THESIS
2
1999

MICHIGAN STATE LIBRARIES
3 1293 01812 9373

LIBRARY
Michigan State
University

This is to certify that the

dissertation entitled

TRAINING TO PROMOTE WORKERS' USE OF HEARING PROTECTION:
THE INFLUENCE OF WORK CLIMATE FACTORS
ON TRAINING EFFECTIVENESS

presented by

Janice Susan Zarza Brady

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Adult & Continuing Education

Department: Educational Administration

Major professor

Date 5/13/99

MSU is an Affirmative Action/Equal Opportunity Institution

O-12771

PLACE IN RETURN BOX to remove this checkout from your record.
TO AVOID FINES return on or before date due.
MAY BE RECALLED with earlier due date if requested.

DATE DUE	DATE DUE	DATE DUE
~~AUG 0 5 2001~~ 072701	DEC 0 9 2007 20 0X 07	
AUG 2 2 2002		

1/98 c:/CIRC/DateDue.p65-p.14

TRAINING TO PROMOTE WORKERS' USE OF HEARING PROTECTION: THE INFLUENCE OF WORK CLIMATE FACTORS ON TRAINING EFFECTIVENESS

By

Janice Susan Zarza Brady

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Educational Administration

1999

ABSTRACT

TRAINING TO PROMOTE WORKERS' USE OF HEARING PROTECTION: THE INFLUENCE OF WORK CLIMATE FACTORS ON TRAINING EFFECTIVENESS

By

Janice Susan Zarza Brady

Work environments pose multiple threats to the health and safety of construction workers. Among these threats is the potential for occupational noise-induced hearing loss (NIHL), caused by frequent exposures to hazardous noise. While permanent in nature, NIHL can be prevented if hearing protection devices (HPDs) are used appropriately, meaning 100% of the time when exposed to high-noise environments.

Training workers in the manufacturing industry about the use of adequate hearing protection is required by federal regulations; however, the construction industry is not covered by these stringent federal guidelines. Unfortunately, even when workers have been trained about the importance and techniques for protecting their hearing, inadequate use of hearing protection often occurs.

Why workers refrain from properly using HPDs (ear plugs, ear muffs, etc.) is not clearly understood; few empirical studies have focused on identifying the associated influencing factors. In an experimental study to evaluate training effectiveness, previous researchers found that post-intervention use of HPDs by Midwestern U.S. construction workers remained insufficient to prevent NIHL. Therefore, more knowledge and insight are needed about what contributes to training effectiveness and what factors influence workers' hearing protection behaviors.

Using data from a prior experimental study, this quantitative study examined the relationship between work climate factors and construction workers' post-training use of hearing protection. Multivariate analyses suggested that the influence of the work climate is a critical component to consider when planning training programs to promote hearing protection behaviors.

Copyright by
JANICE SUSAN ZARZA BRADY
1999

To my husband, Edward, whose unconditional love, steadfast devotion, and incredible support have far exceeded any descriptive boundaries. Indeed, he has been *my soul and my inspiration*. And to my daughters, Katie and Jenni, whose enduring love and compassionate encouragement have continued to fortify and sustain me throughout this journey. Truly, they have been my *master teachers*—providing treasured lessons about what really is important in life.

ACKNOWLEDGMENTS

Completing this dissertation has become a reality because of the support from a number of individuals who have touched my life.

Sincere appreciation is extended to my committee members: my advisor, Dr. John Dirkx, who so generously agreed to chair my committee and whose persistent patience guided me in the quest for quality; Dr. Michael Moore, whose intellect and integrity I have always admired throughout my doctoral program; Dr. Anna Ortiz, whose expertise with quantitative analysis added invaluable assistance to my completing this dissertation; Dr. Sally Lusk, whose professional mentoring has been an energizing force throughout both of my graduate programs; Dr. Marilyn Amey, who adeptly focused my attention on the unique relevance for the adult learner; and Dr. Ann Austin, who provided expert advice and supportive direction in the early stages of this project.

I am deeply indepted to my professional colleagues: Dr. Oi Saeng Hong and Brenda Eakin, who so often brightened and buoyed my sagging spirits; Drs. Jane Wilson Coon and Dick Redman, whose well-timed nudges and affirmations often refocused my sights on the Ph.D. goal; Dr. David Ronis, whose expert guidance steered me through some of the statistical mazes; and all of my MSU colleagues, especially Dr. Craig Douglas, whose sincere interest and genuine concern never ceased to inspire.

Special recognition goes to: my nephew, Matt Johnson, who provided first-hand knowledge of a construction worker's life; and my sister, Diane Regan, who vicariously endured the multiple challenges of this dissertation endeavor.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure

LIST OF ABBREVIATIONS

db	Decibel
HBM	Health Belief Model
HPD	Hearing Protection Device
HPM	Health Promotion Model
NIHL	Noise-induced Hearing Loss
NIOSH	National Institute for Occupational Safety and Health
OSHA	Ocupational Safety and Health Administration
SCT	Social Cognitive Theory
TWA	Time-weighted Average

Chapter 1

INTRODUCTION

In 1996, the National Institute for Occupational Safety and Health (NIOSH) indicated that over 30 million workers are exposed to hazardous noise in work settings (NIOSH, 1996). In approximately one million cases of hearing loss, the cause can be attributed to occupational factors related to manufacturing environments (NIOSH, 1988). Once noise-induced hearing loss (NIHL) occurs, no treatment or assistive technology (e.g., hearing aids) can restore the damaged auditory function. Unfortunately, hearing loss that results from prolonged exposure to high-noise levels in a number of industrial settings is a prevalent occupational health problem; however, it is a disorder that can be prevented (NIOSH, 1996).

Protecting industrial workers against exposure to hazardous noise levels in the work setting is an effective method to reduce the incidence of occupational NIHL. In industrial work settings where workers have daily noise exposures that exceed an eight-hour time-weighted average (TWA) of 85 decibels (dB), the Occupational Safety and Health Administration (OSHA) requires that organizations maintain hearing conservation programs. These programs include annual audiometric testing and training workers about preventing NIHL (Dessoff, 1995).

Protection against NIHL also can be accomplished through the use of engineering controls that potentially block or reduce noise emission from industrial machinery. Even though such controls can be highly effective, they are not always economically or reasonably feasible. This is particularly true for the construction industry where the workplace environment frequently changes and ambient conditions can change dramatically (Ringen, Englund, Welch, Weeks, & Seegal, 1995). Another protective method to reduce NIHL is strict adherence to policies that require the monitoring of noise levels and the wearing of hearing protection devices (HPDs) in high-noise areas. Unfortunately, even though such policies often exist in work settings, occupational hearing loss remains a pervasive problem.

Given that engineering controls are cost-prohibitive for many organizations and that hearing protection policies are often ineffective, it is imperative that workers be adequately trained about the appropriate use of HPDs. According to Savell and Toothman (1987), one's hearing can be protected with the consistent use of HPDs, most commonly recognized as ear plugs or earmuffs. Therefore, one of the effective methods for reducing hearing loss among U.S. workers is to provide education and training about the importance of consistent and proper use of HPDs. Despite OSHA regulations that require hearing conservation programs and training efforts aimed at preventing NIHL, many U.S. workers still fail to use HPDs appropriately (Lusk, 1997).

Statement of the Problem

Training workers about preventing NIHL is critical, but even when workers have been trained in methods to protect their hearing and prevent NIHL, an inadequate use of HPDs still has been reported (Lusk, Kerr, & Kauffman, 1998;

Lusk, Ronis, & Baer, 1995; Lusk, Ronis, Kerr, & Atwood, 1994). In a study of factory workers, the observed and self-reported mean usage of HPDs in high-noise environments ranged from 54% to 62% (Lusk et al., 1995), thus reflecting a high potential for hearing loss. Why workers refrain from properly using HPDs in high-noise environments is still not clearly understood. Unfortunately, few empirical studies have focused on identifying the factors that influence workers' decisions to use appropriate hearing protection (Lusk, Ronis, & Hogan, 1997). In an experimental study to evaluate the effectiveness of hearing protection training, Lusk (1997) found significant differences in the post-training use of HPDs among regional and national construction workers who reported working in high-noise areas; however, HPDs were not used 100% of the time they were needed to prevent hearing loss in these workers. Therefore, more knowledge and awareness are needed about the influencing factors that contribute to training effectiveness and construction workers' decisions to protect their hearing.

Purpose of the Study

The purpose of this study was to examine the influence of the work climate on construction workers' use of HPDs, which is a fairly unexplored area in health behavior research. Previous studies have focused mainly on the individual worker and personal attitudes associated with HPD use; therefore, it is imperative to consider what contextual factors tend to influence workers to wear HPDs. Contextual factors in the work setting contribute to the creation of a work climate that represents workers' perceptions of the prevailing attitudes in an organization. According to Reichers and Schneider (1990), the work climate refers to "shared perceptions of organizational policies, practices, and procedures, both formal and informal" (p. 22). Schneider (1990) further adds that work climate can be defined as "perceptions of the events, practices, and procedures and the kinds of behaviors that get rewarded, supported, and expected" (p. 384). In the organizational literature, work climate factors have been demonstrated to significantly influence worker performance and behavior (Denison, 1993; Tracey, 1992).

Past studies related to health behaviors have primarily focused on personal perceptions, attitudes, and values that influence performance. Included as influencing factors have been the concepts of self-efficacy, barriers, benefits or outcome expectations, and outcome value (Janz & Becker, 1984; Lusk et al., 1997; Pender, Walker, Sechrist, & Frank-Stromborg, 1990; Strecher, Becker, Kirscht, Eraker, & Graham-Tomasi, 1985). Very few studies have focused specifically on hearing protection behaviors and of those that have done so, the concept of work climate as an influencing factor is not clearly explicated (Lusk et al., 1997; Melamed, Rabinowitz, Feiner, Weisberg, & Ribak, 1996). As identified by Ribisl and Reischl (1993), contemporary research related to health promotion activities in work settings has tended to emphasize the importance of individual behaviors while ignoring the influence of the contextual dimension.

This research study was designed to explore the relationship between work climate factors and construction workers' post-training use of HPDs. Examination of this relationship is essential in order to develop increased awareness and understanding about the influence that the work environment has on construction workers' transfer of training (i.e., the actual use of HPDs in work settings). Tracey, Tannenbaum, & Kavanagh (1995) strongly contend that factors within the formal training setting, and the work environment where training skills are meant to be applied, play a crucial role in the transfer of training process. However, very few studies have focused on the specific factors that promote transfer of skills and learning to the work setting. Therefore, research that examines the contextual factors where transfer of training is intended to occur can expand the existing knowledge about training effectiveness. Guided by Bandura's (1986) social cognitive theory (SCT) and specifically focusing on work climate factors and hearing protection training, six research hypotheses were developed for this study.

Research Hypotheses

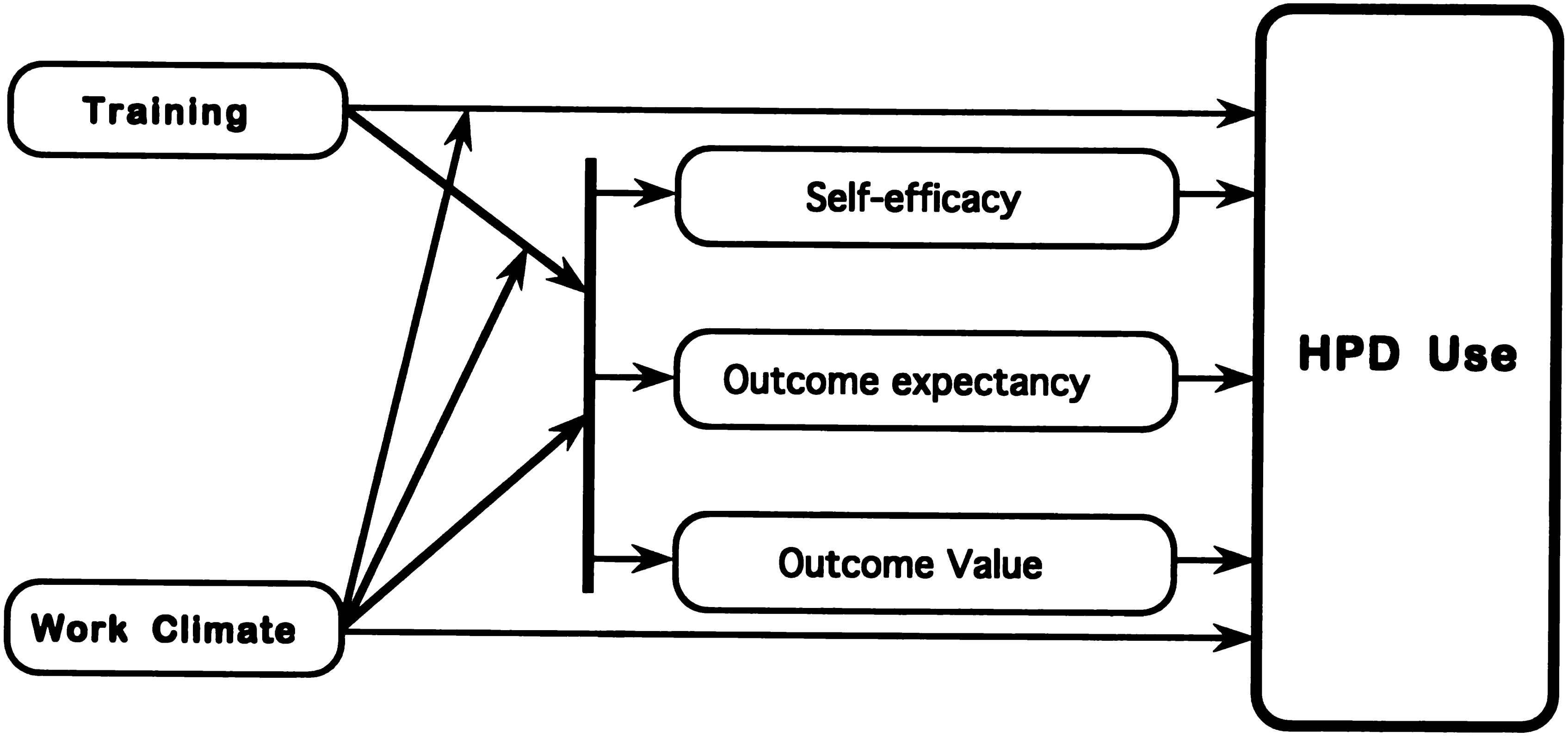
1. *There is a positive relationship between work climate factors and construction workers' use of hearing protection devices (HPDs).*
2. *Construction workers who perceive a supportive work climate will report a greater use of HPDs than construction workers who perceive a non-supportive work climate.*
3. *There is a positive relationship among work climate factors, self-efficacy, outcome expectancy, and outcome value for using HPDs.*
4. *Construction workers who perceive a supportive work climate will report higher self-efficacy, outcome expectancy, and outcome value for using HPDs than construction workers who perceive a non-supportive work climate.*

5. *Hearing protection training, work climate factors, self-efficacy, outcome expectancy, and outcome value will predict the use of HPDs by construction workers.*

6. *For construction workers who received hearing protection training, those who perceived a supportive work climate will report greater self-efficacy, outcome expectancy, outcome value, and use of HPDs than those who perceived a non-supportive climate.*

Conceptual Model

Depicted in Figure 1 is the model generated by the research hypotheses that guided the focus of this study. This model suggests that workers' post-training use of HPDs is influenced by: (1) training programs designed to educate workers about the importance of hearing protection, (2) workers' perceptions of the climate of the work setting, (3) workers' perceived level of self-efficacy in using HPDs, (4) workers' outcome expectancy for using HPDs, and (5) workers' perceived outcome value for using HPDs. This model reflects the importance of the relationships between factors in the contextual work setting and workers' post-training use of HPDs. Reflecting some of the concepts described in Bandura's SCT (1986), workers' behaviors are influenced by contextual factors, especially the behaviors of others in the work environment. Thus, the modeled behaviors and the support of co-workers and supervisors can influence the behavior of individuals in organizational settings. As reported by Noe and Schmitt (1986) and Richey (1992), environments where workers perceive supportive supervisors and co-workers tend to have a positive influence on workers' transferring knowledge and skills acquired during training.



<u>Figure 1.</u> Conceptual model with predictors for use of hearing protection devices (HPDs).

Method

This study employed secondary analysis of data from a study of construction workers and their post-training use of HPDs (Lusk, 1997). An experimental design was used by Lusk to study the effectiveness of hearing protection training among Midwestern U.S. construction workers. The sample ($\underline{N}$ = 798) was specifically chosen because construction workers represent a group at high risk for occupational NIHL. Unfortunately, not all U.S. workers are covered by stringent OSHA regulations related to hearing protection programs. Construction workers, including carpenters, operating engineers, and plumbers/pipefitters, comprise such a group not covered by specific OSHA mandates for comprehensive hearing conservation programs. Compared to the manufacturing sector that includes factory workers, the construction industry has been less stringently regulated (Franks, 1990).

Construction workers are often independent contractors, typically move from site to site, and have limited control over their environments (Nwaelele, 1996). At construction sites, workers are frequently exposed to a variety of noise situations—constant, intermittent, and impulse noise (Franks, 1990). Therefore, construction workers are highly vulnerable for developing occupational hearing loss (Reilly, Rosenman & Kalinowski, 1998). Some of the construction trade associations have educational programs aimed at informing their members about NIHL; nevertheless, a significant number of construction workers still fail to utilize available equipment and measures to preserve their hearing. Since limited requirements for hearing protection training exist in the construction industry, effective methods to educate workers about the necessity to protect their hearing are indeed imperative.

In the experimental study that was intended to evaluate the effectiveness of hearing protection training, Lusk (1997) reported a significant effect in post-intervention HPD use in the regional group of plumbers/pipefitters, but not in the regional group of carpenters or operating engineers. Given that the training program was designed using a predictor-based model, it is perplexing why limited post-training effects were found in the overall group of construction workers. Performing secondary analysis with reconstructed scales on the data provided by Lusk, multivariate regression analysis was applied to explicate the relationship of work climate factors with the effectiveness of training, an area not specifically addressed in the original study.

Definition of Terms

Independent Variables

Training. Planned instruction designed to inform workers about the benefits and methods for protecting their hearing when exposed to hazardous noise levels as defined by OSHA. For regression analyses, training was coded as "yes" or "no" and used as a dummy variable.

Work Climate. Workers' perceptions of factors and characteristics in the work environment that support and facilitate the use of HPDs. Included are factors such as supervisor and/or peer encouragement and support, supervisor and/or co-worker behaviors, availability of hearing protection equipment, and availability of information about HPD use (Coyle, Sleeman, & Adams, 1995; Dedobbeleer & Beland, 1991; NIOSH, 1996; Tracey et al., 1995).

Self-efficacy. Workers' perceptions about their confidence and capabilities to use HPDs appropriately and effectively in their work settings (Bandura, 1986).

Outcome Expectancy. Workers' perceived beliefs about the benefits and results of using HPDs (Bandura, 1986; Vroom, 1964).

Outcome Value. Workers' perceived beliefs about the importance of the possible outcomes associated with using HPDs, (Bandura, 1986; Vroom, 1964).

Personal Factors. Demographic data including workers' age and trade category (e.g., carpenter, operating engineer, plumber/pipefitter).

Dependent Variable

HPD Use. Workers' self-reported use of HPDs (e.g., ear plugs, ear muffs, etc.) when exposed to hazardous noise in their work settings, measured as percentage of time that HPDs were worn at most recent and previous job sites, and at three specific time periods (i.e., past week, past month, past three months).

Significance of the Study

Knowledge gained from this study is intended to assist program planners in designing future educational efforts aimed at reducing NIHL among construction workers. According to the National Safety Council (1992), even though hearing protection programs might be designed to meet OSHA standards, they still can be quite "ineffective in preventing work-related noise-induced hearing loss" (p. xi). Occupational NIHL is preventable, yet once it occurs, it is permanent and costly. Numerous benefits to individuals, families, and society could be achieved if hearing protection training programs were more effective. Supporting, educating, and motivating workers to adopt practices that will protect their hearing are valuable endeavors. In order to accomplish such endeavors, it is necessary to expand the knowledge about how work environments influence workers to effectively use protective hearing devices.

Since past research findings have indicated that the use of hearing protection among construction workers remained inadequate even after training was provided (Lusk, 1997), further investigation of existing data is warranted. Explicating factors that are specifically associated with hearing protection behaviors within the work environment can provide a clearer understanding of the contextual influences, along with a more holistic awareness of construction workers' use of HPDs. Therefore, by focusing on work climate factors and performing secondary analysis of the existing post-training data provided by Lusk, findings from this study can make a valuable contribution toward efforts to reduce the incidence of occupational NIHL among construction workers.

Limitations and Delimitations

When relying upon secondary analysis of existing data, the researcher is constrained by pre-existing questionnaire items, thus limiting the focus of interest and perhaps reducing the validity of constructs. When self-reported scores are used, reliability of measures may be reduced. Since construction workers comprised the study sample, generalizability of findings to other types of workers is not appropriate. Also, this study focused on training issues related to hearing protection behaviors; therefore, findings may not be applicable for all training endeavors.

Chapter 2

REVIEW OF THE LITERATURE

This section begins with an overview of the literature related to significant issues concerning noise-induced hearing loss (NIHL) in occupational settings. The majority of early research and training efforts to prevent NIHL among workers focused on individual or personal attitudes and behaviors, not necessarily organizational or work setting factors. This approach is evident in some of the current theories that have generally guided health behavior studies.

To provide an evolutionary sense of the conceptual thinking that has dominated and directed previous research on health behaviors, an introductory perspective of two relevant theories is first discussed. Presented next is the conceptual framework that guided the specific focus for this study. A discussion of the organizational behavior literature related to work climate then follows, focusing on the sociocultural aspects of the work environment. Bridging the health-related studies with organizational behavior studies is the concept of self-efficacy; therefore, an expanded description of this critical element is provided. Also included is a discussion of the concepts of outcome expectancy and outcome value that are theorized to be motivators of performance. This is followed by a presentation of findings from studies specifically related to hearing protection. The chapter concludes with a discussion of the theoretical and empirical literature related to the work environment and organizational training issues.

Noise-induced Hearing Loss

Noise is a pervasive element in contemporary life. When continuous noise levels exceed 85 decibels (dB), they become potentially hazardous and can destroy microscopic tissues in the inner ear that are necessary for adequate auditory function. Once destroyed, these microscopic elements can never regenerate, nor can they be repaired. As a result, permanent hearing impairment ensues. For many workers, industrial work settings pose a dangerously high risk for such hearing loss to occur. High-noise levels in the work environment can lead to an insidious loss of hearing, one that is progressive and irreversible. Known as occupational noise-induced hearing loss (NIHL), it is non-responsive to treatment. Such hearing loss represents detrimental and costly effects, both for individual workers and society. For example, NIHL produces decreased sensitivity to high-frequency sounds, thus resulting in speech discrimination difficulties and social interaction problems (Bahadori & Bohne, 1993). Exposure to hazardous noise levels has detrimental effects extending beyond the loss of one's hearing; evidence exists that reported stress-related diseases are associated with long-term exposure to high-noise levels (Melamed, Luz, & Green; 1992; Smith, 1997; Suter & Franks, 1992).

In terms of monetary costs to society, estimated costs for workers' compensation claims related to NIHL for the period 1977 to 1987 were reported to be $800 million (NIOSH, 1988). Relative to actual costs for hearing loss compensation claims, the U.S. Veteran's Administration paid out approximately $206 million in the 1990 calendar year (Adera, Donahue, Malit, & Gaydos, 1993; Dobie, 1995a). Predicted costs for future hearing loss claims are staggering.

Using the Canadian claims data presented by Alleyne, Dufresne, Kanji, and Reesal (1989), it was projected that total payout related to hearing loss claims in the U.S. for the time period between 1987 and the year 2000 could potentially reach $35 billion (Atherley, 1989). Indeed, the price for occupational NIHL will remain a high cost to bear.

Unfortunately, no comprehensive epidemiologic data on NIHL are available, but NIOSH estimates that more than 30 million individuals are exposed to potentially damaging noise levels in their work environments (NIOSH, 1996). The only effective strategy for reducing the significant and tremendous costs associated with occupational NIHL is to prevent its occurrence. Limiting hazardous noise levels in work environments through the use of engineering controls, and practicing hearing conservation techniques in work settings where engineering controls are not feasible are the primary suggested approaches for reducing NIHL (Feldman & Grimes, 1985; NIOSH, 1996; Royster & Royster, 1990; Sataloff & Sataloff, 1993; Suter & Franks, 1992).

According to OSHA, at least one million workers in the manufacturing sector are afflicted with an occupational NIHL that interferes with their daily life activities (Dessoff, 1995) and may even be threatening to their employment status (NIOSH, 1988). Federal regulations, administered by OSHA, mandate that industrial employers provide hearing conservation programs in work settings where noise exposures are at an eight-hour time-weighted average level of 85 dB or greater (OSHA, 1985). One of the required components of such programs includes employee training about the importance of using hearing protection devices (HPDs) to prevent NIHL.

Construction workers are in a group whose industry is not covered by the comprehensive OSHA standards that mandate the provision of hearing conservation programs (Dobie, 1995b; Reilly et al., 1998), even though about 13% of production workers in construction are exposed to hazardous noise levels (Franks, 1990; Kuhar, 1996). In fact, a 1980s Canadian study of about 5,000 construction workers found that almost half (49%) of the workers were afflicted with NIHL (Schneider, 1995). Such statistics are alarming, considering that many construction workers are generally in the young- to mid-adult age groups.

Despite a lack of specific coverage under OSHA regulations that mandate the provision of a hearing conservation program, the construction industry does maintain a noise standard and is covered by the *General Duty Clause* which addresses the obligation for employers to provide an employment site that is free from recognized hazards (OSHA, 1995). The OSHA "noise standard 29 CFR 1926.52 requires that the construction industry provide feasible administrative or engineering controls, hearing protection, and a hearing conservation program for employees who are exposed to noise at or above an 8-hour time-weighted average (TWA) of 90 dBA" (Lusk et al., 1998, p. 466). This noise standard is not as stringent or comprehensive as the OSHA regulations for industrial work settings (Franks, 1990; Schneider, 1995). Furthermore, providing worker training about NIHL is not required in the construction industry (Kuhar, 1996).

Even though construction is one of the most dangerous industries in the U.S. (Weil, 1992), very little research has explored the safety practices among construction workers (Dedobbeleer & German, 1987), particularly research related to the use of HPDs (Lusk et al., 1997). Given the nature of the dangerous work in the construction industry, it is not unusual that frequent injuries occur, including the loss of auditory function. Typically, construction workers are exposed to high-noise levels that vary both in duration and intensity and may be of a constant, intermittent, or impulse nature (Franks, 1990). The use of HPDs by construction workers is not well understood nor well documented. The study reported by Lusk et al. (1998), where construction workers reported a mean HPD use of 18% to 49%, represents one of very few studies focused on construction workers' behaviors related to hearing protection.

Indeed, construction workers face multiple safety challenges in their work environments and the potential for occupational NIHL remains quite high. Training workers how to adequately respond to their workplace challenges is a critical concern. The consistent use of HPDs by construction workers represents an effective safety behavior that can preserve auditory function. Therefore, it is beneficial to review the literature about major concepts and studies related to promoting health behaviors, maintaining safe and supportive work climates, and providing training to promote changes in behavior.

Health Behavior Theories

Given that a major concern of this study is focused on a health-related behavior (HPD use), two theories are described in the following section in order to provide some historical perspective for the earlier research related to health behaviors. These theories are presented as background and some of their limitations are noted.

Health Belief Model

One of the earliest and probably most extensively studied theories related to health behavior is the Health Belief Model (HBM). This model describes four major factors that influence individuals to comply with medical suggestions and treatment: (1) perceived vulnerability to a disease condition, (2) perceived severity of the consequences of a disease, (3) degree of motivation or interest in avoiding disease, and (4) appraisal of the costs and benefits of actions required to prevent or treat the disease (Becker & Maiman, 1980). Since its inception, the HBM has provided a theoretical framework for numerous research studies. Basically, the model postulates that individuals will engage in compliant behaviors to avoid a serious threat of disease if they perceive themselves as vulnerable and if they perceive that the benefits of their actions will be greater than the costs.

In a comprehensive analysis of findings from 46 studies that used the HBM as a conceptual framework and were published between 1974 and 1984, Janz and Becker (1984) found that the dimension of perceived barriers (i.e., costs and obstacles of action) was the most powerful concept of the HBM. Regardless of study design, barriers consistently demonstrated statistically significant relationships with health actions and behaviors.

Notably absent, however, from the early studies guided by the HBM were direct measures of variables related to the concepts of self-efficacy and social approval. Janz and Becker (1984) acknowledged this omission and indicated that subsequent research endeavors confirmed the importance of considering these concepts as influencing factors related to health behaviors. Furthermore, Janz and Becker concluded that self-efficacy and normative approval were implied in the dimensions of perceived benefits and barriers. Later discussions of the HBM supported the concept of self-efficacy and explicitly described it as a separate independent variable that warranted inclusion with perceived risk, severity, benefits, and motivation (Rosenstock, Strecher, & Becker, 1988).

Health Promotion Model

Developed by Pender (1987), the Health Promotion Model (HPM) focuses on health promotion behaviors and excludes the threat of disease as an influencing factor (Pender et al.,1990). The HPM, a multivariate model, is an expansion of the HBM and is based upon the social cognitive theory (SCT) of Bandura (1986); therefore, it fully recognizes the influence of perceived self-efficacy as a health behavior determinant. Used as the conceptual model by Pender et al. to explain and predict health-promoting lifestyles among employees in their work settings, 31% of the variance in health-promoting behaviors was explained by workers' perceived control of health, personal competence (self-efficacy variable), definition of health, and health status. The sample was comprised of employees who were currently actively engaged in health fitness programs in their work environments; therefore, results may have reflected their already established health-promotion tendencies.

Interestingly, Pender et al. (1990) noted a positive relationship between employees' health-promoting practices and their perception that health was externally controlled by powerful others. Given this finding, the authors speculated that employees in the sample may have enrolled in fitness programs because such programs afforded an opportunity for co-worker support and encouragement. As a result of this finding, Pender et al. suggested that future studies should explore the contribution of interpersonal and situational factors in explaining health-promoting behaviors. Such a suggestion implies a need to consider the influence of organizational factors on employee behaviors in worksite settings.

In using the HPM as a conceptual framework in a study of hearing protection use among 645 factory workers, researchers reported that self-efficacy, benefits, and low barriers were strong determinants in workers' use of HPDs (Lusk et al., 1994). In causal modeling, the HPM was found to account for up to 53% of the variance in hearing protection use. Absent from this study, however, was a focus on organizational support or work setting influences that might have provided a more expansive understanding of workers' decisions to use HPDs.

In summary, what is clearly evident from the reported research studies using the HBM and the HPM as conceptual models is that the concept of self-efficacy is an important variable to include when studying health-related behaviors. Also clearly evident is the focus on individual behaviors with the exclusion of contextual factors that might potentially influence behaviors. Unfortunately, what remains unknown is how the organizational setting or work climate factors tend to influence individuals in their decisions to carry out specific health-promoting behaviors. By exploring contextual factors and their relationship with health-related behaviors, interventions can be planned that will strengthen individuals' perceptions of their abilities to enact desirable levels of performance.

Conceptual Framework

Research findings and the literature support the concept that social interactions occurring in the work setting are major contextual factors that play a critical role in determining workers' perceptions and behaviors (Ribisl & Reischl, 1993; Reichers & Schneider, 1990; Sloan & Gruman, 1988). Workers are continually influenced by work setting factors and their interactions among peers and supervisors, thus strongly suggesting the value of drawing upon a social interaction theory as the conceptual framework for this study. Representing such a framework is Bandura's (1986) theory of social learning, more recently called social cognitive theory (SCT). Elements from Bandura's SCT have provided a theoretical foundation for a number of research endeavors. This is evident both in the area of health behavior (Melamed et al.,1996; Pender, 1987; Rosenstock et al., 1988; Schwarzer, 1992; Wilson, Sisk, & Baldwin, 1997) and in the area of organizational behavior (Frayne & Latham, 1987; Latham, 1989; Tannenbaum & Yukl, 1992).

Guided by the conceptual framework provided by Bandura's SCT (1986), this research study was designed to explore how work setting characteristics (workers' perceptions of work climate factors) relate to construction workers' perceptions and behaviors about protecting their hearing. The following sections present a discussion of the critical elements comprising the focus for this study using Bandura's concepts related to the learning that is derived from social interactions.

Work climate

Notably absent from many of the studies related to promoting health behavior among workers in organizations is a focus on the climate of the work environment. The literature typically indicates that the primary focus has been on individual behaviors; subsequently, most educational efforts have been directed toward changing personal or individual behaviors. Relative to health promotion programs in work settings, this absence of a focus on the work climate has been highlighted and recently addressed (Crump, Earp, Kozma, and Hertz-Picciotto, 1996; Ribisl & Reischl, 1993; Sloan & Gruman, 1988). These researchers emphasize the importance of organizational factors when considering what elements typically influence workers to participate in wellness-oriented programs.

Interestingly, the concept of the work climate with its influence on worker performance and behavior has been extensively discussed in organizational literature (Denison, 1993; Reichers & Schneider, 1990; Rousseau, 1988; Field & Abelson, 1982; Tagiuri & Litwin, 1968). According to Tagiuri (1968), the concept of work climate refers to "a relatively enduring quality of the internal environment of an organization that (a) is experienced by its members, (b) influences their behavior, and (c) can be described in terms of the values of a particular set of characteristics (or attributes) of the organization" (p. 27). When speaking of organizational climate, Tagiuri (1968) further noted that "organizational climate connotes that the environment is interpreted by the members of the organization to have a certain quality to which they are sensitive and which , in turn, affects their attitudes and motivation" (p. 27). Climate is created through the dynamic interaction that occurs between environmental and personal variables (Forehand, 1968).

As Moos (1976) observed, societal institutions establish social environmental conditions to maximize beneficial behaviors; such environmental conditions, or social climates, greatly influence the behavior of individuals operating within the institution. Moos, who developed tools to measure the social climate in institutions, spoke of social climate as the "personality" of an organization or social institution. In work environments, individuals perceive the existing climate and then pattern their behaviors to coincide with the perceived climate (Field & Abelson, 1982; Reichers & Schneider, 1990).

Human interactions and group behaviors occurring within a work setting are among the characteristics included when exploring the concept of organizational climate. As Owens (1995) described, "organizational climate is the study of perceptions that individuals have of various aspects of the environment in the organization" (p. 86). Factors in the study of organizational climate generally include: (1) workers' perceptions of management commitment, (2) supervisor/co-worker support, (3) obstacles impeding performance, and (4) availability of appropriate equipment/information (Crump et al., 1996; Glasgow, McCaul, & Fisher, 1993; Kozlowski & Hults, 1987; Litwin & Stringer, 1968; Owens, 1995; Ribisl & Reischl, 1993; Reichers & Schneider, 1990; Tracey et al., 1995).

Within work organizations, it is common for multiple subclimates to exist, generally representing diverse groupings of work procedures and practices. In these situations, individual workers develop their own psychological climate, which, in turn, influences the workers' motivation and performance. The term "psychological climate" was introduced by James and Jones (1974) to denote the individual's perception of the work environment as opposed to "organizational climate" which refers to the consensual perceptions among groupings of organizational workers (Howe, 1977).

Debate continues over which level of analysis (individual or group) is more appropriate for assessing work climate factors (Rousseau, 1988; Tracey, 1992). In the exploratory work of Ribisl and Reischl (1993), climate was measured at the individual level. Other researchers (Rouiller & Goldstein, 1993; Zohar, 1980) aggregated individual responses to achieve a general climate score. For this research study, it is reasonable to measure work climate at the individual level, since the sample of construction workers was drawn from unidentifiable and multiple organizations. According to Rousseau (1988), "aggregated climates are constructed based on membership of individuals in some identifiable unit" (p. 145).

Conceivably, it also is possible to perform group-level analysis using aggregated climate scores representing construction workers from three trade groups: carpenters, operating engineers, and plumber/pipefitters. Doing so can reveal unique group-related perceptions of work climate issues. Collective climate scores are also appropriate to distinguish differences in HPD use among groups of workers who demonstrate similar perceptions of behavioral contexts

(Rousseau, 1988). For example, workers who perceive highly supportive work climates might be more likely to report greater use of hearing protection than workers who perceive less supportive work climates.

Climate for Safety

Schneider and Rentsch (1988) expanded on the notion of multiple subclimates and Reichers & Schneider (1990) suggested that organizational climate can be referred to in specific terms, such as "the climate for service or the climate for safety" (p. 23). In other words, the focus of interest should guide the measurement of specific dimensions of climate. Recently, NIOSH (1996) defined safety climate as "the general level of safety awareness and commitment among management and workers in the organization" (p. 56). Safety climate is manifested by a variety of factors, including company safety policies, organizational attitudes about safety concerns, workgroup norms related to safety practices, availability of protective equipment, and provision of information and feedback relative to safety behavior (Lindell, 1994; NIOSH, 1996).

Focusing on a specific dimension of organizational climate, such as the climate for safety, provides a clearer direction for exploring the relationship between factors in the work context and workers' enactment of safety behaviors. In fact, Zohar (1980) used such an approach by incorporating the concept of safety climate in studying workers' perceptions about the importance of industrial safety behavior in Israeli factories. One of the major findings from this study was that workers' perceptions of management's attitude toward safety, demonstrated by the safety officer's level of authority and involvement in decision making, strongly influenced accident prevention and the success of safety programs. By focusing on more specific components of the climate dimension (i.e., safety climate), significant relationships can be identified (Tracey, 1992; Zohar, 1980). In the safety literature, Zohar's study is often referenced; however, the sample consisted of factory workers in Israel and findings should not be generalized beyond this population.

More recent research by Hofmann and Stetzer (1996) supported Zohar's (1980) findings. Using a survey instrument based on Zohar's original measure for safety climate and revised by Dedobbeleer and Beland (1991), the researchers found significant relationships between safety climate, unsafe work behaviors, and actual accident occurrence in a Midwestern chemical processing plant. These findings must be interpreted cautiously, however, because the sample was drawn from only one organization. A more representative sample drawn from multiple work settings would allow greater generalization of findings.

Relative to the safety climate in work settings, prevailing attitudes about safety issues can strongly influence self-protective behaviors. In a study to identify determinants of the use of respirator equipment among construction painters, White, Baker, Larson, and Wolford (1988) identified that discomfort was the primary reason reported for failing to use a respirator. However, the researchers discovered the inclusion of a social behavior determinant—workers' perceptions of their co-workers' attitudes also influenced decision making about respirator use. Unfortunately, the authors provided no information about the reliability or validity of their measures; therefore, caution should be applied when interpreting the reported results.

In summary, the reported findings from studies involving health and safety behaviors in organizations strongly indicate that the climate of the work setting exerts a definite influence on workers' behaviors. Prevailing attitudes about safety issues and behaviors that were demonstrated by supervisors and co-workers clearly contributed to workers' use of safety equipment. Given these findings, the following hypotheses were proposed for testing in this study.

Hypothesis 1. *There is a positive relationship between work climate factors and construction workers' use of hearing protection devices (HPDs).*

Hypothesis 2. *Construction workers who perceive a supportive work climate will report a greater use of HPDs than construction workers who perceive a non-supportive climate.*

Self-efficacy

The element most visible and common to research efforts both in the areas of health promotion and organizational behavior is the concept of self-efficacy. According to Bandura (1986), perceived self-efficacy is a determinant of an individual's behavior and is defined as a person's belief in his or her capability to engage in and perform specific behaviors. Bandura contends that beliefs about one's capabilities are influenced by self-mastery of performances and vicarious experiences—observations of the performance of others. Therefore, in work settings, individuals' perceptions of their self-efficacy can be affected by contextual factors. Thus, the modeled behaviors and the support of co-workers and supervisors can influence the behavior of individuals in organizational settings.

As Hergenhahn and Olson (1997) explain, Bandura's SCT (1986) focuses on humans as dynamic social beings whose learning involves information processing and problem solving that frequently occurs in social settings. Learning occurs through interactions with others and observations of the performances of others. According to Bandura (1986), self-efficacy involves the ability to integrate cognitive, social, and behavioral skills to perform designated actions; however, more than just these skills are required for successful levels of performance. Individuals also must have an inherent belief in their ability to appropriately use their skills when faced with specific tasks to accomplish. Self-efficacy is "concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses" (Bandura, 1986, p. 391).

Bandura (1986) contends that even when individuals believe that certain actions will produce desired outcomes, they still may not carry out the actions or behaviors necessary to achieve valued outcomes, because they may lack conviction in their ability to perform. Intentions to carry out specific behaviors are strongly influenced by one's perceived self-efficacy. In organizational settings, the construct of self-efficacy has been studied in its relationship to training effectiveness; individuals who perceive high levels of self-efficacy have been found to demonstrate higher levels of performance than those who perceive low levels of self-efficacy (Tannenbaum & Yukl, 1992). Gist and Mitchell (1992) emphasize that self-efficacy is a critical motivational construct, influencing individuals in their choices, goals, efforts, and achievement. In the area of health behaviors, self-efficacy has been demonstrated to have a powerful influence both on behavioral intentions and course of action (Schwarzer, 1992).

In a study of cigarette-smoking behavior, Strecher et al. (1985) found that smokers involved in a smoking-cessation program were most likely to reduce their smoking habits if they reported high-efficacy expectations along with a perceived high susceptibility to future smoking-related illness. In this study, efficacy expectations were measured as the subject's perceived ability to refrain from smoking in specific situations. Individuals least likely to reduce their smoking habits were those who reported perceived high susceptibility to illness and low-efficacy expectations. In light of their study findings, the researchers emphasized the importance of strengthening efficacy expectations when attempting to influence health-related behavioral changes.

Using a correlational study design and guided by Bandura's SCT (1986), Wulfert and Wan (1993) studied the relationship between psychological factors (self-efficacy, attitudes, expectancies, peer influence, knowledge, vulnerability) and the practice of risky sexual behaviors among undergraduate students. The researchers hypothesized that students' perceived ability to practice safe sex behaviors would be positively associated with their outcome expectancies (consequences of behavior) and peer group influences. Results of their study indicated that self-efficacy was a central mediator in the relationship between safe behaviors and factors such as outcome expectancies and peer influences. Not surprisingly, the study results also suggested that safe sex behaviors were directly influenced by peer group actions.

While the research findings of Wulfert and Wan (1993) supported the use of Bandura's (1986) theory in explaining safe sex behaviors among college students, results cannot be generalized beyond this particular population. Also, a convenience sample was used, further limiting the ability to generalize the findings. In addition, it is important to note that self-efficacy was measured with one item that rated students' perceived confidence about practicing safe sex behavior in the subsequent six months. As Graziano and Raulin (1989) contend, reliability is reduced when only one observation or measurement for a construct is used. Indeed, increasing the number of observations to obtain a score, generally tends to improve the reliability of that score (Graziano & Raulin).

In a study of the use of hearing protection devices (HPDs) among factory workers (N = 281) in Israel, researchers found that workers' perceived self-efficacy for using HPDs, their perceived susceptibility to hearing loss, and their degree of noise annoyance were strong predictors (Melamed et al., 1996). Together, these strong predictors explained 48% of the variance in workers' use of HPDs. Of these predictors, Melamed et al. found that self-efficacy was the most powerful, supported by the fact that self-efficacy alone accounted for 42% of the variance in HPD use. Given their findings, the researchers suggested that attempts to increase workers' use of HPDs should focus on improving workers' perceived self-efficacy.

In their study of construction workers, Lusk et al. (1997) reported that construction workers tended to report higher HPD use when they perceived high value (benefits) and low barriers (obstacles); furthermore, construction workers who reported higher levels of self-efficacy in using HPDs tended to report greater HPD use. Again, self-efficacy was identified as an important concept in understanding some of the determinants associated with specific worker behaviors related to hearing protection.

To summarize, self-efficacy is a central construct in Bandura's SCT (1986). Self-efficacy refers to "a person's estimate of his or her capacity to orchestrate performance on a specific task" (Gist & Mitchell, 1992, p. 183). Health behavior studies indicate that self-efficacy is a strong determinant for adopting health-related behaviors (Lusk et al., 1997; Pender et al., 1990; Schwarzer, 1992). In organizational studies, it is reported that self-efficacy and work performance are positively correlated and that some types of training can lead to enhanced levels of self-efficacy (Frayne & Latham, 1987; Gist, 1987; Gist & Mitchell, 1992).

Outcome Expectancy and Outcome Value

An individual's judgment of the ultimate results of a specific course of action is considered to be an outcome expectancy. Schwarzer (1992) emphasizes the importance of considering both self-efficacy and outcome expectancy concepts in health behavior studies. In SCT, Bandura (1986) clearly distinguishes between perceived self-efficacy and outcome expectation. Self-efficacy can be thought of as the "can do" belief in one's ability to perform, while outcome expectancy can be considered the "desired and valued result" of the "can do" behavior. Therefore, an outcome expectancy can be defined as a perceived benefit of carrying out specific behaviors (Schwarzer, 1992).

Complementing Bandura's SCT (1986) is Vroom's Expectancy Theory (1964) that relates to one's beliefs about performance capabilities (expectancies) and one's beliefs about outcome contingencies. Vroom's concept of expectancies parallels Bandura's self-efficacy concept, while outcome contingencies are similar to Bandura's outcome expectations. Thus, an individual's behavior is motivated by self-perceptions about expectancies and outcome contingencies. According to Vroom, an individual's degree of motivation is determined by how strongly one perceives he or she can capably perform behavior that will achieve a valued outcome. If individuals perceive that they are capable of performing skills and that their performance will lead to a valued outcome, they will be more inclined to enact the performance behavior.

Vroom (1964) explained that outcome expectancies motivate behavior. "Expectancy is an action-outcome association" (Vroom, p. 18). Health behavior theories that incorporate variables related to the benefits of specific actions generally are referring to the concept of outcome expectancy. The value of the outcomes, or "valence" as described by Vroom, refers to the "affective orientations toward particular outcomes" (Vroom, p. 15). How strongly the anticipated outcomes are desired determines the degree of outcome value. Therefore, both the perception that specific results of action are probable and the degree of value associated with the probable outcomes tend to influence behavior.

Maddux, Norton, and Stoltenberg (1986) investigated the role of self-efficacy, outcome expectancy, and outcome value in predicting behavioral intentions relative to improving interpersonal skills. The authors reported that correlation analyses indicated all three concepts were significant and relatively comparable predictors of behavioral intentions. A major limitation of their study, however, is that the sample consisted of undergraduate students enrolled in an introductory psychology course, thereby reducing generalization of findings.

The literature and research findings suggest that self-efficacy, outcome expectancy, and outcome value are important concepts to explore in an attempt to understand workers' behaviors to protect their hearing. Also supported in the literature and of critical importance to consider is the work setting where hearing protection behaviors are, or are not, consistently enacted. Unfortunately, in health behavior studies, the focus on contextual settings has been fairly limited. Therefore, the following hypothesis was posed for testing in this study:

Hypothesis 3. *There is a positive relationship among work climate factors, self-efficacy, outcome expectancy, and outcome value for using HPDs.*

In summary, self-efficacy has been reported to be a strong predictor for the use of hearing protection; however, little is known about how work settings may contribute to increased levels of self-efficacy and the use of hearing protection. Using workers' perceptions of characteristics in their work settings, this study was designed to explore the relationships among work climate, self-efficacy, outcome expectancy, and outcome value, while ultimately exploring the relationship of these variables to post-training use of HPDs. According to Bandura (1986), observing the performance of others is a major source of strengthening one's perception of self-efficacy; therefore, work settings provide tremendous opportunities for vicarious learning.

In reference to this learning from the experiences of others, Hergenhahn and Olson (1997) note that "Bandura's theory is called social cognitive theory because it emphasizes the fact that most of the information we gain comes from our interactions with other people" (p. 351). In fact, a reciprocal determinism occurs, thus resulting in constant interaction among the environment, behavior, and individual (Bandura, 1991; Hergenhahn & Olson, 1997). Cognizant of Bandura's concept of vicarious learning and its influence on perceived self-efficacy and behavior, it is imperative to investigate the influence of work climate factors when studying workers' perceptions and behaviors related to the use of hearing protection.

Organizational Studies and Hearing Protection Use

Using a convenience sample for a survey study of workers from 48 British organizations, and including in-depth case studies from 10 of these organizations, Leinster, Baum, Tong, and Whitehead (1994) investigated the management, organizational, and psychological factors associated with occupational NIHL. Among the individual workers surveyed, 41% reported using HPDs some of the time when in noisy areas, 43% indicated always wearing HPDs, and 16% reported never using HPDs. Thirty-six percent of the respondents indicated that discomfort was the most common reason for failure to use hearing protection. The researchers contend that important factors associated with strengthening workplace HPD norms include the establishment of clear rules and commitment by senior management, along with ongoing support and modeling of appropriate HPD use by supervisors. Unfortunately, no statistical data about correlational findings were provided in the article. Given this omission, the strength and significance of the reported relationships are unclear.

In their study of HPD use among Israeli factory workers, Melamed et al. (1996) identified a relationship between HPD use and management or co-worker support. Workers who reported non-use of HPDs also reported less management and co-worker pressure to use hearing protection. However, in performing stepwise discriminant analysis to determine the most powerful predictors of HPD use, results were somewhat in contrast to findings from other studies. Melamed et al. found that management pressure and social pressure were not directly related to HPD use. However, management and social pressures were related to workers' perceptions of self-efficacy in using HPDs. Interestingly, this finding provides support for Bandura's (1986) argument that self-efficacy perceptions can be strengthened through social interactions and vicarious experiences. Caution must be used, however, when interpreting these results. Melamed et al. reported that the two variables of management pressure and co-worker pressure were each measured with one item; therefore, the reliability of these measures was possibly reduced.

Hofmann and Stetzer (1996) urged replication and strongly recommended the need for additional studies to address the influence of work and social factors on safety behavior. In addition, very little health-related research has focused on the relationship between work climate factors and self-efficacy, specifically those studies related to hearing protection behaviors. Therefore, a more encompassing framework is needed to understand the overall relationship of factors associated with construction workers' use of hearing protection. Recognizing the central theme of SCT (Bandura, 1986), and based upon the literature describing the importance and relevance of work climate factors, self-efficacy issues, and hearing protection behaviors, the following hypothesis was proposed for testing in this study:

Hypothesis 4. *Construction workers who perceive a supportive work climate will report higher self-efficacy, outcome expectancy, and outcome value for using HPDs than construction workers who perceive a non-supportive work climate.*

In summary, the majority of research studies strongly suggest the existence of a relationship between work climate factors and worker behaviors. Most notable is the relationship between safety climate factors and the performance of safe behaviors, particularly those related to the use of hearing protection. While results of the research findings have been impressive, some limitations exist due to sample selection methods and issues related to instrument reliability and validity. Therefore, additional research is warranted.

Work Climate and Training Issues

Obviously lacking in the literature are studies that have explored the interrelationship of work climate factors, self-efficacy, and training efforts to reduce the incidence of occupational NIHL among construction workers. As reported in the literature, even when workers are trained to use HPDs, many of them fail to transfer learning from training programs to their workplace settings (Merry & Franks, 1995; NIOSH, 1996).

Often neglected, but critical to consider when training adult learners in work settings, is the climate of the environment where workers will be expected to use the skills acquired in training sessions. The degree to which newly learned skills are applied to the work setting can be considered a measure of training effectiveness, or essentially a transfer of training (Tannenbaum & Yukl, 1992). Applying knowledge, behaviors, skills, and attitudes learned in training programs to real world environments is symbolic of transfer of training—an indicator of training effectiveness (Kirkpatrick, 1994; Tracey et al., 1995).

As Garavaglia (1996) contends, training efforts are successful when workers not only acquire desired knowledge and skills, but also when they apply the newly-gained knowledge by utilizing the newly-learned skills in the work setting. A critical component for such transfer of learning to occur is a work climate that encourages and facilitates workers to use their new knowledge and skills (Tracey et al., 1995). In reference to working with adult learners and identifying factors that influence the application of learning from training programs, Caffarella (1994) emphasized that an organizational context "either supports or inhibits the transfer of learning" (p. 110). As reported by Noe and Schmitt (1986) and Richey (1992), environments where workers perceive supportive supervisors and co-workers tend to have a positive influence on workers' transferring knowledge and skills acquired during training.

Support and encouragement from managers, supervisors, and peers are essential components for transfer of learning to occur (Baldwin & Ford, 1988; Caffarella, 1994). In an extensive review of the organizational training literature, Baldwin and Ford cited seven studies that focused on the relationship between work environment factors and transfer of training. All seven studies used a correlational, survey design and most of the studies involved human relations training. Based upon results from these studies, the authors concluded that supportive work climates greatly contribute to positive transfer of training. Acknowledging limitations in the existing empirical evidence related to the influence of work environments on training effectiveness, Baldwin and Ford strongly recommended that "more research is needed to identify and operationalize variables that significantly facilitate or inhibit transfer" (p. 92).

Using an experimental design, Brinkerhoff and Montesino (1995) examined the relationship between management support interventions (mutual goal setting and follow-up discussions) and transfer of training in a group of 91 participants enrolled in development courses in a Fortune 200 company. Unfortunately, contamination of the study groups occurred. A few members in the treatment group reported having received no management interventions, or less than planned. In the control group, some members reported having received management interventions, similar to that intended for the experimental group. Despite the fact that the study design was weakened, results indicated a significant relationship between management support and transfer of training to the work setting. Study participants who perceived more favorable supervisory support tended to report more application of their training-acquired skills. Even though this study lacked experimental rigor and a small sample size was used, results still confirmed the importance of work climate factors (management support) in fostering the transfer of training.

In a study of manager trainees in the fast-food industry, findings reported by Rouiller and Goldstein (1993) support the concept that work climate factors influence transfer of training to work settings. Rouiller and Goldstein operationalized their climate measures to be situations and consequences that inhibit or facilitate the use of skills learned in training. Among some of the work climate factors measured by the authors were supervisor/peer influences, provision of feedback, and availability of equipment/opportunities to apply newly-learned skills. The researchers found that supportive work climate factors were significantly associated with positive post-training behaviors in the work environment.

Expanding on the work conducted by Rouiller and Goldstein (1993), Tracey, et al. (1995) performed LISREL analyses to examine the influence of transfer of training climate and continuous-learning climate on the post-training performance of supermarket manager trainees. Using some measurement tools similar to those reported by Rouiller and Goldstein, Tracey et al. concluded that post-training behaviors were directly influenced by the climate or culture factors of the work environment. When trainees perceived factors to be supportive, they demonstrated increased performance of newly-learned skills. Most influential of the climate or culture factors were those related to the social system, namely supervisory encouragement and facilitation for using newly-acquired learning. While Rouiller and Goldstein and Tracey et al. reported significant findings related to transfer of training, it is important to note that both studies lacked a control group. If control groups had been included in the study designs, the reported results would bear more strength.

Work Climate and Safety Training

Recognizing that the influence of organizational climate can often be overlooked when considering training effectiveness, Richey (1992) examined results from an extensive evaluation of three safety-training programs conducted over approximately four years in the automotive industry as a joint labor/management endeavor. The theory of Systemic Training Design (STD) was used for analyzing program outcomes. As a conceptual framework, the STD model incorporates organizational climate and learner attitudes as major influencing factors associated with the accomplishment of training goals. In describing concepts supported by the STD framework, Richey emphasized that "organizational climate plays its most important role as either a facilitator or an inhibitor of transfer of training" (p. 154). Contending that deficiencies in post-training performance are often attributed to problems with instructional design or delivery, Richey argued that the problems may actually result from characteristics or factors in the work environment itself.

Study findings reported by Richey (1992) indicated that critical factors in the work climate associated with transfer of learning included management and supervisory support, along with modeling of behaviors central to the goals of the training program. While the extensive findings presented by Richey merit considerable attention, results should be viewed cautiously. The safety-training project involved a convenience sample and had no control group for comparison. In addition, the study was conducted over a four-year time period. Other events in the overall work environment may have contributed to the observed outcomes and maturation of subjects could have occurred, possibly posing as threats to the validity of findings. Nevertheless, the reported findings are impressive and provide considerable insight about the influence that the work climate exerts on post-training behaviors.

Clearly, research findings reported in the literature suggest that factors in the work setting can significantly influence training efforts and should not be overlooked if training is to be effective. Supportive work environments tend to promote transfer of training to the work setting. Focusing on the combination of issues related to transfer of training, safety behaviors, and organizational climate that have been reported in the literature, the following hypotheses were presented for testing in this study.

Hypothesis 5. *Hearing protection training, work climate factors, self-efficacy, outcome expectancy, and outcome value will predict the use of HPDs by construction workers.*

Hypothesis 6. *For construction workers who received hearing protection training, those who perceived a supportive work climate will report greater self-efficacy, outcome expectancy, outcome value, and use of HPDs than those who perceived a non-supportive climate.*

Summary of Literature Findings

Occupational NIHL is preventable. In order to reduce its occurrence, it is imperative to combine knowledge gained from organizational behavior studies with those related to health promotion and health behaviors. Research that focuses on the contextual factors where transfer of training is intended to occur can expand the existing knowledge about the effectiveness of training to protect construction workers' hearing in the work setting. Such knowledge can lead to the development of more effective training programs.

Organizational behavior studies designed to examine the relationship between work climate factors and training effectiveness have provided evidence that climate plays a major influential role in contributing to training outcomes. What has not been extensively studied with scientific rigor is how work climate factors influence the practice of health-related behaviors in work settings. Relative to safety and health promotion behaviors in organizational settings, a number of researchers have strongly urged that future studies address the influence of work climate factors (Hofmann & Stetzer, 1996; Pender et al. 1990; Ribisl & Reischl, 1993; Sloan & Gruman, 1988). Guided by the concepts espoused by Bandura (1986), it is valuable to explore how work climate factors and hearing protection training influence workers' perceptions and behaviors associated with the use of HPDs in work settings.

In the study conducted by Lusk (1997), results indicated that training to promote the use of HPDs by regional construction workers had significant, but limited, effects. What remains unknown and warrants further investigation is the importance of the specific relationship between work climate factors and construction workers' post-training use of HPDs. Additional insight is needed about how work climate factors influence workers' self-efficacy, outcome expectancy, outcome value, and post-training behaviors.

In this research study, secondary analysis of the data reported by Lusk (1997) was planned to provide explication of the association between work climate factors and construction workers' post-training behaviors to protect their hearing. Such analysis can contribute to the existing knowledge about construction workers' use of HPDs. By explicating how the work climate tends to influence transfer of training to actual work settings, more effective training programs for construction workers can be designed and implemented. In doing so, the incidence of occupational NIHL among construction workers might be greatly reduced.

Chapter 3

METHODS

In the area of health education, minimal attention has focused on the environmental aspects associated with the settings where individuals are expected to enact healthy behaviors. Most studies on health promotion and health behavior issues have focused on a combination of personal and situational factors related to enacting healthy behaviors. The purpose of this study, however, was to examine the context of the work setting as a distinct factor that influences construction workers' post-training use of hearing protection devices (HPDs). The literature on training effectiveness strongly suggests that work climates have a critical influence on post-training behaviors (Baldwin & Ford, 1988; Richey, 1992; Tracey et al., 1995). Drawing upon concepts related to Bandura's (1986) SCT and findings related to work climate factors reported in the literature, the hypotheses stated below were posed for testing in this study.

Research Hypotheses

1. *There is a positive relationship between work climate factors and construction workers' use of hearing protection devices (HPDs).*
2. *Construction workers who perceive a supportive work climate will report a greater use of HPDs than construction workers who perceive a non-supportive work climate.*

3. *There is a positive relationship among work climate factors, self-efficacy, outcome expectancy, and outcome value for using HPDs.*

4. *Construction workers who perceive a supportive work climate will report higher self-efficacy, outcome expectancy, and outcome value for using HPDs than construction workers who perceive a non-supportive work climate.*

5. *Hearing protection training, work climate factors, self-efficacy, outcome expectancy, and outcome value will predict the use of HPDs by construction workers.*

6. *For construction workers who received hearing protection training, those who perceived a supportive work climate will report greater self-efficacy, outcome expectancy, outcome value, and use of HPDs than those who perceived a non-supportive climate.*

Research Design

This ex post facto study used secondary analysis as the research design to explore additional concepts from the study of construction workers by Lusk (1997). Secondary data analysis is an effective mechanism for applying new analytical perspectives to data previously collected by others (Bryman, 1989; Hakim, 1982; Hyman, 1972; Kiecolt & Nathan, 1985). In addition, secondary data analysis can be viewed as an economic and practical tool to derive additional benefit from pre-existing data, thereby expanding the value of the original study (Polit & Hungler, 1991). Lusk measured workers' perceptions of factors that related to the use of HPDs in work settings; some of these factors included both a personal and organizational focus. This research study was intended to extricate some of these factors and specifically examine the influence of organizational factors (work climate) on workers' use of HPDs, thus expanding knowledge gained from the original study.

Summary of Original Project

Procedure

In the research project conducted by Lusk (1997) and funded by NIOSH (Grant No. R01 0H03136), an experimental design was used to test the effectiveness of a theory-based training program for improving construction workers' use of HPDs. Participation was voluntary and informed consent of the construction workers was obtained prior to data collection. Based upon a Solomon four-group design, construction workers were randomly assigned to one of four groups: (1) pretest and posttest; (2) pretest, training, and posttest; (3) training and posttest; and (4) posttest only. A self-administered written questionnaire in booklet format was used for both pretest and posttest data collection and approximately 35 to 45 minutes were required for completion of the questionnaire. For purposes of this research study, secondary data analysis focused on the posttest data collected during 1996, approximately 10 to 12 months after the hearing protection training occurred.

A total of four instructors-trainers (working as a team of two in each training session) provided all the hearing protection training by using a standardized script and instructional format. Overall, the training session lasted about 45 minutes and included a 20-minute videotape segment that was specifically developed for construction workers and based upon previous research by Lusk et al. (1997). In the video segment, a discussion about the importance of hearing protection was portrayed between an occupational health nurse and a construction worker. Also portrayed in the video were interactions among construction workers as they discussed the use of HPDs in their work settings. The training program included an opportunity for questions and answers, along with a guided-practice session for construction workers to try various types of hearing protection. Brochures that provided general information about hearing loss and HPD availability also were distributed to the construction workers as part of the training program (Lusk et al., in press).

Sample

The original convenience sample of regional construction workers (N = 798) used by Lusk (1997) for posttest data analysis consisted of unionized construction workers in the Midwestern U.S. who represented three trade groups: carpenters, operating engineers (heavy equipment operators), and plumbers/pipefitters. Workers had been recruited through principal contact individuals from trade unions and trade group associations. These contacts arranged for the researcher to collect data and provide training during the time when workers were assembled in classroom settings for regular training update sessions.

Of the original 798 construction workers (carpenters, operating engineers, and plumbers/pipefitters) who participated in the posttest phase of the study conducted by Lusk (1997), workers who reported no worksite exposure to hazardous noise (n = 146) were excluded from the secondary analyses performed for this study. Since this study focused on the effectiveness of training related to workers' use of HPDs when exposed to potentially harmful noise, it was reasonable to include only those workers who reported actual exposures to high-noise levels in their work environments. Therefore, the sample for secondary analysis in this study consisted of 652 unionized construction workers who reported having been exposed to hazardous noise in their work settings during the past week, past month, past three months, most recent job site, and/or previous job site. Since no pretest effect on HPD use was reported by Lusk (1997), the original Solomon four groups were collapsed into two groups for this study, thus representing the groups of construction workers who had received hearing protection training (n = 336) and those who had not (n = 316).

Demographics of the Sample

In this research study, the sample consisted of construction workers who had been exposed to hazardous noise in their work settings. Workers ranged in age from 20 to 60 years with a mean age of 36 years (SD = 10.5). The study sample represented a fairly homogeneous group; workers were predominately male (96.3%) and Caucasian (90.2%). Length of time that workers had practiced their trade ranged from 1 to 45 years (M = 11.44, SD = 9.9). Table 1 describes the demographic characteristics of the study sample.

Table 1

Sample Demographics

Characteristics	n	percent
Trade		
Operating Engineers	288	44.2
Plumbers/Pipefitters	200	30.7
Carpenters	164	25.2
TOTAL	652	100.1
Gender		
Male	628	96.3
Female	19	2.9
No response	5	.8
TOTAL	652	100
Ethnicity		
White	588	90.2
Black	26	4.0
Native American	13	2.0
Hispanic	12	1.8
Asian	1	.2
Other	1	.2
No response	11	1.7
TOTAL	652	100.1

Note. Percents may not add to 100 due to rounding.

Almost all of the workers (91.1%) had at least a high school education, with 31.1% reporting some type of additional education (trade school or college) beyond high school. Educational categories are described in Table 2.

Table 2

Highest Level of Education

Level	n	**percent**
Eighth Grade	9	1.4
High School	391	60.0
Trade School	44	6.7
High School and Trade School	122	18.7
Associate Degree	40	6.1
Associate Degree and Trade School	21	3.2
Baccalaureate Degree	15	2.3
Associate and Baccalaureate Degree	3	.5
Graduate Degree	2	.3
No Response	5	.8
TOTAL	652	100.0

Instruments and Measures

Portions and reconstructions of the original instruments reported by Lusk et al. (1997) that were used in this research study are described in the following section. With regard to the work climate and self-efficacy scales used in this study, theoretical concepts and research findings reported in the health promotion and organizational behavior literature guided their creation. In addition, an expert panel consisting of individuals with knowledge and experience in organizational behavior reviewed both of these scales for face validity.

Work Climate Scale (see Appendix A)

The work climate scale created for secondary analysis in this study consisted of 21 items that measured construction workers' perceptions of organizational or work setting factors facilitating or impeding the use of hearing protection. These items were drawn from multiple scales used by Lusk et al. (1997) and were originally measured on 3-point, 4-point, 5-point, and 6-point Likert-type scales. Prior to secondary analysis, appropriate items were reverse-scored and the values for each of the 21 items were transformed into standardized scores; thus the mean was equal to zero and the standard deviation was equal to one. Following this conversion to standardized scores, the work climate scale was computed as the mean of the standardized scores on the 21 items.

Four of the 21 items were drawn from the HPD benefits and barriers scale developed by Lusk et al. (1997) and adapted from an instrument related to exercise behavior that was originally created by Murdaugh and Hinshaw (1986). Eight situational items in the climate scale related to HPD use by construction workers in the work setting. Also included in the climate scale was one item previously used as a self-efficacy item by Lusk et al. ("I am sure that I can ask for help if I have difficulty using hearing protection."). This item was selected for the work climate scale in this study because it represented availability of assistance for workers relative to using hearing protection equipment in their work setting. The literature on occupational NIHL suggested the need for having consistent and reliable support available for workers in order to encourage the use of appropriate hearing protection equipment (Leinster et al., 1994).

The work climate scale constructed for this study also incorporated eight items developed by Lusk et al. (1997) to measure norms, modeling, and interpersonal support related to the use of hearing protection. These items were developed by Lusk et al. and based upon instruments originally designed by the Child Adolescent Health Behavior Research Center at the University of Michigan to measure social support for exercise behavior (cited in Lusk et al., 1997).

In this study, psychometric reliability assessment (Cronbach's alpha) of the work climate scale was .89.

Self-efficacy Scale (see Appendix B)

The self-efficacy scale consisted of 12 items drawn from several scales originally developed by Lusk et al. (1997). Items on this scale represented construction workers' perceptions about their ability to use HPDs correctly and adequately. All self-efficacy items were measured on a 6-point Likert-type scale, ranging from strongly disagree (1) to strongly agree (6). Items that were negatively worded were reverse-scored for data analysis and a self-efficacy score was computed using the mean of the 12 items.

In this study, psychometric reliability assessment (Cronbach's alpha) of the self-efficacy scale was .76.

Outcome Expectancy Scale (see Appendix C)

Seven items represented construction workers' perceptions about the potential results or benefits related to using hearing protection. These items were drawn from the benefits and barriers scale of Lusk et al. (1997) and were measured on a 6-point Likert-type scale, ranging from strongly disagree (1) to strongly agree (6). Appropriate items were reverse-scored prior to statistical analysis and the outcome expectancy score was computed from the mean of the seven items.

In this study, psychometric reliability assessment (Cronbach's alpha) of the outcome expectancy scale was .70.

Outcome Value Scale (see Appendix D)

Five items were used to measure workers' perceptions of the importance of the expected outcomes resulting from the use of HPDs. These items were the original items developed by Lusk et al. (1997), based on Pender's value of outcome exercise scale (cited in Lusk et al., 1997). Items were measured on a visual analog scale (10 centimeters in length), ranging from slightly important (0%) to highly important (100%). Workers were asked to mark an "X" on the line of the visual analog scale to indicate the point that described their personal rating of the importance of the outcome associated with using hearing protection.

In scoring the five items on this scale, a ten-centimeter ruler was used to measure the point where the "X" was made; each millimeter on the line corresponded with one percent of value. For example, an "X" measured at 60 millimeters on the line was coded as 60%. The score for the outcome expectancy scale was then computed using the mean percent from these five items.

In this study, psychometric reliability assessment (Cronbach's alpha) of the outcome expectancy scale was .87.

HPD Use (see Appendix E)

Five items originally developed by Lusk et al. (1997) measured the frequency of HPD use by construction workers. Representing the ratio-level measure used as the dependent variable in the multivariate regression analysis, a mean use frequency score was computed from the mean of these five items. Items measured percentage of time workers reported using HPDs (e.g., ear plugs, ear muffs) when exposed to high-noise levels at their most recent and previous job sites, and at three specific time periods (i.e., past week, past month, past three months). Computing a mean use frequency score was recommended by Lusk et al. since high correlations (.79 to .96) were achieved among the five items. With regard to the use of self-reported measures as the primary dependent variable, researchers have investigated the results of such measures in other studies and found the self-reported measures to be valid and reliable (Hofmann & Stetzer, 1996; Lusk et al., 1995).

HPD Training Intervention

Hearing protection training consisted of approximately 45 minutes of planned instruction about the benefits and methods for protecting one's hearing when exposed to hazardous noise levels. Content included information related to the fact that when levels of environmental noise reach or exceed 85 to 90 decibels, they are considered hazardous and sustained exposure can be detrimental to one's hearing. The existence of hazardous noise levels was roughly identified by having to shout in order to be heard by another at a distance of three feet or less. Included during the training session was planned time for construction workers to practice with different types of hearing protection.

The Solomon four-group design originally used by Lusk (1997) included two groups of construction workers who had been assigned to the training intervention (experimental grouping) and two groups who had received no training (control grouping). In each of the experimental and control groupings to which construction workers had been randomly assigned, one of the two groups also received a pretest in order to assess for any evidence of pretest sensitization at the time of posttest data collection. As previously mentioned, no pretest effect was observed in study results reported by Lusk, thus indicating that no pretest sensitization had occurred. Therefore, the Solomon four groups were collapsed into two groups (training, no training) for purposes of secondary analysis in this study (Braver & Braver, 1988). In the multivariate analyses, a dummy variable was used and coded: training = 1, no training = 0.

Data Analysis

Data were analyzed using SPSS 7.5 for Windows Graduate Pack. Statistical analyses were conducted to describe the sample of construction workers who participated in the study. Descriptive statistical analyses (e.g., means, standard deviations, percentages, etc.) were performed on the independent variables measured on interval-level scales to provide an overall summary of the general perceptions of construction workers relative to climate factors, self-efficacy, outcome expectancy, and outcome value associated with using hearing protection in work settings. Since the independent variable of training was measured on a nominal scale (training, no training) only the number and percentage of workers who received training or did not receive training were reported. For the dependent variable of workers' self-reported use of HPDs, measured as ratio-level data, descriptive statistics were performed. Relative to each of the research hypotheses, specific statistical tests were applied and are described in the following sections. The alpha level was set at .05 for determining statistical significance.

Hypothesis 1. *There is a positive relationship between work climate factors and construction workers' use of hearing protection devices (HPDs).*

Bivariate linear regression was performed to determine if workers' perceptions of climate factors predicted workers' use of HPDs. The strength and statistical significance of the relationship between these two variables were analyzed.

Hypothesis 2. *Construction workers who perceive a supportive work climate will report a greater use of HPDs than construction workers who perceive a non-supportive work climate.*

Two categories were formed using high and low scores from the work climate scale. High scores represented the group of workers who perceived a supportive work climate and low scores represented the group of workers who perceived a non-supportive work climate. An independent-samples t-test was performed to determine if the mean HPD use was significantly different between these two groups.

Hypothesis 3. *There is a positive relationship among work climate factors, self-efficacy, outcome expectancy, and outcome value for using HPDs.*

Pearson product-moment correlations were performed to determine the existence, degree, and significance of linear relationships among these variables.

Hypothesis 4. *Construction workers who perceive a supportive work climate will report higher self-efficacy, outcome expectancy, and outcome value for using HPDs than construction workers who perceive a non-supportive work climate.*

Three independent-samples t-tests were performed to determine if the mean scores on self-efficacy, outcome expectancy, and outcome value differed significantly between workers who perceived supportive work climates and those who perceived non-supportive work climates.

Hypothesis 5. *Hearing protection training, work climate factors, self-efficacy, outcome expectancy, and outcome value will predict the use of HPDs by construction workers.*

Multiple regression analysis was performed to determine how much of the variance in workers' post-training use of HPDs (dependent variable) was explained by the independent variables as illustrated in the conceptual model for this study (see Figure 1). This analysis was conducted to indicate how well the group of independent variables (e.g., training, work climate, self-efficacy, outcome expectancy, and outcome value) predicted the amount of HPD use. Hierarchical multiple regression analysis was performed to determine the degree of change that occurred in the predictive power of the model as independent variables were added in a series of steps, while controlling for the effects of the previously-entered independent variables. Subsequent multiple regression analyses were conducted to identify direct and indirect effects among the predicator variables.

Hypothesis 6. *For construction workers who received hearing protection training, those who perceived a supportive work climate will report greater self-efficacy, outcome expectancy, outcome value, and use of HPDs than those who perceived a non-supportive climate.*

Multifactor analysis of variance (two-way ANOVA) was performed to assess the main effects of training and work climate on the mean scores of self-efficacy, outcome expectancy, outcome value, and HPD use. This method of analysis was performed to reveal the existence of an interaction between training and climate level, indicating that the effect of training might vary between supportive and non-supportive work climates.

Chapter 4

RESULTS

The purpose of this research study was to examine the influence of work climate factors on the effectiveness of training that was designed to improve the use of hearing protection among regional Midwestern U.S. construction workers. Secondary data analysis, employing the database provided by Lusk (1997), was used to test six hypotheses. The data were derived from 652 construction workers. These workers consisted of individuals from the Midwestern U.S. and represented three trade groups: carpenters (n = 164), operating engineers (n = 288), and plumbers/pipefitters (n = 200).

Data analyses included Pearson product-moment correlations, bivariate linear regression, independent-samples t-tests, multiple regression, and multifactor analysis of variance (two-way ANOVA). In this chapter, results of the data analyses are presented, beginning with descriptive findings related to the study variables and followed by findings related to the research hypotheses. The six hypotheses stated below were tested in this study.

Research Hypotheses

1. *There is a positive relationship between work climate factors and construction workers' use of hearing protection devices (HPDs).*
2. *Construction workers who perceive a supportive work climate will report a greater use of HPDs than construction workers who perceive a non-supportive work climate.*

3. *There is a positive relationship among work climate factors, self-efficacy, outcome expectancy, and outcome value for using HPDs.*

4. *Construction workers who perceive a supportive work climate will report higher self-efficacy, outcome expectancy, and outcome value for using HPDs than construction workers who perceive a non-supportive work climate.*

5. *Hearing protection training, work climate factors, self-efficacy, outcome expectancy, and outcome value will predict the use of HPDs by construction workers.*

6. *For construction workers who received hearing protection training, those who perceived a supportive work climate will report greater self-efficacy, outcome expectancy, outcome value, and use of HPDs than those who perceived a non-supportive climate.*

Results Related to Study Variables

Results from descriptive analyses of each of the independent variables and the dependent variable that were measured in this research study are presented below. A concise description of the measured values of the research variables can be found in Table 3 (excluding *HPD Training* that was measured as a dichotomous variable).

Independent Variables

HPD Training. Construction workers who received the hearing protection training intervention (n = 336) represented 51.5% of the overall sample (N = 652).

Table 3

Study Variables

Variable	n	Mean	S.D.	Actual Range (*Possible Range*)	Skewness	Variance
Work Climate	652	.001	.55	-1.25 – 1.51 (*n.a.*)	.197	.30
Self-Efficacy	652	4.201	.70	2.17 – 6.00 (*1 – 6*)	.196	.48
Outcome Expectancy	652	5.257	.72	2.29 – 6.00 (*1 – 6*)	-1.047	.514
Outcome Value (%)	648	86.294	12.04	6.60 – 100 (*0 – 100*)	-2.350	144.90
HPD Use (%)	650	49.124	35.09	.00 – 100 (*0 – 100*)	.031	1231.10

Work Climate. Construction workers reported an overall perception that their work climates were fairly moderate in terms of supportiveness for hearing protection behaviors. Scores ranged from -1.246 to 1.515 (M = 0.001, SD = .550). (Items comprising the work climate scale in this research study were originally measured on varying scales; therefore, the original scores were transformed into standardized scores {M = 0} prior to scale construction.)

For additional analyses, the work climate scale was recoded into a dichotomous variable using a median split. Low scores on the work climate scale (-1.246 through -0.020) were considered to represent perceptions of individuals (n = 326) from work settings with non-supportive climates for the use of HPDs. High scores on the work climate scale (-0.019 through 1.515) were considered representative of individuals (n = 326) who perceived that their work environments supported the use of HPDs.

Self-efficacy. Construction workers reported a moderate perception that they could use HPDs appropriately to protect their hearing. Scores on the self-efficacy scale ranged from 2.2 to 6.0 (M = 4.2, SD = .70).

Outcome Expectancy. Construction workers reported a high level of belief in the potential benefits for using hearing protection. HPD outcome expectancy scores ranged from 2.3 to 6.0 (M = 5.3, SD = .72).

The reported values on this scale reflected a negatively skewed distribution; however, the skewness index (-1.05) revealed that the distribution was not a severe violation of the assumptions required for multivariate regression. According to Lewis-Beck (1980), regression analysis is a robust technique where parameters are not severely influenced by mild departures from normality, particularly when the sample size is large.

Outcome Value. Construction workers reported a high degree of value for the outcomes associated with using HPDs. Scores ranged from 6.6% to 100% (M = 86.3%, SD = 12.0%).

Scores on the outcome value scale represented a highly skewed distribution with the majority of scores at the high end of the scale. Given that the skewness index was found to be -2.35, a transformation of the variable was attempted to improve the distribution in order to avoid a violation of the assumptions for multivariate analyses. By raising the outcome value scores to a power of six, the skewness index of the outcome value scale was reduced to -0.325; however, using such a transformation makes interpretation of results extremely difficult. Therefore, given the large sample size and the robust nature of multivariate regression, the original form of the variable was used and was not transformed.

Dependent Variable

HPD Use. Construction workers reported a moderate use of HPDs when exposed to high noise in their work environments. Self-reported scores ranged from 0% to 100% (M = 49.1%, SD = 35.1%).

Results of Hypothesis Testing

Hypothesis 1

There is a positive relationship between work climate factors and construction workers' use of hearing protection devices (HPDs).

Using bivariate linear regression, the analysis revealed a low to moderate positive relationship between work climate factors and HPD use, $\underline{r}$ (648) = .34, $\underline{p}$ < .001. Work climate factors were a significant predictor for workers' use of hearing protection, accounting for 11.4% of the variance in HPD use, $\underline{F}$ (1, 648) = 83.69, $\underline{p}$ < .001. As hypothesized, construction workers in supportive work climates reported a greater use of hearing protection.

Hypothesis 2

Construction workers who perceive a supportive work climate will report a greater use of HPDs than construction workers who perceive a non-supportive work climate.

Using a median split of the work climate scale, a dichotomous work climate variable was created to distinguish between work settings that were supportive of HPD use (high climate) and work settings that were non-supportive (low climate). The low climate category represented work climate scores ranging from -1.246 through -.020, thus indicating work settings where HPD use was not strongly supported or encouraged. The high climate category included work climate scores ranging from -.0186 through 1.515, and indicated work settings where the use of hearing protection was encouraged and supported.

To test the hypothesis, an independent-samples $\underline{t}$-test was performed to determine if the use of hearing protection differed between the climate groups. Results indicated a statistically significant difference in mean HPD use between construction workers in high climate settings and workers in low climate settings, $\underline{t}$ (648) = -8.17, $\underline{p}$ < .001. In the high climate group, workers reported using their HPDs 59.8% ($\underline{SD}$ = 33.6) of the time when exposed to high-noise environments, while workers in the low climate group reported using hearing protection 38.4% (SD = 33.3) of the time when they were exposed to high-noise levels. Therefore, the hypothesis was supported. Illustrated in the bar graph in Figure 2 is the difference in average HPD use between the high and low work climate groups.

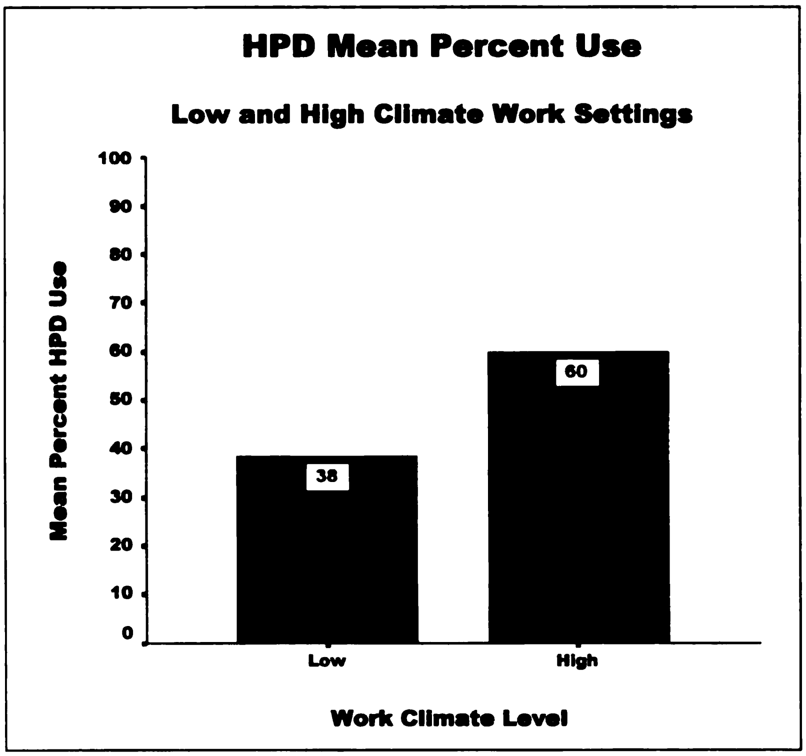


Figure 2. HPD use in low and high climate work settings.

Table 4 provides information on the demographic characteristics of workers in the high and low work climate groups. In the low climate group (n = 326), construction workers ranged in age from 20 to 63 years (M = 33) while workers in the high climate group (n = 326) ranged in age from 21 to 63 years (M = 38). Construction workers in the high climate group were significantly older than workers in the low climate group, t (642) = -5.38, $p < .001$. Of the three trade groups, operating engineers tended to report more supportive work climates for HPD use. Over half of the operating engineers (64.6%) were in the high work climate group.

Table 4

Demographics of Construction Workers in Low and High Work Climates

Characteristic	Low Climate (n = 326) (Mean Age = 33 years)		High Climate (n = 326) (Mean Age = 38 years)	
	n	%	n	%
Trade category				
Carpenters	121	37.1	43	13.2
Operating Engineers	102	31.3	186	57.1
Plumbers/Pipefitters	103	31.6	97	29.8
Gender				
Male	315	96.6	313	96.0
Female	8	2.5	11	3.4
No response	3	.9	2	.6
Ethnicity				
White	293	89.9	295	90.5
Black	12	3.7	14	4.3
Native American	7	2.1	6	1.8
Hispanic	6	1.8	6	1.8
Asian	1	.3	—	—
Other	—	—	1	.3
No response	7	2.1	4	1.2
Education				
High school or less	213	65.3	231	70.9
Beyond high school	110	33.7	93	28.5
No response	3	.9	2	.6

Hypothesis 3

There is a positive relationship among work climate factors, self-efficacy, outcome expectancy, and outcome value for using HPDs.

Pearson product-moment bivariate correlations were performed among work climate, self-efficacy, outcome expectancy, and outcome value scales. Results indicated that all correlations were positive and statistically significant at a level of $p < .01$. As workers perceived their work settings to be more supportive for using HPDs, their self-efficacy, outcome expectancy, and outcome value for using HPDs also increased. Table 5 indicates the intercorrelations among the variables. As depicted, there is a moderate relationship between work climate and self-efficacy, while weak relationships are evident between work climate and outcome expectancy and between work climate and outcome value. Also interesting to note is the moderately strong relationship between outcome expectancy and outcome value.

Table 5

Pearson Product-Moment Correlations

	Work Climate Scale	Self-efficacy Scale	Outcome Expectancy Scale	Outcome Value Scale
Work Climate Scale	1.000			
Self-efficacy Scale	.388**	1.000		
Outcome Expectancy Scale	.180**	.383**	1.000	
Outcome Value Scale	.188**	.281**	.422**	1.000

** p <.01, two-tailed.

Hypothesis 4

Construction workers who perceive a supportive work climate will report higher self-efficacy, outcome expectancy, and outcome value for using HPDs than construction workers who perceive a non-supportive work climate.

Three independent-samples t-tests (see Table 6) were performed to determine if the study variables of self-efficacy, outcome expectancy, and outcome value for using HPDs differed between construction workers in supportive work settings and those in non-supportive settings. As hypothesized, workers in supportive work climates reported significantly higher levels of self-efficacy, outcome expectancy, and outcome value at an alpha level of

$p < .001$. Mean scores of these variables for the low and high climate groups and t-test results are depicted in Table 6.

Table 6

T-tests between Work Climate Levels

Variable	Work Climate Level	Mean	t-value	df	prob. (2-tailed)
Self-efficacy	low high	3.96 4.44	-9.48	646	<.001
Outcome expectancy	low high	5.12 5.39	-4.80	650	<.001
Outcome value	low high	84.03 88.56	-4.88	630	<.001

Hypothesis 5

Hearing protection training, work climate factors, self-efficacy, outcome expectancy, and outcome value will predict the use of HPDs by construction workers.

Hierarchical multiple regression (see Table 7) was used in order to enter the predictor (independent) variables in systematic steps as suggested by the conceptual model illustrated in Figure 1. Predictor variables (training, work climate, self-efficacy, outcome expectancy, and outcome value) were entered in ordered steps or "blocks", thus allowing an examination of the R^2 changes at each step. As suggested by Astin (1993), demographic variables (age, trade group) were entered first, at step 1, in the multiple regression analysis to control for their effects (eliminate their influence) on the dependent variable (HPD use). By entering variables related to demographic characteristics in step 1 of the

Table 7

Results of Hierarchical Regression with Model Predictors of HPD Use

Variable	B	SE B	β	t	Sig. t
Step 1					
Age	.154	.174	.046	.885	.377
Operating Engineers	24.797	4.347	.353	5.704	.000
Plumbers/Pipefitters	6.453	3.561	.086	1.812	.070
Step 2					
Age	.129	.174	.039	.742	.458
Operating Engineers	25.314	4.347	.360	5.824	.000
Plumbers/Pipefitters	6.498	3.554	.086	1.828	.068
HPD Training	4.985	2.605	.071	1.914	.056
Step 3					
Age	.059	.168	.018	.352	.725
Operating Engineers	17.988	4.328	.256	4.156	.000
Plumbers/Pipefitters	1.138	3.517	.015	.323	.746
HPD Training	5.422	2.515	.078	2.156	.031
Work Climate	16.936	2.456	.266	6.894	.000
Step 4					
Age	.101	.167	.030	.606	.545
Operating Engineers	17.400	4.293	.247	4.053	.000
Plumbers/Pipefitters	.659	3.489	.009	.189	.850
HPD Training	4.230	2.516	.061	1.681	.093
Work Climate	13.462	2.626	.212	5.127	.000
Self-efficacy	7.005	1.984	.138	3.531	.000

(table continues)

Table 7 (*continued*)

Variable	**B**	**SE B**	**β**	**t**	**Sig. t**
Step 5					
Age	.097	.167	.029	.584	.560
Operating Engineers	17.507	4.298	.249	4.073	.000
Plumbers/Pipefitters	.702	3.491	.009	.201	.841
HPD Training	4.261	2.517	.061	1.693	.091
Work Climate	13.379	2.630	.210	5.087	.000
Self-efficacy	6.529	2.119	.128	3.081	.002
Outcome Expectancy	1.209	1.889	.025	.640	.522
Step 6					
Age	.055	.166	.016	.328	.743
Operating Engineers	17.332	4.269	.247	4.060	.000
Plumbers/Pipefitters	.033	3.474	.000	.009	.993
HPD Training	4.332	2.500	.062	1.733	.084
Work Climate	12.814	2.619	.201	4.894	.000
Self-efficacy	5.936	2.113	.117	2.809	.005
Outcome Expectancy	-.972	2.002	-.020	-.485	.628
Outcome Value	.369	.118	.124	3.116	.002

Note. Overall Model (Step 6): $R^2 = .21$, $F\ (8, 631) = 21.24$, $p < .001$.

analysis, statistical control is exerted. Variables entered at subsequent steps can then reveal their contributions to prediction beyond that provided by demographic characteristics. Since trade group was a categorical variable that represented the three groups of construction workers, three dichotomous dummy variables were created. The carpenters' category served as the reference group; therefore, it was not entered into the multiple regression (Astin, 1993).

Results of the hierarchical multiple regression (see Table 7) suggest that workers who reported being in high climate (supportive) settings tended to use hearing protection more than workers in low climate (non-supportive) settings. In the overall model at step 6, HPD training did not significantly predict the construction workers' use of HPDs; therefore, the hypothesis as stated was only partially supported. However, in addition to work climate, three other significant contributors to the model were trade category, self-efficacy, and outcome value. Of the four significant predictors, type of construction worker (operating engineers) and work climate factors were the strongest predictors for HPD use, indicated by standardized betas of .25 and .20 respectively.

An unexpected and perplexing result, depicted in the regression results displayed in Table 7, was the non-significant and negative standardized beta (-.02) for outcome expectancy in step 6. The negative sign would suggest that construction workers used HPDs more when they perceived a low expectancy for the results associated with using hearing protection. Since the bivariate correlation between outcome expectancy and HPD use was positive, $\underline{r}$ (648) = .13, $\underline{p}$ < .01, the negative beta for outcome expectancy revealed in step 6 of the hierarchical regression might be indicative of multicollinearity between outcome expectancy and outcome value. The bivariate correlation between these two variables was .42 (p < .001), indicating a moderate correlation. Furthermore, the beta for outcome expectancy changed signs when outcome value entered the regression equation at step 6, a sign often signaling the possibility of multicollinearity (Hamilton, 1992). When multicollinearity exists, the coefficient estimates tend to be unstable and less precise.

Using the non-standardized regression coefficients from the overall model, the multiple regression equation to predict HPD use in construction workers is:

> *Predicted HPD Use = -14.147 + .055(age) + 17.332(operating engineers) + .033(plumbers/pipefitters) + 4.332(HPD training) + 12.814(work climate) + 5.936(self-efficacy) -.972(outcome expectancy) + .369(outcome value).*

With reference to individual items that comprised the work climate scale (see Table 8), the strongest significant bivariate correlations with HPD use occurred between peer modeling of HPD use, r (641) = .41, p <.001, and having enough time to use hearing protection, r (647) = .33, p <.001. Slightly lower in strength was the bivariate correlation between supervisor modeling of HPD use and HPD use, r (640) = .29, p < .001.

Table 8

Work Climate Items and Bivariate Correlations with HPD Mean Use

Variable	Correlation
Co-worker pressure gets in way[a]	.13**
No time for HPDs[a]	.33**
HPD information unavailable[a]	.07[NS]
Nobody cares if I wear HPDs[a]	.22**
Can ask for HPD help	.10*
HPDs available at worksite	.26**
Own HPDs assigned to me	.19**
Need request for HPDs[a]	.13**
Not enough HPDs available[a]	.18**
HPD supply is far away[a]	.18**
Free to use many HPDs	.21**
HPD work signs present	.16**
HPD choices available	.11**
Co-worker thinks I should wear	.20**
Supervisor thinks I should wear	.20**
Co-worker wears (models) HPDs	.41**
Supervisor wears (models) HPDs	.29**
Supervisor encourages me	.20**
Supervisor praises me	.13**
Co-worker encourages me	.13**
Co-worker praises me	.15**

[a] Indicates reverse-scored item.

* $p<.05$, two-tailed. ** $p<.01$, two-tailed. NS = not significant.

As illustrated in Table 9, the overall model with all the independent variables entered at step 6 significantly predicted the use of hearing protection by construction workers. As a group, the predictor variables accounted for 21.2% (adj. R^2 = 20.1%) of the variance in HPD use by construction workers. After controlling for demographic characteristics and training effects, work climate factors made a significant contribution to the explanatory power of the model. When work climate entered the regression equation at step 3, a significant change in the R^2 occurred, increasing the explanatory power of the model by 6.1%.

Table 9

Model Summary of Hierarchical Regression with Predictors of HPD Use

Variable	R	R^2	Adj. R^2	SE of Estimate	R^2 Change	F Change	df	Sig. F Change
Step 1 Age Operating Engineers Plumbers/Pipefitters	.343	.118	.113	32.89	.118	28.23	3,636	.000
Step 2 Age Operating Engineers Plumbers/Pipefitters Training	.350	.123	.117	32.83	.005	3.66	1,635	.056
Step 3 Age Operating Engineers Plumbers/Pipefitters Training Work Climate	.429	.184	.177	31.68	.061	47.53	1,634	.000

(table continues)

Table 9 (*continued*)

Variable	R	R^2	Adj. R^2	SE of Estimate	R^2 Change	F Change	df	Sig. F Change
Step 4	.447	.200	.192	31.40	.016	12.47	1,633	.000
Age								
Operating Engineers								
Plumbers/Pipefitters								
Training								
Work Climate								
Self-efficacy								
Step 5	.447	.200	.191	31.42	.001	.41	1,632	.522
Age								
Operating Engineers								
Plumbers/Pipefitters								
Training								
Work Climate								
Self-efficacy								
Outcome Expectancy								
Step 6	.461	.212	.202	31.20	.012	9.71	1,631	.002
Age								
Operating Engineers								
Plumbers/Pipefitters								
Training								
Work Climate								
Self-efficacy								
Outcome Expectancy								
Outcome Value								

Note. Overall Model (Step 6): F (8, 631) = 21.24, $p < .001$.

For purposes of clarifying the direct and indirect effects among the predictor variables and HPD use, and to revise the conceptual model that directed the focus of this study, three additional hierarchical multiple regression analyses were performed. Self-efficacy, outcome expectancy, and outcome value (endogenous variables) were individually regressed on age, trade category, training, and work climate (exogenous variables). Results of these analyses are reported in Tables 10 through 12.

The conceptual model was revised using the significant standardized betas resulting from step 3 in the additional regression analyses, and the significant standardized betas resulting from step 6 (overall model) in the multiple regression analysis previously reported in Table 7. These significant betas are included on the variable paths of the revised conceptual model depicted in Figure 3. As illustrated in the revised model, training exhibits an indirect effect on HPD use through the mediating influence of self-efficacy. Work climate has both direct and indirect effects on HPD use, while trade category (operating engineers) has a direct effect. Work climate and trade category represent the strongest predictors in the revised conceptual model. Combined (direct and indirect) effects of work climate = .26 and the direct effect of trade = .25.

Table 10

Results of Hierarchical Regression of Self-efficacy on Exogenous Variables

Variable	B	SE B	β	t	Sig. t
Step 1					
Age	-.004	.004	-.060	-1.099	.272
Operating Engineers	.263	.091	.189	2.905	.004
Plumbers/Pipefitters	.209	.074	.139	2.812	.005
Step 2					
Age	-.005	.004	-.071	-1.297	.195
Operating Engineers	.276	.090	.198	3.061	.002
Plumbers/Pipefitters	.209	.074	.140	2.829	.005
HPD Training	.140	.054	.101	2.590	.010
Step 3					
Age	-.007	.003	-.104	-2.051	.041
Operating Engineers	.066	.086	.047	.759	.448
Plumbers/Pipefitters	.054	.070	.036	.766	.444
HPD Training	.155	.050	.112	3.083	.002
Work Climate	.502	.049	.398	10.248	.000

Note. Model at Step 3: $R^2 = 16.4$, $F\,(5, 640) = 25.1$, $p < .001$.

Table 11

Results of Hierarchical Regression of Outcome Expectancy on Exogenous Variables

Variable	B	SE B	β	t	Sig. t
Step 1					
Age	-.0007	.004	.010	.178	.859
Operating Engineers	.068	.095	.047	.718	.473
Plumbers/Pipefitters	.085	.078	.055	1.099	.272
Step 2					
Age	.0005	.004	.007	.129	.897
Operating Engineers	.071	.095	.049	.752	.452
Plumbers/Pipefitters	.085	.078	.055	1.099	.272
HPD Training	.036	.057	.025	.635	.525
Step 3					
Age	-.0006	.004	-.009	-.169	.866
Operating Engineers	-.036	.096	-.025	-.376	.707
Plumbers/Pipefitters	.006	.078	.004	.080	.936
HPD Training	.044	.056	.030	.779	.437
Work Climate	.256	.055	.195	4.685	.000

Note. Model at Step 3: $R^2 = .04$, $F\ (5, 640) = 4.81$, $p < .001$.

Table 12

Results of Hierarchical Regression of Outcome Value on Exogenous Variables

Variable	B	SE B	β	t	Sig. t
Step 1					
Age	.09	.063	.078	1.433	.152
Operating Engineers	2.248	1.573	.093	1.429	.154
Plumbers/Pipefitters	3.241	1.289	.125	2.514	.012
Step 2					
Age	.089	.063	.078	1.417	.157
Operating Engineers	2.261	1.577	.094	1.433	.152
Plumbers/Pipefitters	3.242	1.290	.125	2.513	.012
HPD Training	.128	.945	.005	.135	.892
Step 3					
Age	.073	.062	.064	1.175	.240
Operating Engineers	.675	1.607	.028	.420	.674
Plumbers/Pipefitters	2.079	1.307	.080	1.590	.112
HPD Training	.214	.934	.009	.229	.819
Work Climate	3.685	.912	.168	4.040	.000

Note. Model at Step 3: $R^2 = .05$, $F(5, 636) = 6.0$, $p < .001$.

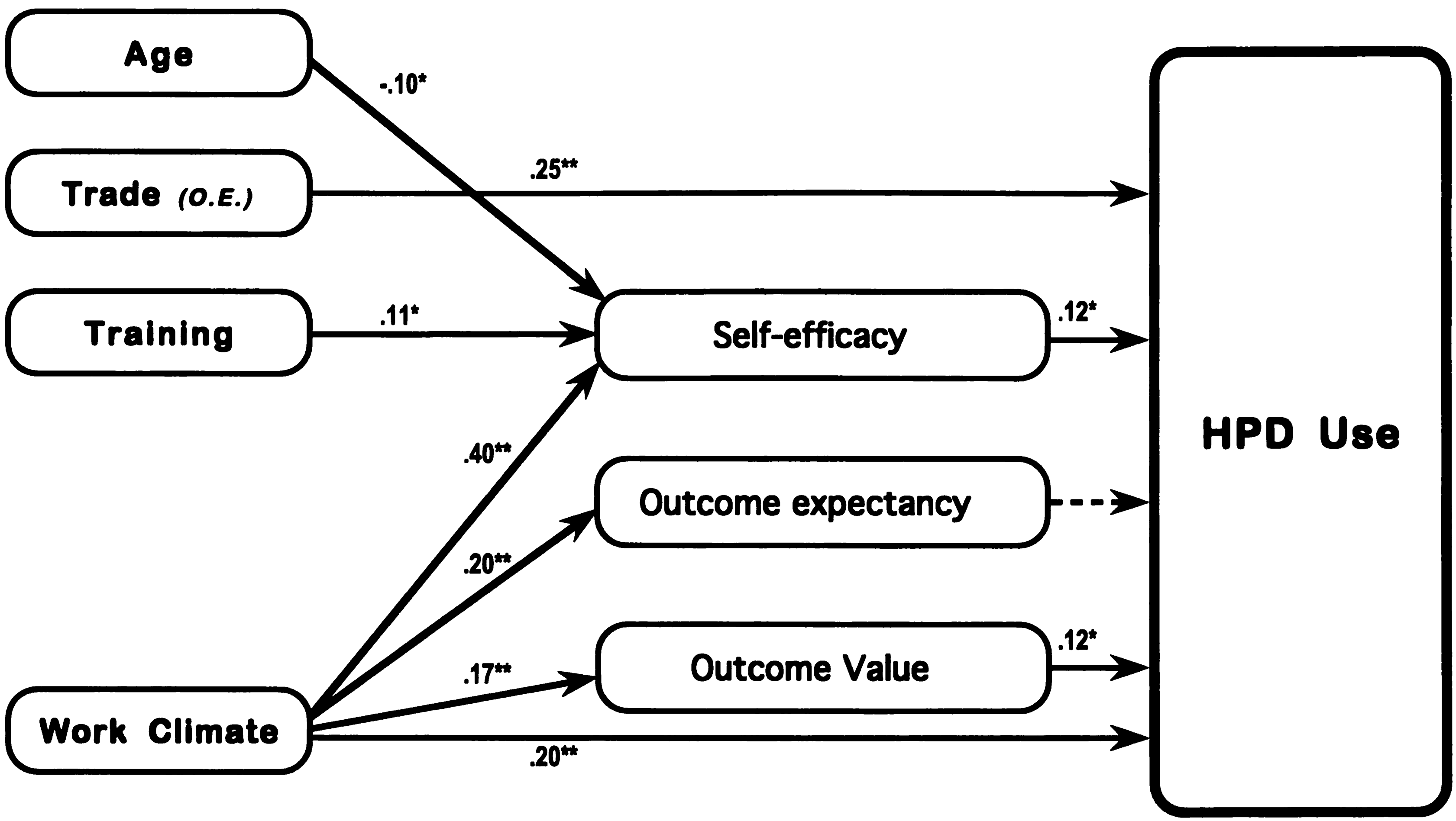


Figure 3. Revised conceptual model identifying significant betas of predictors for use of hearing protection devices (HPDs).

* $p < .05$. ** $p < .001$.

Hypothesis 6

For construction workers who received hearing protection training, those who perceived a supportive work climate will report greater self-efficacy, outcome expectancy, outcome value, and use of HPDs than those who perceived a non-supportive climate.

Essentially, this hypothesis consisted of four subsections. To test this hypothesis, four separate multifactor analysis of variance tests (two-way ANOVAs) were conducted to examine the main and combined (interaction) effects of HPD training and work climate level on: (1) self-efficacy, (2) outcome expectancy, (3) outcome value, and (4) HPD use. Descriptive statistics for self-efficacy, outcome expectancy, outcome value, and HPD use by training and work climate level are presented in Tables 13 and 14 respectively. Table 13 indicates that construction workers who received HPD training had higher mean levels of self-efficacy, outcome expectancy, outcome value, and HPD use than workers who had received no training. Similarly, in Table 14, the mean levels of self-efficacy, outcome expectancy, outcome value, and HPD use are higher for workers in supportive work climates versus non-supportive work climates.

Table 13

Descriptive Statistics of Variables Used in Analysis of Variance by HPD Training

HPD Training		Self-efficacy	Outcome Expectancy	Outcome Value	HPD Use
No	n	316	316	314	315
	Mean	4.124	5.238	86.172	46.865
	Std. Deviation	.705	.744	12.081	34.716
	Variance	.497	.554	145.956	1205.214
Yes	n	336	336	334	335
	Mean	4.269	5.275	86.410	51.250
	Std. Deviation	.683	.693	12.014	35.352
	Variance	.467	.480	144.324	1249.782
Total	n	652	652	648	650
	Mean	4.199	5.257	86.294	49.125
	Std. Deviation	.697	.718	12.038	35.087
	Variance	.486	.515	144.904	1231.104

Table 14

Descriptive Statistics of Variables Used in Analysis of Variance by Work Climate Level

Work Climate		Self-efficacy	Outcome Expectancy	Outcome Value	HPD Use
Low	n	326	326	324	325
	Mean	3.956	5.124	84.028	38.416
	Std. Deviation	.626	.746	12.754	33.306
	Variance	.392	.556	162.672	1109.271
High	n	326	326	324	325
	Mean	4.442	5.390	88.561	59.834
	Std. Deviation	.680	.664	10.830	33.566
	Variance	.462	.440	117.284	1126.653
Total	n	652	652	648	650
	Mean	4.199	5.257	86.294	49.125
	Std. Deviation	.697	.718	12.038	35.087
	Variance	.486	.515	144.904	1231.104

ANOVA (1). Results indicated in Table 15 identify significant main effects for HPD training and work climate level. Self-efficacy was significantly greater for workers who received HPD training. In addition, self-efficacy was greater for workers who perceived supportive work climates; however, no significant interaction (joint effect) of HPD training and work climate level was observed. There was no moderating effect by climate level on HPD training effects.

ANOVA (2), (3), and (4). With regard to (2) outcome expectancy, (3) outcome value, and (4) HPD use, results indicated significant main effects for work climate level, but no main effects for HPD training. Workers who perceived supportive work climates had significantly greater outcome expectancy (see Table 16), outcome value (see Table 17), and HPD use (see Table 18) than workers who perceived non-supportive climates. As indicated in the respective tables, no significant main effects were observed for HPD training and no significant combined (interaction) effects of training and climate level occurred.

Overall results from the four separate multifactor analysis of variance tests did not support the study hypothesis. Even though HPD training and work climate level had significant main effects on self efficacy, no interaction was revealed in any of the four ANOVA results. Work climate had no moderating effect on training effects. For those construction workers who had received HPD training, the workers who perceived supportive work climates were no different than the workers who perceived non-supportive work climates, in terms of reported self-efficacy, outcome expectancy, outcome value, and HPD use.

Table 15

Analysis of Variance for Self-efficacy by HPD Training and Work Climate

Source	Sum of Squares	df	Mean Square	F	Sig.
HPD Training	3.16	1	3.16	7.47	.01
Work Climate Level	37.83	1	37.83	89.46	.00
HPD Training × Work Climate Level	.61	1	.61	1.45	.23
Model	42.20	3	14.07	33.27	.00
Residual	273.98	648	.42		
Total	316.18	651	.49		

Table 16

Analysis of Variance for Outcome Expectancy by HPD Training and Work Climate

Source	Sum of Squares	df	Mean Square	F	Sig.
HPD Training	.18	1	.18	.36	.55
Work Climate Level	11.46	1	11.46	22.93	.00
HPD Training × Work Climate Level	.01	1	.01	.02	.88
Model	11.67	3	3.89	7.79	.00
Residual	323.67	648	.50		
Total	335.34	651	.52		

Table 17

Analysis of Variance for Outcome Value by HPD Training and Work Climate

Source	Sum of Squares	df	Mean Square	F	Sig.
HPD Training	5.41	1	5.41	.04	.84
Work Climate Level	3245.52	1	3245.52	23.23	.00
HPD Training × Work Climate Level	449.11	1	449.11	3.22	.07
Model	3781.92	3	1260.64	9.02	.00
Residual	89971.26	644	139.71		
Total	93753.18	647	144.90		

Table 18

Analysis of Variance for HPD Use by HPD Training and Work Climate

Source	Sum of Squares	df	Mean Square	F	Sig.
HPD Training	2848.20	1	2848.20	2.55	.11
Work Climate Level	73796.41	1	73796.41	66.12	.00
HPD Training × Work Climate Level	585.22	1	585.22	.52	.47
Model	77978.91	3	25992.97	23.29	.00
Residual	721007.6	646	1116.11		
Total	798986.5	649	1231.10		

Summary of Results

Statistical analysis revealed a significant positive relationship between work climate factors and construction workers' HPD use. Workers who perceived supportive work climates, where peers and supervisors encouraged and modeled hearing protection behaviors, tended to report a higher mean use of HPDs. Results from the hierarchical multiple regression indicated that the overall conceptual model, displayed in Figure 3, successfully explained 21.2 % of the variance in HPD use by Midwestern U.S. construction workers. Variables in the overall model that were demonstrated to be significant predictors of HPD use included: trade category (operating engineers), work climate, self-efficacy, and outcome value. HPD training did not significantly predict HPD use; however, it had an indirect effect on HPD use, through a mediating influence of self-efficacy. Results from the ANOVA analyses indicated there was no interaction effect between work climate and HPD training, thus suggesting that work climate had no moderating influence on HPD training effectiveness. Nevertheless, work climate consistently influenced self-efficacy, outcome expectancy, outcome value, and HPD use.

behaviors, it was not surprising to find that workers tended to report a greater use of HPDs. In fact, supportive work climates were significant predictors for hearing protection behaviors, accounting for 11.4% of the variance in HPD use.

A critical component of supportive work climates is having adequate time and appropriate equipment available for using hearing protection. But even more important in work settings, as revealed in this study and previously reported by Lusk et al. (1997), is the visibility of role models to encourage workers to wear their HPDs. In this research study, when co-workers actually demonstrated desired hearing protection behaviors, construction workers were more likely to enact similar behaviors, as evidenced by the moderately strong correlation between peer modeling and workers' reported use of HPDs (see Table 8). Interestingly, supervisor modeling had a slightly lower correlation with workers' HPD use (see Table 8). In the sample of construction workers in this study, the influence of co-workers was stronger than that of supervisors, thus emphasizing the critical importance of peers in modeling desired behaviors.

Findings from this study both support and somewhat contradict earlier studies reported in the literature. In a study of painters and their use of respirators, White et al. (1988) found that social factors, such as perceived attitudes of others in the work setting, played a major role in promoting health-protective behaviors. Similarly, the work of Zohar (1980) and Leinster et al. (1994) substantiated the importance of management commitment for producing adequate hearing protection behaviors in the workplace. Slightly different from the perceptions reported by construction workers in this study, Richey (1992) determined that modeling of desired safety behaviors by supervisors and management was more influential than behavior modeling by co-workers. In contrast to these findings that emphasized the importance of a supportive work setting, Melamed et al. (1996) reported that social and management pressure explained little additional variance in HPD use among factory workers in Israel. However, Melamed et al. admitted that their finding might have been the result of a ceiling effect related to the already conscientious use of HPDs in factory sites where management had agreed to participate in the study.

Clearly, findings from this study align with previous studies that highlighted the importance of supportive work climates to encourage the enactment of safety behaviors. What differs among the studies is the source of the more influential modeling support: co-workers or supervisors. For the construction workers in this research study, the influence of co-workers was found to be somewhat stronger than that of supervisors, thus indicating the more influential role of work peers in modeling hearing protection behaviors. Perhaps this greater influence from work peers is related to the nature of the construction industry itself where OSHA requirements relative to hearing protection are not as stringent, and where workers tend to be more transient—often changing sites as a team and encountering variable supervisors. Whatever the source of support for hearing protection behaviors might be, the importance of role modeling in the work setting cannot be ignored. Indeed, it is a critical factor to consider when attempting to improve the practice of safety behaviors, particularly the use of HPDs among construction workers.

HPD Use in Low and High Climate Work Settings

As hypothesized in this study, data analysis revealed a significant difference in the use of hearing protection between construction workers in supportive and non-supportive climates. In supportive climates, however, the average reported use of HPDs by construction workers was approximately 60% and still inadequately low (see Figure 2). Interestingly, this average use in supportive climates reflects the higher end of the range of HPD use (18%-62%) that has been previously reported in the literature (Hong, Chen, & Conrad, 1998; Lusk et al., 1998; Lusk et al., 1995; Lusk et al., 1997; Melamed et al., 1996). Even though high climate settings in this study promoted HPD use more than 50% of the time, it is crucial to emphasize that HPDs must be worn 100% of the time in order to achieve maximum hearing protection when exposed to high-noise levels (Savell & Toothman, 1987).

Therefore, even more inadequate and certainly disconcerting was the mean HPD use of 38% reported by construction workers in low climate settings. Work climates that were perceived by construction workers to be non-supportive relative to the use of HPDs had a negative influence on hearing protection behaviors. Given that the average age of workers in the low climate group was 33 years, it is extremely unfortunate to realize how vulnerable this group is for acquiring an occupational noise-induced hearing loss (NIHL) so early in life. With the permanent nature of such a hearing loss, the future quality of life for these construction workers is greatly jeopardized. Even more tragic to consider is that occupational NIHL is entirely preventable when appropriate use of HPDs is fostered in work settings.

Relationship of Work Climate with Self-efficacy, Outcome Expectancy, and Outcome Value

As hypothesized in this study, work climate factors were positively associated with construction workers' perceptions of their self-efficacy for using HPDs, their expectancy of the outcomes (benefits) for using HPDs, and their valuing of the outcomes related to the use of HPDs. All three relationships were statistically significant with the correlation between work climate factors and self-efficacy being the strongest among the three (see Table 5). The relationship between self-efficacy and work climate factors is especially important to consider, in light of the research findings reported by Schwarzer (1992) indicating that self-efficacy exerts a powerful influence on behavior.

In this research study, construction workers in supportive climates differed significantly from workers in non-supportive climates. Since the self-efficacy scale measured workers' perceptions about their ability to use HPDs correctly and effectively, it is understandable that supportive work climates contributed to higher levels of self-efficacy perceptions. As construction workers in this study were encouraged to use HPDs in their work settings and as they observed modeled behaviors, it is not surprising that their confidence to use HPDs correctly was enhanced. Furthermore, by observing consistent hearing protection behaviors of peers and supervisors, construction workers were more likely to anticipate the beneficial outcomes and values associated with using HPDs.

Observational learning is a central concept in social cognitive theory (SCT) espoused by Bandura (1986). Certainly consistent with SCT is the notion that a supportive work climate provides ongoing opportunity for workers to engage in vicarious learning. Even if workers are encouraged in training sessions to adopt hearing protection behaviors, they are still much more likely to do so when they witness their peers enacting hearing protection behaviors. According to Bandura's concepts, observing the successful experiences of others provides a dynamic catalyst and mediates the adoption of new behaviors.

Reflecting some of the earlier findings reported by Lusk (1997) are the results clearly highlighted in this study. The influence of social modeling in the work setting plays a dramatic role in promoting hearing protection behaviors among construction workers. In a sense, the work setting provides an opportunity for ongoing "real-time" testimonials where the beliefs and behaviors of co-workers dynamically affirm the value of HPD use. Clearly supporting this contention is the previously discussed correlational finding from this research study: construction workers' use of HPDs increased when they observed their peers modeling HPD behavior (see Table 8).

Model for Predicting HPD Use

In the hierarchical multiple regression analysis, using the conceptual model that directed the focus of this study, results indicated that 21% of the variance in HPD use by construction workers was explained by the group of predictor variables (age, trade, training, work climate, self-efficacy, outcome expectancy, and outcome value). The research hypothesis relative to the predictive ability of the overall model was partially supported. While the variance in HPD use explained by the model is rather modest, the regression results clearly emphasize the influence of trade category, work climate factors, self-efficacy, and outcome value as significant predictors for HPD use among construction workers.

Even though training was not evident as a significant predictor in the overall model, it is important to recognize that self-efficacy was a significant predictor for HPD use, having a standardized beta of .12 (p = .005). This is worthwhile to note because subsequent analysis (ANOVA) revealed that construction workers who had received hearing protection training also perceived and reported a significantly higher level of self-efficacy for using HPDs. There was an indirect influence of training in relationship to HPD use; training appeared to be mediated by self-efficacy as illustrated in the revised conceptual model (see Figure 3). Therefore, training contributed to construction workers' feeling more confident about their ability to use HPDs adequately and effectively, which then resulted in a higher use of HPDs.

In considering that a guided-practice session was included in the HPD training intervention for construction workers (Lusk, 1997), this indirect influence of training on HPD use (mediated by self-efficacy) seems quite plausible. Opportunity to practice skills, along with observing others doing the same, can lead to increased levels of self-efficacy (Bandura, 1986). This finding certainly strengthens the justification for incorporating "hands-on" opportunities during training, especially since adult learners tend to be pragmatic and respond favorably when learning can be applied to their current situations (Caffarella, 1994).

Work Climate and Training Effectiveness

Recognizing that work climate was found to be a fairly important predictor in the regression model, it was somewhat surprising to note that work climate did not moderate the training effects on self-efficacy, outcome expectancy, outcome value, and HPD use. An interaction between training and work climate had been hypothesized; increased levels of self-efficacy, expectancy, value, and HPD use were anticipated in construction workers who had received hearing protection training and who had reported working in supportive climates. However, data analyses did not support the hypothesis. Perhaps if the training effect had been stronger, an interaction effect may have been observed.

As suggested by Tracey (1992), underlying values related to training in general may influence training effects. Certainly, it is well recognized that adult learners bring a myriad of experiences to any training event. With the absence of an interaction effect in this study, further investigation is needed to reveal the dynamics involved. Given the modest predictive power of the conceptual model, additional predictor variables for HPD use remain to be identified. If we maintain that HPD training is essential and support the concept that factors in the work context influence behaviors, then future research is imperative in order to reduce the occurrence of occupational hearing loss.

Training, Self-efficacy, and Work Settings

An important finding emerged from this study. As previously discussed, training was not a significant predictor for HPD use in the overall regression analysis using the conceptual model. However, additional data analysis revealed that training had an indirect effect on HPD use, working through the mediation effect of self-efficacy. Perhaps the influence of training might have been more evident if self-efficacy were given more time to develop. Meaningful behavior changes are generally not quickly enacted. Despite its limitations as an overall significant predictor, the relationship between training and self-efficacy is encouraging and certainly provides a point of departure for future research endeavors.

Results from this study build upon the research of Mathieu, Martineau, and Tannenbaum (1993) who explored the antecedents of self-efficacy levels in relationship to training effectiveness. Aggregate situational constraints, such as non-supportive group dynamics in the training session, were hypothesized to influence self-efficacy levels and training effectiveness. Mathieu et al. reported that individual constraints (i.e., competing demands, time limitations) were found to adversely affect the development of self-efficacy, but situational constraints did not significantly impede self-efficacy development. Individual and situational constraints were associated, however, with less favorable responses to training. Failing to find support for their hypothesis regarding the relationship between situational factors and self-efficacy, Mathieu et al. strongly emphasized the need for further research to examine the influence of work setting constraints on training effectiveness, suggesting that work policies and supervisor behaviors could impede the training process. Interestingly, in a study addressing transfer of training, Rouiller and Goldstein (1993) found that supportive climates tended to promote transfer of skills learned in training.

Consistent with the hypothesis of Mathieu et al. (1993) and findings reported by Rouiller and Goldstein (1993), this research study demonstrated a significant correlation between work climate and self-efficacy, which then influenced construction workers' use of HPDs. Most assuredly, if organizations fail to address situational constraints in the work environment, they are likely to experience minimal gains from training efforts. Given the findings from the work of Rouiller and Goldstein, it was somewhat puzzling to observe no interaction effect between training and work climate in this research study. Perhaps more refined and discrete instruments for variable measurement would reduce the potential for measurement error and enhance understanding of the complex interplay involved in workers' behaviors to protect their hearing.

The theory-based training intervention that was provided for construction workers in the study reported by Lusk (1997) consisted of one classroom session that lasted approximately 45 minutes and included a video presentation, along with a guided-practice session and distribution of relevant printed materials. In order to change the hearing protection behaviors of construction workers, it also is important to recognize and plan for adjustments that might be needed in work settings where transfer of what is learned in training is intended to occur. Failure to perform an adequate assessment of the actual and potential needs in the work environment may result in wasted training efforts (Schneider & Rentsch, 1988). Training will be much more effective if it is rooted in the workplace environment and nurtured on a continuing basis (Minter, 1996). In addition, contractors, managers, and site supervisors should be assisted and encouraged to provide post-training feedback that is likely to reinforce desired behaviors.

Also important to consider are periodic refresher training sessions that tend to engender more enduring changes in hearing protection behaviors (Minter).

Implications for Theory

Theories, such as the Health Belief Model (HBM) and the Health Promotion Model (HPM) that guided earlier research about health-related behaviors focused predominantly on individual or personal factors that influenced health-promoting behaviors. Juxtaposing this individual-personal focus is the evidence from this study which indicates that construction workers' behaviors to protect their hearing are influenced by more than just individual or personal factors. Contextual factors, such as supervisor and peer support within the work environment, exert a moderately strong influence on construction workers' hearing protection behaviors. Given the findings from this study, it is imperative to expand upon the earlier health behavior theories by including an explicit focus on the sociocultural factors that influence workers' behaviors. Focusing primarily on personal factors is not enough; the organizational context must also be addressed.

Specifically with regard to health and safety behaviors occurring in work settings, the earlier theories could be enhanced by moving beyond a primary focus on individual-personal factors and incorporating a focus on work climate factors that function as significant predictors of behaviors. Inclusion of elements that create a climate for influencing workers' behaviors within the work environment would strengthen the existing health-related theoretical models.

Consequently, a greater awareness and clearer understanding of workers' behaviors might be achieved if more inclusive theories are applied.

Overall findings from this study strongly support the concepts that Bandura (1986) espoused about self-efficacy and vicarious learning in SCT. Of primary importance in SCT is the critical role that the social environment plays in determining individual behaviors and performance. As emphasized by Bandura and reinforced by findings in this study, contextual factors have a definite influence on behavior. In reference to adult learners, Merriam and Caffarella (1999) contend that Bandura's theory has major relevance. It is the dynamic combination of the individual within a social context that profoundly influences adult learning. Certainly, findings from this study provide support for the use of a social interactive theory to predict and explain post-training hearing protection behaviors. With increased knowledge and awareness of the predictors for workers' post-training behaviors, more comprehensive training programs can be designed and implemented.

What has been well recognized by educators of adult learners is that the process of learning occurs not in a vacuum, but within a social context that exerts tremendous influence on learning outcomes (Merriam & Brockett, 1997). Indeed, findings from this study demonstrate how important it is to evaluate the associated social context where learned behaviors are expected to occur. Construction workers' post-training HPD use was significantly influenced by contextual factors such as peer-supervisor support and modeling of hearing protection behaviors. These findings align with some of the tenets associated with situated cognition, a concept gaining more recognition in the field of adult education. "Situated cognition is based on the idea that what we know and the meanings we attach to what we know are socially constructed" (Merriam & Brockett, 1997, p. 156). Clearly, interactive experiences within a social context play a prominent role in adult learning and subsequent behavior (Wilson, 1993).

Findings from this study also support the concept of outcome value as a motivating force of behavior described by Vroom (1964) in Expectancy Theory. Not surprisingly, when construction workers highly valued the outcomes associated with wearing hearing protection, (e.g., prevention of hearing loss, protection from harmful noise) their use of HPDs increased. However, findings from the multiple regression analysis in this study tend not to support Vroom's concept of outcome expectancy as a motivating force. Somewhat surprising and certainly perplexing was the non-significant negative beta (-.02) of outcome expectancy in the final step of the hierarchical regression analysis. This finding would suggest that high expectations of the outcomes (benefits) from wearing HPDs (e.g., reduction of hearing loss from noise exposure, protection of hearing) contributed to a low use of HPDs—a finding somewhat contrary to logical expectation and Vroom's theoretical model.

A more likely reason for this unexpected finding is the possibility of multicollinearity between outcome expectancy and outcome value, since they appear to measure similar concepts. Even though the bivariate correlation of .42 ($p < .001$) between these two variables is not necessarily high to produce multicollinearity, a linear combination of the two variables with an undetectable third predictor variable could produce a multicollinearity problem (Hamilton, 1992). Perhaps more refined instruments are needed to improve the measurement precision of these variables in future research studies.

Implications for Practice

With regard to the practical application of findings obtained from this research study, it should be recognized that the work climate is a critical factor to consider when planning hearing protection training. Not only should efforts focus on changing individual behaviors, but work climates as well must be addressed and adjusted. As suggested in the literature related to safety behaviors (Dedobbeleer & Beland, 1991; White et al., 1988) and worksite health promotion programs (Ribisl & Reischl, 1993), the influence of work settings must be a primary concern. When workers learn behaviors in training sessions, it cannot be generally assumed that the targeted behaviors will automatically transfer to the work environment (Baldwin & Ford, 1988). Situational factors such as lack of equipment and supervisor-peer support can often constrain enactment of desired safety behaviors.

Unfortunately, adult learning principles and their relevance are often neglected when training programs are designed and implemented in work settings. In planning educational programs for adult learners, the potential for authentic application of learning is a critical element to assess (Knowles, 1984). For adults, learning is strengthened when they perceive a reality for the opportunity to apply newly-learned skills. Therefore, if a work environment is perceived by workers as non-conducive for the application of skills learned in training, minimal transfer of learning will occur. Consequently, the effectiveness of training programs is often jeopardized when work environments lack support for the application of newly-learned skills.

It would be beneficial to plan HPD training interventions that incorporate principles that are relevant for adult learners. Particularly useful to consider are context-based instructional sessions where real-life work situations and experiences of construction workers could be drawn upon to guide the presentation and discussion of training content (Dirkx & Prenger, 1997). Context-based instruction involves actively engaging adult learners in the process of identifying and determining what is meaningful for them to learn. This type of strategy could provide a reality orientation for the HPD training content and increase the potential for transfer of learning to actual work settings.

Given that the reported HPD use by construction workers in this study was inadequate to fully protect their hearing, it also is crucial to recognize the influence of the peer group in work environments when planning and implementing hearing protection training programs. As demonstrated by the findings from this research study, even when well-designed, theory-based training programs are conducted, work climate factors still exert a moderate influence in predicting hearing protection behaviors. Therefore, serious consideration must again be focused on the work setting where hearing protection behaviors, taught during training sessions, are expected to transfer. Enactment of behaviors learned in training programs will be influenced by contextual factors such as peer and supervisor support.

It is important to consider how specific findings from this study might be applied to the population of construction workers. Recalling that HPD modeling by peers and supervisors significantly predicted construction workers' HPD use, training sessions could be designed to include on-site peer groups along with supervisors and managers. It would be advantageous to consider training programs that incorporate teams or groups of workers whose daily work activities involve close interaction. Supervisors also should be included in such training sessions, thus providing visible commitment and credible support for hearing protection efforts. In essence, not only must supervisors and organizational management "speak" a commitment for training efforts, but they must visibly "practice" it too. When messages about the importance of using HPDs are consistently conveyed throughout the organizational setting and among various levels, there is greater potential for increased transfer of knowledge, skills, and attitudes from training programs to work environments (Ford & Fisher, 1994).

Brief "tool box" or "tailgate" sessions (Schneider, Johanning, Belard, & Engholm, 1995) that are familiar to the construction industry might effectively reinforce annual HPD training. Having HPD equipment available during these on-site sessions would encourage construction workers to practice with the devices and try them on for size, thus potentiating their sense of self-efficacy. Comprehensive HPD training is valuable, but desired behaviors must be encouraged and reinforced in the work environment if adequate use of HPDs and reduction of occupational NIHL are to be achieved.

The sample in this study consisted of unionized construction workers; therefore, involving union leaders in efforts to reduce NIHL is another strategy to consider when planning training programs for unionized groups. Dedobbeleer, Champagne, and German (1990) found that exposure to safety training tends to be more prevalent among unionized construction workers. Building upon this reported finding, the participation of union leaders can be encouraged, thus providing additional opportunities for construction workers to observe social modeling of acceptable HPD behaviors.

Cognizant of the influence that work climate exerts, training efforts should include preparation of the worksite for reinforcing HPD training. Visible management support is essential for transfer of training to occur. Encouraging site managers and supervisors to provide adequate HPD equipment and consistent reminders for HPD use in their work environments can help to improve the retention of training skills. The environment should reflect and reinforce what has been emphasized in training. When workers perceive that management is serious about the dangers associated with exposure to hazardous noise, they are much more likely to enact positive hearing protection behaviors.

Limitations

It is helpful to note that some limitations of this study exist. Midwestern U.S. construction workers comprised the sample for this study; therefore, findings cannot be generalized beyond this population. In addition, self-reporting of HPD behaviors was used to measure the dependent variable, thus possibly reducing the reliability of reported results. A lack of a significant relationship between training and HPD use may have resulted from the fact that the training intervention occurred outside of the normal work setting and consisted of one 45-minute classroom session. Perhaps this may have been a limiting factor.

Construction workers might benefit from training that is conducted on a more frequent basis within their work environments.

Secondary analysis of existing data was the technique applied in this research study. Performing secondary data analysis has distinct advantages accompanied by definite disadvantages. At best, using a pre-existing data set provides an economical approach for conducting additional studies in the current environment of limited resources (both time and money). However, one of the primary drawbacks of secondary data analysis is the limitation imposed by pre-existing variables and scales that have been designed and developed from another theoretical perspective. Scales and measurements may lack validity and not match the desired precision for the secondary analysis. Nevertheless, working with pre-existing data sets affords access to large sample sizes, often not readily available and very difficult to obtain. Lastly, performing secondary data analysis encourages a researcher to be creative by looking at existing data with a different point of view.

Recommendations

Future research should continue to focus on self-efficacy and examine its antecedents in order to develop a more comprehensive understanding of what contributes to training effectiveness. Construction workers in this study who received hearing protection training had significantly higher levels of self-efficacy. Continued examination of this apparent linkage is warranted if a broader awareness of learning dynamics is desired. Also, since operating engineers in this study demonstrated a higher use of hearing protection, research should be directed on exploring the factors contributing to their unique behaviors and characteristics.

Still to be answered is the perplexing question about the role of outcome expectancy in relation to hearing protection behaviors. Contrary to the conceptual model that directed the focus of this study, outcome expectancy was not a significant predictor. Again, this emphasizes the need for improved measurement precision to reduce the potential for multicollinearity and confusing regression results.

While the overall conceptual model used in this study was successful in predicting HPD use among Midwestern U.S. construction workers, the $\underline{R}^2$ achieved (21%) was somewhat modest, but not too uncommon in studies involving the social sciences. Nevertheless, the modest predictive power strongly suggests that further investigation is needed to explain the remaining 79% of the variance in hearing protection behaviors among construction workers. In addition, a clearer operational understanding and comprehensive description of elements comprising the work climate construct are needed in order to ensure greater measurement precision. To identify and clarify other factors associated with HPD behaviors, qualitative studies that are grounded in construction workers' actual experiences are worthwhile to consider for future research efforts.

Summary

Currently, there is a renewed focus on the effectiveness of training, particularly by those involved with training endeavors in work settings.

Increasingly, organizations are critically analyzing costs and benefits associated with training programs since they represent a major organizational investment of both time and money. Needless to say, sound evidence is needed to justify training expenditures (Cascio, 1989). Consequently, it is imperative that researchers and practitioners increase their awareness and understanding of the contextual factors that contribute to effective training efforts.

In light of this urgency, what has this research study provided? How enlightened have we become about providing hearing protection training for construction workers? Most emphatically, findings from this study have emphasized the importance of work setting factors in predicting post-training hearing protection behaviors. For the group of construction workers in this study, co-worker support and modeling of HPD behaviors played a dominant role. When asked about what would encourage him to wear HPDs, one young construction worker spontaneously responded, “If my buddies wore them, I would too!” Therefore, the context where learned skills are expected to transfer should be of crucial concern and must not be ignored.

Generally, those who work closely with adult learners develop an acute appreciation for the dynamics involved in learning environments, but an awareness of the critical factors that promote transfer of learning to work settings is often limited. Knowledge gained from this study can encourage us to expand our focus beyond the specific training environment, thus broadening our view to include work settings where other important lessons are learned. Therefore, it is absolutely essential to assess and recognize the influence of work environments if training is to be effective. By understanding the dynamic contextual factors associated with hearing protection behaviors in work settings, more suitable training strategies can be developed. Most assuredly, with more effective HPD training, the potential to reduce occupational NIHL will be greatly enhanced.

REFERENCES

REFERENCES

Adera, T., Donahue, A. M., Malit, B. D., & Gaydos, J. C. (1993). Assessment of the proposed Draft American National Standard method for evaluating the effectiveness of hearing conservation programs. Journal of Occupational Medicine, 35(6), 568-573.

Alleyne, B. C., Dufresne, R. M., Kanji, N., & Reesal, M. R. (1989). Costs of workers' compensation claims for hearing loss. Journal of Occupational Medicine, 31(2), 134-138.

Astin, A. W. (1993). Assessment for excellence: The philosophy and practice of assessment and evaluation in higher education. Phoenix, AZ: Oryx Press.

Atherley, G. (1989). Prevention of occupational deafness: A coming crisis? Journal of Occupational Medicine, 31(2), 139.

Bahadori, R. S., & Bohne, B. A. (1993). Adverse effects of noise and hearing. American Family Physician, 47(5), 1219-1226.

Baldwin, T. T., & Ford, J. K. (1988). Transfer of training: A review and directions for future research. Personnel Psychology, 41(1), 63-105.

Bandura, A. (1991). Social cognitive theory of self-regulation. Organizational Behavior and Human Decision Processes, 50(2), 248-287.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall.

Becker, M. H., & Maiman, L. A. (1980). Strategies for enhancing patient compliance. Journal of Community Health, 6(2), 113-135.

Braver, M. C. W., & Braver, S. L. (1988). Statistical treatment of the Solomon four-group design: A meta-analytic approach. Psychological Bulletin, 104(1), 150-154.

Brinkerhoff, R. O., & Montesino, M. U. (1995). Partnerships for training transfer: Lessons from a corporate study. Human Resource Development Quarterly, 6(3), 263-274.

Bryman, A. (1989). Research methods and organization studies. London, UK: Unwin Hyman.

Caffarella, R. S. (1994). Planning programs for adult learners: A practical guide for educators, trainers, and staff developers. San Francisco, CA: Jossey-Bass Publishers.

Cascio, W. F. (1989). Using utility analysis to assess training outcomes. In I. L. Goldstein & Associates (Eds.), Training and Development in Organizations (pp. 63-88). San Francisco, CA: Jossey-Bass Publishers.

Coyle, I. R., Sleeman, S. D., & Adams, N. (1995). Safety climate. Journal of Safety Research, 26(4), 247-254.

Crump, C. E., Earp, J. L., Kozma, C. M., & Hertz-Picciotto, I. (1996). Effect of organization-level variables on differential employee participation in 10 federal worksite health promotion programs. Heath Education Quarterly, 23(2), 204-223.

Dedobbeleer, N., & Beland, F. (1991). A safety climate measure for construction sites. Journal of Safety Research, 22(2), 97-103.

Dedobbeleer, N., Champagne, F., & German, P. (1990). Safety performance among union and nonunion workers in the construction industry. Journal of Occupational Medicine, 32(11), 1099-1103.

Dedobbeleer, N., & German, P. (1987). Safety practices in construction industry. Journal of Occupational Medicine, 29(11), 863-868.

Denison, D. R. (1993). What is the difference between organizational culture and organizational climate? A native's point of view on a decade of paradigm wars. (Working paper #729). Ann Arbor, MI: University of Michigan, School of Business Administration.

Dessoff, A. L. (1995). Hearing protection: No noise is good news. Safety + Health, 151(2), 54-57.

Dirkx, J. M., & Prenger, S. M. (1997). A guide for planning and implementing instruction for adults: A theme-based approach. San Francisco, CA: Jossey-Bass Publishers.

Dobie, R. A. (1995a). Economic compensation for hearing loss. Occupational Medicine: State of the Art Reviews, 10(3), 663-668.

Dobie, R. A. (1995b). Prevention of noise-induced hearing loss. Archives of Otolaryngology -- Head and Neck Surgery, 121(4), 385-391.

Feldman, A. S., & Grimes, C. T. (1985). Hearing conservation in industry. Baltimore, MD: Williams & Wilkins.

Field, G. R. H., & Abelson, M. A. (1982). Climate: A reconceptiualization and proposed model. Human Relations, 35(3), 181-201.

Ford, J. K., & Fisher, S. (1994). The transfer of safety training in work organizations: A systems perspective to continuous learning. Occupational Medicine: State of the Art Reviews, 9(2), 241-259.

Forehand, G. A. (1968). On the interaction of persons and organizations. In Tagiuri R., & Litwin G. W. (Eds.), Organizational climate: Explorations of a concept (pp. 65-82). Boston: Harvard University, Graduate School of Business Administration.

Franks, J. R. (1990). Noise in the construction industry and its effect on hearing. Hearing Instruments, 41(10), 18-19.

Frayne, C. A., & Latham, G. P. (1987). Application of social learning theory to employee self-management of attendance. Journal of Applied Psychology, 72(3), 387-392.

Garavaglia, P. L. (1996). The transfer of training: A comprehenisve process model. Educational Technology, 36(2), 61-63.

Gist, M. E., & Mitchell, T. R. (1992). Self-efficacy: A theoretical analysis of its determinants and malleability. The Academy of Management Review, 17(2), 183-211.

Gist, M. E. (1987). Self-efficacy: Implications for organizational behavior and human resource management. The Academy of Management Review, 12(3), 473-485.

Glasgow, R. E., McCaul, K. D., & Fisher, K. J. (1993). Participation in worksite health promotion: A critique of the literature and recommendations for future practice. Health Education Quarterly, 20(3), 391-408.

Graziano, A. M., & Raulin, M. L. (1989). Research methods: A process of inquiry. New York, NY: Harper Collins Publishers.

Hakim, C. (1982). Secondary analysis in social research: A guide to data sources and methods with examples. London, UK: George Allen & Unwin.

Hamilton, L. C. (1992). Regression with graphics: A second course in applied statistics. Belmont, CA: Duxbury Press.

Hergenhahn, B. R., & Olson, M. H. (1997). An introduction to theories of learning (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Hofmann, D. A., & Stetzer, A. (1996). A cross-level investigation of factors influencing unsafe behaviors and accidents. Personnel Psychology, 49(2), 307-339.

Hong, O. S., Chen, S.-P. C., & Conrad, K. M. (1998). Noise induced hearing loss among male airport workers in Korea. American Association of Occupational Health Nurses, 46(2), 67-75.

Howe, J. G. (1977). Group climate: an exploratory analysis of construct validity. Organizational Behavior and Human Performance, 19(1), 106-125.

Hyman, H. H. (1972). Secondary analysis of sample surveys: Principles, procedures, and potentialities. New York, NY: John Wiley & Sons.

James, L. R., & Jones, A. P. (1974). Organizational climate: A review of theory and research. Psychological Bulletin, 81(12), 1096-1112.

Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. Health Education Quarterly, 11(1), 1-47.

Kiecolt, K. J., & Nathan, L. E. (1985). Secondary analysis of survey data. Newbury Park, CA: Sage Publications.

Kirkpatrick, D. L. (1994). Evaluating training programs: The four levels. San Francisco, CA: Berrett-Koehler Publishers.

Knowles, M. (1984). The adult learner: A neglected species (3rd ed.). Houston, TX: Gulf Publishing Company.

Kozlowski, S. W. J., & Hults, B. M. (1987). An exploration of climates for technical updating and performance. Personnel Psychology, 40(1), 539-563.

Kuhar, M. S. (1996). Help needed for hearing protection? Occupational Hazards, 87-90.

Latham, G. P. (1989). Behavioral approaches to the training and learning process. In I. L. Goldstein & Associates (Eds.), Training and development in organizations (pp. 256-295). San Francisco, CA: Jossey-Bass Publishers.

Leinster, P., Baum, J., Tong, D., & Whitehead, C. (1994). Management and motivational factors in the control of noise-induced hearing loss (NIHL). The Annals of Occupational Hygiene, 38(5), 649-662.

Lewis-Beck, M. S. (1980). Applied regression: An introduction. Newbury Park, CA: Sage Publications.

Lindell, M. K. (1994). Motivational and organizational factors affecting implementation of worker safety training. Occupational Medicine: State of the Art Review, 9(2), 211-240.

Litwin, G. H., & Stringer, R. A., Jr. (1968). Motivation and organizational climate. Boston, MA: Harvard University, Graduate School of Business Administration, Division of Research.

Lusk, S. L. (1997). Preventing noise-induced hearing loss in construction workers. A final report to the National Institute for Occupational Safety and Health (Grant No. R01 OH03136).

Lusk, S. L., Hong, O. S., Ronis, D. L., Kerr, M., Eakin, B. L., & Early, M. R. (in press). Test of the effectiveness of an intervention to increase use of hearing protection devices in construction workers. Human Factors.

Lusk, S. L., Kerr, M. J., & Kauffman, S. A. (1998). Use of hearing protection and perceptions of noise exposure and hearing loss among construction workers. American Industrial Hygiene Association Journal, 59, 466-470.

Lusk, S. L., Ronis, D. L., & Baer L. M. (1995). A comparison of multiple indicators: Observations, supervisor report, and self-report as measures of workers' hearing protection use. Evaluation & the Health Professions, 18(1), 51-63.

Lusk, S. L., Ronis, D. L., & Hogan, M. M. (1997). Test of the health promotion model as a causal model of construction workers' use of hearing protection. Research in Nursing & Health, 20, 183-194.

Lusk, S. L., Ronis, D. L., Kerr, M. J., & Atwood, J. R. (1994). Test of the health promotion model as a causal model of workers' use of hearing protection. Nursing Research, 43(3).

Maddux, J. E., Norton, L. W., & Stoltenberg, C. D. (1986). Self-efficacy expectancy, outcome expectancy, and outcome value: Relative effects on behavioral intentions. Journal of Personality and Social Psychology, 51(4), 783-789.

Mathieu, J. E., Martineau, J. W., & Tannenbaum, S. I. (1993). Individual and situational influences on the development of self-efficacy: Implications for training effectiveness. Personnel Psychology, 46(1), 125-147.

Melamed, S., Luz, J., & Green, M. S. (1992). Noise exposure, noise annoyance, and their relation to psychological distress, accident and sickness absence among blue-collar workers - the Cordis Study. Israel Journal of Medical Sciences, 28(8-9), 629-635.

Melamed, S., Rabinowitz, S., Feiner, M., Weisberg, E., & Ribak, J. (1996). Usefulness of the protection motivation theory in explaining hearing protection device use among male industrial workers. Health Psychology, 15(3), 209-215.

Merriam, S. B., & Brockett, R. G. (1997). The profession and practice of adult education: An introduction. San Francisco, CA: Jossey-Bass Publishers.

Merriam, S. B., & Caffarella, R. S. (1999). Learning in adulthood: A comprehensive guide (2nd ed.). San Francisco, CA: Jossey-Bass Publishers.

Merry, C. J., & Franks, J. R. (1995). Historical assessment and future directions in the prevention of occupational hearing loss. Occupational Medicine, 10(3), 669-681.

Minter, S. G. (1996). Safety training that sticks. Occupational Hazards, 33-36.

Moos, R. H. (1976). The human context: Environmental determinants of behavior. New York, NY: John Wiley & Sons.

Murdaugh, C., & Hinshaw, A. S. (1986). Theoretical model testing to identify personality variables effecting preventive behaviors. Nursing Research, 35(1).

National Institute for Occupational Safety and Health [NIOSH]. (1996). Preventing occupational hearing loss: A practical guide. Washington, DC: U.S. Government Printing Office.

National Institute for Occupational Safety and Health [NIOSH]. (1988). Proposed national strategy for the prevention of noise-induced hearing loss. Washington, DC: U.S. Government Printing Office.

National Safety Council. (1992). Hearing conservation in the workplace: A practical guide. Washington, DC: National Safety Council.

Noe, R. A., & Schmitt, N. (1986). The influence of trainee attitudes on training effectiveness: Test of a model. Personnel Psychology, 39(3), 497-523.

Nwaelele, O. D. (1996). Prudent owners take proactive approach. American Society of Safety Engineers, 41(4), 27-29.

Occupational Safety and Health Administration [OSHA]. (1995). Construction Industry Digest . Washington, DC: U.S. Government Printing Office.

Occupational Safety and Health Administration [OSHA]. (1985). Hearing Conservation . Washington, DC: U.S. Government Printing Office.

Owens, R. G. (1995). Organizational behavior in education (5th ed.). Boston, MA: Allyn and Bacon.

Pender, N. J. (1987). Health promotion in nursing practice (2nd ed.). Norwalk, CT: Appleton & Lange.

Pender, N. J., Walker, S. N., Sechrist, K. R., & Frank-Stromborg, M. (1990). Predicting health-promoting lifestyles in the workplace. Nursing Research, 39(6), 326-332.

Polit, D. F., & Hungler, B. P. (1991). Nursing research: Principles and methods (4th ed.). Philadelphia: J.B. Lippincott Company.

Reichers, A. E., & Schneider, B. (1990). Climate and culture: An evolution of constructs. In B. Schneider (Ed.), Organizational climate and culture (pp. 5-39). San Francisco, CA: Jossey-Bass Publishers.

Reilly, M. J., Rosenman, K. D., & Kalinowski, D. J. (1998). Occupational noise-induced hearing loss surveillance in Michigan. Journal of Occupational and Environmental Medicine, 40(8), 667-674.

Ribisl, K. M., & Reischl, T. M. (1993). Measuring the climate for health at organizations: Development of the worksite health climate scales. Journal of Occupational Medicine, 35, 812-824.

Richey, R. (1992). Designing instruction for the adult learner: Systemic training theory and practice. London, UK: Kogan Page.

Ringen, K., Englund, A., Welch, L., Weeks, J. L., & Seegal, J. L. (1995). Why construction is different. Occupational Medicine: State of the Art Reviews, 10(2).

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. Health Education Quarterly, 15(2), 176-183.

Rouiller, J. Z., & Goldstein, I. L. (1993). The relationship between organizational transfer climate and positive transfer of training. Human Resource Development Quarterly, 4(4), 377-390.

Rousseau, D. M. (1988). The construction of climate in organizational research. In C. L. Cooper, & I. T. Robertson (Eds.), International Review of Industrial and Organizational Psychology (pp. 139-158). Chichester, UK: John Wiley & Sons.

Royster, J. D., & Royster, L. H. (1990). Hearing conservation programs: Practical guidelines for success. Chelsea, MI: Lewis Publishers.

Sataloff, R. T., & Sataloff, J. (1993). Occupational hearing loss. New York, NY: Marcel Dekker, Inc.

Savell, J. F., & Toothman, E. H. (1987). Group mean hearing threshold changes in a noise-exposed industrial population using personal hearing protectors. American Industrial Hygiene Association Journal, 48(1), 23-27.

Schneider, B., & Rentsch, J. (1988). Managing climates and cultures: A futures perspecitve. In J. Hage (Ed.) Futures of organizations (pp. 181-200). Lexington, MA: Lexington Books.

Schneider, B. (1990). The climate for service: An application of the climate construct. In B. Schneider (Ed.), Organizational climate and culture (pp. 383-412). San Francisco, CA: Jossey-Bass Publishers.

Schneider, S. (1995). Preventing hearing loss among construction workers. Paper presented at the National Hearing Conservation Conference III/XX (pp. 11-16).

Schneider, S., Johanning, E., Belard, J.-L., & Engholm, G. (1995). Noise, vibration, and heat and cold. Occupational Medicine: State of the Art Reviews, 10(2), 363-383.

Schwarzer, R. (1992). Self-efficacy in the adoption and maintenance of health behaviors: Theoretical approaches and a new model. In R. Schwarzer (Ed.), Self-efficacy: Thought control of action (pp. 217-243). Washington, DC: Hemisphere Publishing Corporation.

Sloan, R. P., & Gruman, J. C. (1988). Participation in workplace health promotion programs: The contribution of health and organizational factors. Health Education Quarterly, 15(3), 269-288.

Smith, S. L. (1997). The "other" effects of noise. Occupational Hazards, 5, 79-81.

Strecher, V. J., Becker, M. H., Kirscht, J. P., Eraker, S. A., & Graham-Tomasi, R. P. (1985). Psychosocial aspects of changes in cigarette-smoking behavior. Patient Education and Counseling, 7(3), 249-262.

Suter, A. H., & Franks, J. R. Eds. (1992). Hearing conservation in the workplace: A practical guide. Washington, DC: National Safety Council.

Tagiuri, R. (1968). The concept of organizational climate. In R. Tagiuri, & G. H. Litwin (Eds.), Organizational Climate: Explorations of a concept (pp. 11-32). Boston, MA: Harvard University, Graduate School of Business Administration.

Tagiuri, R., & Litwin, G. H. (1968). Organizational Climate: Explorations of a concept. Boston, MA: Harvard University, Graduate School of Business Administration.

Tannenbaum, S. I., & Yukl, G. (1992). Training and development in work organizations. Annual Review of Psychology, 43, 399-441.

Tracey, J. B. (1992). The effects of organizational climate and culture on the transfer of training. Unpublished doctoral dissertation, State University of New York-Albany, Albany, NY.

Tracey, J. B., Tannenbaum, S. I., & Kavanagh, M. J. (1995). Applying trained skills on the job: The importance of the work environment. Journal of Applied Psychology, 80(2), 239-252.

Vroom, V. (1964). Work and motivation. New York, NY: John Wiley &Sons.

Weil, D. (1992). Building safety: The role of construction unions in the enforcement of OSHA. Journal of Labor Research, XIII(1), 121-132.

White, M. C., Baker, E. L., Larson, M. B., & Wolford, R. (1988). The role of personal beliefs and social influences as determinants of respirator use among construction painters. Scandinavian Journal of Work, Environment & Health, 14(4), 239-245.

Wilson, A. L. (1993). The promise of situated cognition. In S. B. Merriam (Ed.), An update on adult learning theory. New Directions for Adult and Continuing Education. Vol. 57 (pp. 71-79). San Francisco, CA: Jossey-Bass Publishers.

Wilson, S., Sisk, R. J., & Baldwin, K. A. (1997). Health beliefs of blue collar workers: Increasing self-efficacy and removing barriers. AAOHN Journal, 45(5), 254-258.

Wulfert, E., & Wan, C. K. (1993). Condom use: A self-efficacy model. Health Psychology, 12(5), 346-353.

Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. Journal of Applied Psychology, 65(1), 96-102.

APPENDICES

APPENDIX A

APPENDIX A

WORK CLIMATE

The following are beliefs about hearing protection (for example, ear plugs or ear muffs). Circle the number that best represents how much you disagree or agree with the statement.

		Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
1.[a]	Pressure from co-workers can often get in the way of wearing hearing protection.	1	2	3	4	5	6
2.[a]	Even though it may be a good idea, I don't have time to use hearing protection.	1	2	3	4	5	6
3.[a]	The information on the benefits of using hearing protection is too inconclusive/unavailable to encourage me to use hearing protection.	1	2	3	4	5	6
4.[a]	Nobody at work cares if I wear hearing protection.	1	2	3	4	5	6
5.	I am sure that I can ask for help if I have difficulty using hearing protection.	1	2	3	4	5	6
6.	Ear plugs are available to pick up at my job sites.	1	2	3	4	5	6
7.	I have my own ear muffs assigned to me.	1	2	3	4	5	6
8.[a]	I have to make a request in order to obtain ear plugs.	1	2	3	4	5	6
9.[a]	There are not enough ear plugs available so that I can use several pairs in one day.	1	2	3	4	5	6
10.[a]	The supply of ear plugs is not close to my work.	1	2	3	4	5	6
11.	I am free to use as many pairs of ear plugs in a day as I want to.	1	2	3	4	5	6
12.	There are signs at my job sites reminding me to use hearing protection.	1	2	3	4	5	6
13.	At my job sites, I have a choice of different types of ear plugs.	1	2	3	4	5	6

<u>**Note**</u>. [a] Indicates reverse-scored item.

Appendix A
(continued)

How much do you believe the following people think you should wear hearing protection when you are in a high-noise work environment? Circle your answer. (Circle "Does Not Apply" ONLY if you have NO person in that particular category.)

1. The worker I spend the most time with	Not at All	Sort of	A lot	Does Not Apply
2. Supervisor at work	Not at All	Sort of	A lot	Does Not Apply

In general, how much do you think the following people wear hearing protection when exposed to high noise? Please circle a response.

3. The coworker I spend the most time with	Never	Usually Not	About Half the Time	Usually	Always
4. My supervisor	Never	Usually Not	About Half the Time	Usually	Always

In general, how much do you think the following people do these things? Please circle the best response for you.

5. My **supervisor** encourages me to wear hearing protection	Never	Sometimes	Often
6. My **supervisor** praises me for wearing hearing protection	Never	Sometimes	Often
7. My **co-workers** encourage me to wear hearing protection	Never	Sometimes	Often
8. My **co-workers** praise me for wearing hearing protection	Never	Sometimes	Often

Note. From Preventing Noise-Induced Hearing Loss in Construction Workers by S.L. Lusk, 1997, The University of Michigan School of Nursing. Adapted with permission.

APPENDIX B

APPENDIX B

SELF-EFFICACY

The following are beliefs about hearing protection (for example, ear plugs or ear muffs). Circle the number that best represents how much you disagree or agree with the statement.

		Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
1.[a]	It's difficult to talk with other people when I'm wearing my hearing protection.	1	2	3	4	5	6
2.[a]	Hearing protection keeps me from hearing what I want to hear.	1	2	3	4	5	6
3.[a]	When I use hearing protection, it does not effectively block out noise for me.	1	2	3	4	5	6
4.[a]	I need to learn more so that I can use hearing protection effectively.	1	2	3	4	5	6
5.	I can use hearing protection correctly.	1	2	3	4	5	6
6.[a]	I do not always use my hearing protection the way it should be used.	1	2	3	4	5	6
7.	I know how to use my hearing protection so that it works effectively.	1	2	3	4	5	6
8.	I do everything possible to make my hearing protection work effectively.	1	2	3	4	5	6
9.[a]	I am not sure that I can use hearing protection correctly.	1	2	3	4	5	6
10.[a]	I am not sure I can tell if my hearing protection is working effectively.	1	2	3	4	5	6
11.	I am sure I can talk with someone while using my hearing protection.	1	2	3	4	5	6
12.	I am sure I can use my hearing protection so it works effectively.	1	2	3	4	5	6

Note. From Preventing Noise-Induced Hearing Loss in Construction Workers by S.L. Lusk, 1996, The University of Michigan School of Nursing. Adapted with permission.

[a] Indicates reverse-scored items.

APPENDIX C

APPENDIX C

OUTCOME EXPECTANCY

The following are beliefs about hearing protection (for example, ear plugs or ear muffs). Circle the number that best represents how much you disagree or agree with the statement.

		Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
1.	Wearing hearing protection protects me against hearing loss from noise exposure.	1	2	3	4	5	6
2.[a]	Even if I wear my hearing protection at all times on the job, I will not reduce my chances of developing hearing loss.	1	2	3	4	5	6
3.[a]	It's debatable if wearing hearing protection will lessen my chances of becoming hard of hearing.	1	2	3	4	5	6
4.[a]	If I do not have a hearing problem now, I don't see any need to wear hearing protection.	1	2	3	4	5	6
5.	Regular use of hearing protection is beneficial to me because it helps protect my hearing.	1	2	3	4	5	6
6.[a]	Protecting my hearing is not important to me.	1	2	3	4	5	6
7.[a]	In the long run, my hearing will decrease anyway so I need not bother to wear hearing protection.	1	2	3	4	5	6

Note. From Preventing Noise-Induced Hearing Loss in Construction Workers by S.L. Lusk, 1997, The University of Michigan School of Nursing. Adapted with permission.

[a] Indicates reverse-scored item.

APPENDIX D

APPENDIX D

OUTCOME VALUE

Possible outcomes from using hearing protection are listed below. Please indicate your *personal* rating of their importance by placing an X on the line that best shows the value or importance of that outcome *for you.*

1. Protection of inner ear

   Slightly Important |______________________| Highly Important

2. Keep out noise

   Slightly Important |______________________| Highly Important

3. Prevention of hearing loss

   Slightly Important |______________________| Highly Important

4. Keep out harmful noise

   Slightly Important |______________________| Highly Important

5. Reduce amount of hearing loss

   Slightly Important |______________________| Highly Important

Note. From Preventing Noise-Induced Hearing Loss in Construction Workers by S.L. Lusk, 1997, The University of Michigan School of Nursing. Adapted with permission.

APPENDIX E

APPENDIX E

HPD USE

This part of the survey deals with noise exposure on your job sites. Noise levels are high when you have to shout to be heard by a co-worker who is three feet or less away.

The following questions ask you about your exposure to high noise and use of hearing protection during specific time periods. First answer whether or not you were exposed to high noise at your job sites during the given time period. If you were not exposed to noise during that time, go on to the next question; if you were, what percent of the time that you were exposed to high noise did you wear hearing protection?

	Were you exposed to **high noise** at your job sites:	(Circle **NO/YES**: If **YES**, then ⇒ ⇒)			**% of time** in high noise you used hearing protection?
a.	at your most recent job site?	NO ⇓	YES	⇒ ⇒	________%
b.	at the site before that?	NO ⇓	YES	⇒ ⇒	________%
c.	during the past week?	NO ⇓	YES	⇒ ⇒	________%
d.	during the past month?	NO ⇓	YES	⇒ ⇒	________%
e.	during the past 3 months?	NO	YES	⇒ ⇒	________%

Note. From Preventing Noise-Induced Hearing Loss in Construction Workers by S.L. Lusk, 1997, The University of Michigan School of Nursing. Adapted with permission.

APPENDIX F

APPENDIX F

MICHIGAN STATE UNIVERSITY

July 8, 1998

TO: John M. Dirkx
408 Erickson Hall

RE: IRB#: 98-424
TITLE: TRAINING TO PROMOTE WORKERS' USE OF HEARING PROTECTION: THE INFLUENCE OF WORK CLIMATE FACTORS ON TRAINING EFFECTIVENESS
REVISION REQUESTED: N/A
CATEGORY: 1-E
APPROVAL DATE: 06/25/98

The University Committee on Research Involving Human Subjects' (UCRIHS) review of this project is complete. I am pleased to advise that the rights and welfare of the human subjects appear to be adequately protected and methods to obtain informed consent are appropriate. Therefore, the UCRIHS approved this project and any revisions listed above.

RENEWAL: UCRIHS approval is valid for one calendar year, beginning with the approval date shown above. Investigators planning to continue a project beyond one year must use the green renewal form (enclosed with the original approval letter or when a project is renewed) to seek updated certification. There is a maximum of four such expedited renewals possible. Investigators wishing to continue a project beyond that time need to submit it again for complete review.

REVISIONS: UCRIHS must review any changes in procedures involving human subjects, prior to initiation of the change. If this is done at the time of renewal, please use the green renewal form. To revise an approved protocol at any other time during the year, send your written request to the UCRIHS Chair, requesting revised approval and referencing the project's IRB # and title. Include in your request a description of the change and any revised instruments, consent forms or advertisements that are applicable.

PROBLEMS/ CHANGES: Should either of the following arise during the course of the work, investigators must notify UCRIHS promptly: (1) problems (unexpected side effects, complaints, etc.) involving human subjects or (2) changes in the research environment or new information indicating greater risk to the human subjects than existed when the protocol was previously reviewed and approved.

If we can be of any future help, please do not hesitate to contact us at (517)355-2180 or FAX (517)432-1171.

Sincerely,

David E. Wright

David E. Wright, Ph.D.
UCRIHS Chair

DEW:bed

cc: Janice S. Brady

OFFICE OF
RESEARCH AND GRADUATE STUDIES

University Committee on Research Involving Human Subjects (UCRIHS)

Michigan State University
246 Administration Building
East Lansing, Michigan
48824-1046

517/355-2180
FAX: 517/432-1171

The Michigan State University IDEA is Institutional Diversity: Excellence in Action.

MSU is an affirmative-action, equal-opportunity institution

APPENDIX G

APPENDIX G

The University of Michigan

SCHOOL OF NURSING
HEALTH PROMOTION AND RISK REDUCTION PROGRAMS
Community Health Nursing/Parent-Child Nursing

400 N. Ingalls, Rm. 3160
Ann Arbor, Michigan 48109-0482
(313) 763-5597
Fax: (313) 647-0351

May 7, 1998

David E. Wright, PhD, Chair
UCRIHS - Michigan State University

Dear Dr. Wright:

This letter is to affirm that I have given Ms. Jan Brady permission to use the aggregated data from my research project "Preventing Noise-induced Hearing Loss in Construction Workers", NIOSH grant number R01 OH03136, for her dissertation at Michigan State University. She will be using only the computer data files and will not have access to the participants' names. Enclosed is a copy of the most recent copy of the Institutional Review Board approval from The University of Michigan for my project.

If you have any questions or need further information, please feel free to contact me at 734-647-0347 or via email at lusk@umich.edu.

Sincerely,

Sally L. Lusk

Sally L. Lusk, PhD, RN, FAAN
Professor and Director
Occupational Health Nursing

SLL:swl

coores.sll206.doc

APPENDIX G
(continued)

The University of Michigan

SCHOOL OF NURSING
HEALTH PROMOTION AND RISK REDUCTION PROGRAMS
Community Health Nursing/Parent-Child Nursing

400 N. Ingalls, Rm. 3160
Ann Arbor, Michigan 48109-0482
(313) 763-5597
Fax: (313) 647-0351

MEMORANDUM

TO: Jan Brady, Doctoral Student

FROM: Sally Lusk, PhD, RN, FAAN S L Lusk

DATE: December 1, 1998

RE: Reproduction of Questionnaire Items

You have my permission to reproduce questionnaire items from my study, *Preventing Noise-induced Hearing Loss in Construction Workers* (NIOSH grant number R01 OH03136), in your dissertation, *Training to Promote Workers' Use of Hearing Protection: The Influence of Work Climate Factors on Training Effectiveness*, which involved performing secondary analysis of the data resulting from my study.

APPENDIX G
(*continued*)

The University of Michigan

SCHOOL OF NURSING
HEALTH PROMOTION AND RISK REDUCTION PROGRAMS
Community Health Nursing/Parent-Child Nursing

400 N. Ingalls, Rm. 3160
Ann Arbor, Michigan 48109-0482
(734) 763-5597
Fax: (734) 647-0351

MEMORANDUM

TO: Jan Brady, PhD Candidate

FROM: Sally L. Lusk, PhD, RN, FAAN Sally L Lusk

DATE: April 13, 1999

SUBJECT: Reproduction of Questionnaire Items

This memo is to re-confirm that you have my permission to reproduce questionnaire items from my study, *Preventing Noise-induced Hearing Loss in Construction Workers* (NIOSH grant number R01 OH03136), in your dissertation, *Training to Promote Workers' Use of Hearing Protection: The Influence of Work Climate Factors on Training Effectiveness,* which involved performing secondary analysis of the data resulting from my study.

I understand that UMI Dissertation Services may make single copies of your dissertation on demand. UMI will not be held responsible for any damages that may arise from copyright violations.

Brady 41399memo.doc

MICHIGAN STATE UNIV. LIBRARIES
31293018129373