designed program is in fact preventing injury by effectively teaching safe behaviors.

Using the results of this study by including the use of active learning and a meaningful environment in an education program may increase the learning of safe behaviors to prevent injury. Although statistics do not support this suggested trend, Knowles' (1978) conditions of learning for adult learners report that the conditions of learning need to be included in order for learning to take place. When organizing an educational program targeting this population, occupational therapists need to consider using Knowles' (1978) conditions of learning, specifically active learning and the use of a meaningful environment. Based on the visual trend shown in the literature, these two conditions of learning will promote effective learning that will in turn promote safety and prevent injury.

Based on the reported statistics of the number of workers injured each year and the money spent covering these injuries, preventing worker injury is a serious issue. It is important to continue researching this topic to determine what leads to long-term learning so employees will learn to consistently perform their work tasks safely.

This review of the past research is not in search of a formula that would make a program successful. It is an attempt to uncover past trends that lead to effective learning to prevent injury. Even when a trend is uncovered that includes a certain characteristic, programs still need to be developed keeping the individual needs of the participants in mind. Uncovered trends may increase the likelihood of a positive outcome of the educational program but professional input is essential to include the needed characteristics while tailoring the program to meet the needs of the specific employee and his or her job.

Chapter 6

Summary

The Occupational Safety and Health Administration (OSHA) is currently promoting prevention of work related injuries through worker education programs. Education programs have been utilized throughout the past 30 years but have not consistently prevented injury. By methodically reviewing the literature it was expected that a trend might be uncovered to help guide an employer to develop a program to effectively prevent injury and comply with OSHA's standards.

The presented literature has many different variables making it difficult to compare pre-existing education programs. Strict criteria were set in an attempt to eliminate some of these variables. A visual trend was noted that linked the inclusion of active learning and the use of a meaningful environment to effective change of worker behavior for preventing injury. Due to the small number of included studies, significant statistical findings did not further support the suggestion of this trend.

Future Research

Continued Analysis of Gathered Data from Literature

This review of literature regarding preventive educational programs leads to the need for further research using the gathered data. The collected data were sorted with industrial and service worker populations. A new method could be used focusing the analysis on the difference in educational approaches regarding industrial versus service worker populations. A trend may be noted when comparing the data of the two differing populations. However, more studies would need to be included for an equal distribution of the populations.

Also, the collected data could be used to look further at the trends in characteristics used for mandatory versus voluntary enrollment into a worker educational program. Different characteristics may be necessary to include when teaching material to a group of employees that have not identified personal meaning of the program. Comparing a voluntary enrollment educational program may have greater success since the person has identified the program content as being essential. With OSHA implementing a mandatory program, trends of effective mandatory enrollment programs will be needed.

Further Collection and Analysis of Research

The twenty reviewed articles report 15 programs that result in significant behavior change and 5 programs that do not note a significant trend with chi-square statistics. The more studies obtained to represent each behavior change could lead to more noticeably significant trends. Loosening the set criteria could influence the number of included studies. To widen the criteria, other populations could be included such as worker educational programs developed for health care workers such as nurses or nursing aides.

Further collection of data could also focus on including non-English literature. Worker educational programs are influencing the entire world, especially European countries. Availability of these articles translated into English would be useful to further add depth to the available information.

Research Study

Scientific research is needed that specifically identifies essential characteristics of the prevention program. This information needs to compare experimental versus control groups and include a follow-up to determine if long-term learning had occurred. The

identified characteristics can be aligned with Knowles' (1978) conditions of learning and principles of teaching to determine whether the approach is effective and which characteristic is essential.

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Appendices

Appendix A

Studies that did not meet the criteria for inclusion in the review

Study Count	Author(s)	Citation
1	Alexy & Eynon	*AAOHN*, 1991; 39: 53-6
2	Anderson	*Orthop Nurs*, 1989; 8: 43-36
3	Bigos et al.	*Orth Clin N Am*, 1991; 22:273-282
4	Berke	*N Engl J Med*, 1997; 337: 1924-5
5	Berwick et al.	*Spine*, 1989; 14: 338-343
6	Blix	*AAOHN J*, 1999; 168-71
7	Cherniack & Warren	*Occup Med*, 1999; 14: 1-16
8	Danneberg & Fowler	*Inj Prev*, 1998; 4:141-147
9	De Vries & Lechner	*J Occup Environ Med*, 2000; 42: 88-95
10	Dortch & Trombly	*AJOT*, 1990; 44:777-782
11	Engels et al.	*Int Occup Environ Health*, 1997;69:475-81
12	Fanello et al.	*Rev Rhum Engl Ed*, 1999; 66:711-6
13	Fisher	*AAOHN J*, 1998; 46: 296-301
14	Fragala	*Nurs Manage*, 1994; 24: 98-100
15	Fragala & Santamaria	*Health FACIL Manage*, 1997; 10: 22-7
16	Garb & Dockery	*AORN J*, 1995; 61:1046-52
17	Garcy et al.	*Spine*, 1996; 15: 952-9
18	Goldenhar et al.	*Am J Ind Med*, 1999; 35: 112-23
19	Hazard et al.	*Spine*, 1989; 14: 157-161

Study Count	Author(s)	Citation
20	Hochanadel et al.	*J Occup Med*, 1993; 53: 1011-1016
21	Indahl et al.	*Spine*, 1998; 23: 2625-2630
22	Keijsers et al.	*Patient Educ Couns*, 1989; 14: 31-44
23	Kerssens et al.	*Phys Ther*, 1999; 79:286-295
24	Lankhorst et al.	*Scand J Rehabil Med*, 1983; 15: 141-145
25	Lindqvist et al.	*Work*, 1999; 13: 89-96
26	Lusk & Kelemen	*Public Health Nurs*, 1993; 10: 189-96
27	Lusk et al.	*Am J Health Promot*, 1999; 13: 219-27
28	Maniscalco et al.	*J Occup Environ Med*, 1999; 41:813-20
29	McKechnie	*Occup Health Nurs*, 1985; 33:552-557
30	Menckel et al.	*Appl Ergon*, 1997; 28:1-7
31	Muggleton et al.	*Ergonomics*, 1999; 42: 714-39
32	Owen	*Am J Nurs*, 1999; 99: 76
33	Pan et al.	*Int J Occup Environ Health*, 1999; 5:79-87
34	Rest	*AAOHN J*, 1996; 44:226-227
35	Rizzo et al.	*Am J Health Promot*, 1997; 11:250-3
36	Ryden et al.	*J Community Health*, 1998; 13: 222-30
37	Schwartz et al.	*N Engl J Med*, 1997; 337: 1924-1925
38	Sharkey & Bey	*AAOHN*, 1998; 46: 133-44
39	Silverstein & Fine	*J Occup Med*, 1991; 33: 642-4

Study Count	Author(s)	Citation
40	Silverstein et al.	*Am J Ind Med,* 1997; 31:600-608
41	Snook	*J Occup Med,* 1978; 20: 478-481
42	Stankovic & Johnell	*Spine,* 1990; 15: 120- 123
43	Stobbe	*Occup Med,* 1996; 11:531-43
44	Wells et al.	*J Occup Health Psychol,* 1997; 2: 25-34
45	Woodruff et al.	*Mil Med,* 1994; 159: 475-484

Appendix B

Studies that did meet the criteria for inclusion in the review

Study Count	Author(s)	Citation
1	Amosun & Falodun	*CAJM*, 1991;37:120-123
2	Brown et al.	*Spine*, 1992;17:1224-28
3	Carlton	*AJOT*, 1987;41:16-20
4	Chavalinitkul et al.	*JHE*, 1995;24:55-58
5	Coleman & Hansen	*NursManage*,1994;25:58-61
6	Daltroy et al.	*NewEngJMed*, 1997;337:322-28
7	Donchin et al.	*Spine*, 1990;15:1317-20
8	Feldstein et al.	*JOccMed*, 1993;35:114-19
9	Gundewall et al.	*Spine*, 1993;18:587-94
10	Klaber et al.	*Spine*,1986;11:120-22
11	Leclaire et al.	*AchPM&R*,1996;77:673-79
12	Linton et al.	*Pain*, 1989;36:197-207
13	McCauley	*AJOT*, 1990;44:402-407
14	Ryan et al.	*Spine*, 1995;20:489-91
15	Schenk et al.	*Spine*, 1996;21:2183-89
16	Sulzer-Azaroff et al.	*JOBM*,1990;11:99-120
17	van Poppel et al.	*JAMA*, 1998;279:1789-94
18	Versloot et al.	*Spine*, 1992;17:22-27
19	Walsh & Schwartz	*AmJPMR*,1990;69:245-50
20	Wollenberg	*IJNS*,1989;26:43-52

Appendix C

Categories and Codes Developed for Matrix Method

General Characteristics

- Researcher name
- Year that study was published
- Prevention approach used in the design of the program
    1. Secondary prevention
    2. Tertiary prevention
    3. Two groups studied, included both secondary and tertiary prevention

Participant (Worker) Characteristics

- Occupation label of participants involved in education program
- Number of participants involved in education program
    1. 1-50 participants
    2. 51-100 participants
    3. 101-200 participants
    4. 201-400 participants
    5. 400+ participants
- Specific Age of Participants
- Gender of Participants
    1. Greater than 50% of participants are male
    2. Greater than 50% of participants are female
    3. 50% of participants are male, 50% are female
- Percentage of participants with a pre-existing injury

- Years of education participants completed prior to education program

Program Characteristics

- Professionals involved in planning or implementing the education program
    1. Occupational therapist
    2. Physical therapist
    3. Nurse
    4. Occupational therapist and physical therapist
    5. Team, more than 3 different professionals were involved
    6. Physical therapist and orthopedic surgeon
    7. Physical therapist and psychologist
    8. Physical therapist, orthopedic surgeon, and psychologist
    9. Other
- Teaching style used during the education program
    1. Auditory, visual, and kinesthetic teaching style
    2. Auditory and visual teaching style
    3. Auditory and kinesthetic teaching style
- Number of educational sessions used during program
- Frequency that participants attended sessions during the education program
- Duration of session time during implementation of educational program
- Total time used for education of participants
- Group design used for the study
    1. Experimental group; control group
    2. Experimental group 1; experimental group 2

3. Experimental group 1; experimental group 2; control group

4. Experimental group 1; experimental group 2; experimental group 3

5. Experimental group 1; experimental group 2; experimental group 3; control group

6. Experimental group 1

- Environment used during program presentations

1. Work station (where participant performs actual work tasks)

2. Simulated job tasks (mock set-up in classroom using work equipment)

3. Formal classroom (desk and chair set-up)

4. Work station; simulated tasks; classroom

5. Work station; simulated tasks

6. Work station; classroom

7. Simulated tasks; classroom

8. Informal meeting

9. Other

- Motivational factor to change behavior included in the program

1. Yes, positive verbal reinforcement from leader, supervisor, or shift member

2. Yes, tangible reward system implemented

3. No, motivation was not addressed

- Follow- up education reinforcement included in program

1. Yes, follow-up instruction to reinforce learning was included

2. No, follow-up instruction was not included

- Number of weeks between intervention and when behavior was reassessed

- Type of behavior change measure included in study

    1. Skilled observation and visual evaluation of behavior

    2. Written or verbal questionnaire or self report testing behavior and knowledge

    3. Analysis of pre and post workers' compensation statistics

    4. Skilled observation, visual evaluations; written or verbal questionnaire

    5. Skilled observation, visual evaluations; analysis of workers' compensation statistics

    6. Written or verbal questionnaire; analysis or workers' compensation statistics

    7. Skilled observation, visual evaluations; written or verbal questionnaire; analysis of worker's compensation statistics

- Inclusion of a Professional using skilled observation of body mechanics at work station

    1. Yes, a professional observed the employee's behavior at the actual work station

    2. No, observation of behavior at work station was not included

- Significant positive preventive behavior was observed during reassessment

    1.Yes

    2. No

Appendix D

SPSS sorting and clustering regarding the inclusion of active learning and the use of a meaningful environment for a worker education program

Study	Active	Meaning	Behavior Change
Chavalinitikul et al.	1	1	1
Ryan et al.	1	1	1
McCauley	1	1	1
Sulzer-Azaroff et al.	1	1	1
Klaber et al.	1	1	1
Coleman & Hansen	1	1	1
Feldstein et al.	1	1	1
Linton et al.	1	1	1
Daltroy et al.	1	1	2
van Poppel et al.	1	1	2
Wollenberg	1	.	1
Schenk et al.	1	.	1
Leclaire et al.	1	.	2
Carlton	1	.	2
Donchin et al.	1	.	2
Gundewall et al.	.	1	1
Brown et al.	.	.	1
Amosun & Falodun	.	.	1
Walsh & Schwartz	.	.	1
Versloot et al.	.	.	1

Note. *Active*= active learning through kinesthetic, doing activities; *Meaning*=meaningful environment with actual or simulated work environment; *Behavior Change*=significant change in worker's behavior; *1*=learning style present, behavior change significant; *2*=behavior change not significant

Appendix E

Insignificant chi-square statistics regarding the inclusion of active learning and the use of a meaningful environment for a worker education program

Programs Including Active Learning that Resulted in a Behavior Change

Chi-Square Tests

	Value	dF	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	2.222[b]	1	.136	
Continuity Correction[a]	.800	1	.371	
Likelihood Ratio	3.398	1	.065	
Fisher's Exact Test				.266
Linear-by-Linear Association	2.111	1	.146	
N of Valid Cases	20			

Note. a. Computed only for a 2x2 table. b. 3 cells (75.0%) have expected count less than 5. The minimum expected count is 1.25.

Programs Including a Meaningful Environment that Resulted in a Behavior Change

Chi-Square Tests

	Value	dF	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.606[b]	1	.436	
Continuity Correction[a]	.067	1	.795	
Likelihood Ratio	.605	1	.437	
Fisher's Exact Test				.617
Linear-by-Linear Association	.576	1	.448	
N of Valid Cases	20			

Note. a. Computed only for a 2x2 table. b. 2 cells (50.0%) have expected count less than 5. This minimum expected count is 2.25.

Appendix F

Definition of Terms

auditory teaching: includes speaking lectures, uses hearing senses

back injury: most back injuries are due to a herniated disc, commonly called a slipped disc or throwing out your back

back pain: results from back injury, severity of symptoms varies per person

back school: an educational program that was developed to educate individuals on proper body mechanics and care of back structures

custodial population: part of the service industry, job tasks include vacuuming, sweeping, moving furniture, cleaning bathrooms, shoveling snow

ergonomic program standard: a standard OSHA is developing to reduce incidence and severity of work-related musculoskeletal disorders-includes hazard identification and control, training, medical management, and program evaluation

industrial worker: an individual that works in a factory type setting, job tasks included heavy lifting or repetitive motions

kinesthetic teaching: visual demonstrations are provided, participants are expected to perform the movement to reinforce learning

matrix method: structure and a process for systematically reviewing the literature

occupational therapy: a health care professional working in a variety of different settings for achievement of person-task-environment fit leading to optimal performance in life roles

OSHA: Occupational Safety and Health Administration

Occupational Safety and Health Administration: an association that sets mandatory standards to protect the health of and well being of all workers

primary prevention: education or activities for the general population that prevent an illness or injury before symptoms or negative conditions begin

secondary prevention: education or activities for populations at risk for injury that prevent illness or injury to adapt environment and change behavior

tertiary prevention: education or activities for populations previously injured that focus on preventing re-injury or increasing the severity of the injury

visual teaching: includes utilizing demonstrations, handouts, overheads, videos, etc.

WMSD: work-related musculoskeletal disorder

Work-related musculoskeletal disorder: any injury or disorder in the musculoskeletal system that is a result from a work task and environmental danger

worker: a person that receives pay for their services

workers' compensation: employers pay for health care treatment and a percentage of lost wages if an employee suffers from a work-related injury