DEVELOPMENT OF A HEALTH-BELIEF-MODEL-BASED INSTRUMENT TO ASSESS WORKER BELIEFS ABOUT USING PERSONAL PROTECTIVE EQUIPMENT

by

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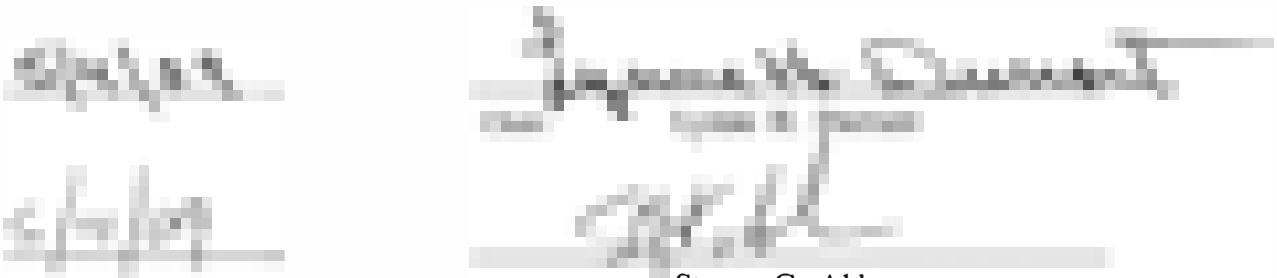

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FINAL READING APPROVAL

To the Graduate Council of the University of Utah:

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ABSTRACT

Occupational illness is a problem in the United States that affects thousands of workers. Of the numerous occupational illnesses reported each year, most are preventable through the use of personal protective equipment. The purpose of this study was to develop an instrument to assess the significance of the determinants that predict the use of personal protective equipment in a small industrial shop setting. The aim of the study was to develop a valid and reliable theory-driven instrument to assess the determinants so that effective interventions can be constructed to improve the use of personal protective equipment in the occupational setting. The health belief model was used as the theoretical basis for the instrument.

The procedures selected for this study employed an expert and an employee focus group to establish instrument validity. A two-judge content validity index was calculated using judges from the expert focus group. Reliability was established by test-retest administration of the instrument using a pilot group. An analysis of Cronbach's alpha was used to assess the test-retest reliability of the health belief model constructs used in the instrument.

The focus groups established that the instrument is valid. Reliability of the instrument varied by construct, with the majority of the constructs having sufficient reliability to make the instrument useful for assessing determinants of behavior

contributing to the use of personal protective equipment in the small industrial shop setting. More research is recommended to further enhance the reliability of the instrument. The developed instrument fills a need for theory-based instruments that can be used to plan theory-driven interventions that target increasing personal protective equipment use in the small industrial shop setting.

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I owe the most thanks to my wife, Doreen, who never lost confidence and was always there to love, nurture, encourage, and motivate as only she can. Thank you Angel.

CHAPTER 1

INTRODUCTION

Background and Significance

Occupational illness is a significant problem in the United States that affects thousands of workers. *Occupational illness* is defined by the U.S. Department of Labor, Occupational Safety and Health Administration (2006) as

> a physiological harm or loss of capacity produced by systematic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc; or other continued and repeated exposures to conditions of the work environment over a period of time. (n.p.)

For the purpose of the current study, occupational illnesses were considered separately from occupational injuries.

Of the numerous occupational illnesses reported each year, most are preventable. The bulk of the prevention burden is placed on employers. Employers are legally obligated to protect workers in a variety of ways such as educating workers about workplace hazards and providing personal protective equipment. Workers are expected to understand the hazards to which they are exposed and to use the personal protective equipment provided by their employers. Despite their knowledge of the hazards and the provision of personal protective equipment, evidence shows that most workers use personal protective equipment inconsistently, if at all. The inconsistent use of personal protective equipment is especially

prevalent in small shops (i.e., those that employ 10 or fewer workers) where few financial or human resources are available to ensure or motivate worker health through prevention. Public health in the United States has approached the problem of occupational illness primarily through the passage of laws geared to drive employers to protect their workers. Worker protection is most commonly accomplished through the administrative enforcement of those laws and the imposition of fines to employers found in violation.

Problem Statement

Although workers may fully realize the potential harmful health effects of their exposure to hazards in the workplace, few consistently wear personal protective equipment. Multiple determinants interact to account for worker use or lack of use of personal protective equipment, including individual, social/cultural, and environmental determinants. These determinants interact in complex ways, and their influence on the use of personal protective equipment is not completely understood. However, it is clear that in spite of their knowledge of the risks and stringent laws mandating protection of workers, the use of personal protective equipment is inconsistent. The inconsistent use of personal protective equipment leads to exposure to harmful agents such as hazardous chemicals or noise in the workplace, making workers more susceptible to occupational illness.

Although occupational illness has been identified as a significant and preventable health issue, relatively little research about the determinants that motivate workers to comply with the wear of personal protective equipment has

been done using health promotion and education theoretical models to guide workplace interventions (Ronis, Hong, & Lusk, 2006). Coupled with the lack of research about determinants is a corresponding lack of health-promotion-and-education-theory-based instruments available to researchers to assess the effectiveness of theory-driven interventions.

As the workforce continues to grow, the risk of occupational illness is expected to show a corresponding increase, particularly in the service sector where job growth is expected to continue (Centers for Disease Control and Prevention, 2004). As the risk for occupational illness continues among workers, it will be essential for multiple disciplines, including health promotion and education, to provide effective, theoretically based instruments and interventions in an effort to prevent illness.

Purpose of the Study

The purpose of the current study was to develop an instrument to assess the significance of the determinants that predict the use of personal protective equipment in a small industrial shop setting. The aim of the study was to develop a theory-driven instrument so that effective interventions can be constructed to improve the use of personal protective equipment in the occupational setting. The health belief model was used as the theoretical basis for the development of the instrument. The study employed focus groups and elicitation interviews to develop questions significant and relevant to the population studied. Identification of the most significant determinants involved in the use of personal protective equipment

was undertaken. The cues to action component of the health belief model was specifically targeted with the intent to identify which cues to action components were the most important to activate behavior towards the increased use of personal protective equipment. The instrument was designed to ascertain which cues to action components have the most significant impact in the identified shops. The instrument measures worker beliefs with regard to each of the components of the health belief model.

Research Questions

The research questions addressed were as follows:

1. Is the developed instrument applicable and relevant to the occupational setting?
2. What is the reliability and validity of the developed measuring instrument?
3. Does the developed instrument have sufficient validity and reliability to assess the significance of the determinants that predict the use of personal protective equipment?

Limitations of the Study

The following limitations were identified:

1. Since this study took place in a workplace setting comprised of small shops, it did not take place in a controlled environment under experimental research conditions.

2. The sample of participants was small (N = 23).
3. Several self-reported behaviors were used in the study, including the incidence of personal protective equipment use, factors influencing the use of personal protective equipment, and the perception of the effectiveness of shop-specific cues to action to increase the use of personal protective equipment.
4. Several self-reported demographics were used in the study analysis, including age, gender, race, job experience, and level of personal protective equipment training.
5. Since the study took place at a military facility, it may not be generalized beyond adult military workers.

Delimitations of the Study

The following delimitations were identified:

1. The study population was selected using convenience, availability, and experience, resulting in a small sample size due to the limited number of shop supervisors working at the small installation.
2. The study population was derived from shops where personal protective equipment is expected to be frequently employed and where workers are required by the U.S. Department of Labor, Occupational Safety and Health Administration's directives to employ personal protective equipment.
3. Only experienced workers and supervisors were used in the study.

Significance of the Study

Protecting the health of U.S. workers is primarily the concern of the U.S. Department of Labor, Occupational Safety and Health Administration. This government agency focuses on worker protection through the enforcement of stringent laws that concentrate their efforts on the employer. Other disciplines such as occupational health nursing and bioenvironmental engineering focus on rehabilitation and altering the workplace to mitigate the hazards. However, relatively little is being done by health educators to protect U.S. workers through the employment of theoretically based programs designed to target the *prevention* of occupational illness by motivating workers to wear personal protective equipment. The lack of health education emphasis on the use of personal protective equipment leaves a significant niche for health educators to test theoretically based interventions in the workplace setting in an effort to influence worker behavior to prevent occupational illness. It has been demonstrated that individually tailored interventions that target determinants associated with a particular health problem are effective in mitigating adverse health effects (Champion et al., 2003). The information gained from this study will be useful to health educators by providing a valid and reliable instrument to assess the significance of the determinants involved in the use of personal protective equipment. The information gained by assessing the determinants with this instrument can be used to develop a health-belief-model-based intervention to promote the use of personal protective equipment.

CHAPTER 2

LITERATURE REVIEW

Occupational Illness Incidence and Prevalence in the United States

In the United States, the risk of occupational exposure to hazardous substances and noise is enormous. From 1981 to 1983, the U.S. Centers for Disease Control (1988) conducted the National Occupational Exposure Survey and identified more than 13,000 "agents of concern" (n.p.) that impact worker health. These exposures can lead to significant health impacts for U.S. workers.

In 2005, there were 242,500 newly reported cases of occupational illness in the private industry sector (U.S. Department of Labor, Bureau of Labor Statistics, 2006). Each year in the United States, 5 out of every 100 workers will incur an occupational illness. Each day, 137 workers will die from work-related illnesses alone. In addition, the economic burden from occupational illness is $171 billion, $1 billion more than that of cancer, accounting for 3% of the nation's gross domestic product (U.S. Department of Health and Human Services, 2000). In 2002, the U.S. Department of Labor, Office of Workers Compensation (2005) paid $2.3 billion, compensating more than 283,000 affected workers.

The incidence of occupational illness increased sharply throughout the middle 1990s. The increases are a result of the U.S. Department of Labor,

Occupational Safety and Health Administration initiating the mandatory reporting and tracking of more types of illness such as noise-induced hearing loss. By industry type, the incidence of occupational illness is predominant in manufacturing and services. Distribution of the prevalence of occupational illness is to be expected due to the distribution of workers in these sectors, and it patterns the U.S. economy in terms of job distribution (Centers for Disease Control and Prevention, 2004).

Of particular concern in the United States is the employment of large numbers of workers in small businesses and work sites. These businesses generally do not have the resources to effectively protect worker health. In addition, due to resource limitations, the U.S. Department of Labor, Occupational Safety and Health Administration has difficulty regulating worker health in small shops (Okun, Lentz, Schulte, & Stayner, 2001).

Small businesses are identified as those that employ 100 or fewer employees. More than half of the U.S. workforce is employed in small businesses, accounting for 53 million workers.

In recognizing that occupational illness is a significant health issue, the Centers for Disease Control and Prevention (2004) established goals and objectives in an effort to mitigate the adverse impact on worker health. The overarching goal is to "promote the health and safety of people at work through prevention and early intervention" (pp. 20-21). Promoting worker health can be accomplished by various objectives, including the reduction of lost time due to illnesses by 30% and

the reduction of occupational skin diseases by 30% as well as the developmental objective to reduce noise-induced hearing loss (U.S. Department of Health and Human Services, 2000).

In examining ways to help reach these important objectives, it is useful to consider that exposures in the workplace are typically preventable by the use of engineering controls such as improved ventilation and administrative controls such as mandating the use of nonhazardous chemicals in place of those that pose a hazard or the use of personal protective equipment to create a barrier between the worker and the exposure. Employing the use of personal protective equipment is an especially important consideration due to the costs and difficulties associated with other types of controls. By definition, personal protective equipment is any clothing and other work accessories designed to create a barrier between the worker and the hazard. Examples of personal protective equipment include but are not limited to safety goggles, hard hats, hearing protective devices such as ear plugs and muffs, respirators, and aprons. The Centers for Disease Control and Prevention, through the National Institutes of Occupational Safety and Health, sets health-based permissible exposure limits for each chemical and hazardous noise found at the work site. The use of personal protective equipment is mandated when engineering and administrative controls cannot reduce exposure to levels below the permissible exposure limit (U.S. Department of Health and Human Services, 2000).

Of the significant occupational illnesses that can be prevented by using personal protective equipment, three body-protection areas were selected as the

focus of the current research: (a) skin protection, accounting for 36% of all occupational illnesses such as skin cancer; (b) respiratory protection, accounting for 16% of all occupational illnesses such as asthma and lung cancer; and (c) hearing protection, accounting for 11% of all occupational illnesses such as noise-induced hearing loss (U.S. Department of Labor, Bureau of Labor Statistics, 1997).

Worker Use of Personal Protective Equipment

The association between personal protective equipment use and disease prevention has been demonstrated in several research studies. Salazar et al. (1999) pointed out that "the inappropriate or nonuse of personal protective equipment by workers may be an important contributor to the occurrence of occupational diseases" (p. 472). Other researchers have found that even among well-educated workers who are aware of the hazards and the associated health impacts, the use of personal protective equipment is still not fully employed in all situations where the law would require it. In a study of physicians, Michalsen et al. (1997) found that compliance with the use of personal protective equipment was low (31% to 38%) in the hospital setting. Their study involved self-reports of compliance with universal precautions, they conducted the study in three geographically distinct locations, and the study involved a number of physicians (N = 322). Last, several studies (Lusk, Kerr, & Kauffman, 1998; Lusk, Ronis, & Hogan, 1997; Lusk et al., 2003; Ronis et al., 2006) have determined, due to low-perceived risk, that few workers use hearing protection consistently enough to prevent hearing loss. The

aforementioned research was conducted in a variety of settings that involved construction workers and factory workers, with a high number of workers being sampled in each study. The sample sizes for this body of research ranged from 139 to 2,119. The most recent study (Ronis et al.) evaluated worker use of hearing protection in construction, including carpenters (N = 138), operating engineers (N = 234), plumbers (N = 182), and plumber trainers (N = 149). Respondents completed questionnaires about the use of hearing protection and exposure to high noise. The respondents were predominantly male (97%) and Caucasian (88%). Few had posthigh school education (21%). Respondents were asked about perceived barriers to the use of hearing protection such as perceived benefits of hearing protection, accessibility of hearing protection, and perceived adverse impacts to job performance by utilizing Likert-type scale questions such as: "Hearing protection keeps me from hearing what I want to hear" (Ronis et al., p. 9). In this study and in previously mentioned studies, the employment of hearing protection was notably lacking and ranged from 18% to 49% among workers exposed to hazardous noise (Lusk et al., 1997).

Determinants Related to the Use of Personal Protective Equipment

For purposes of the current research, the individual, sociocultural, and environmental influences upon a health behavior were called *determinants*. Determinants for the use of personal protective equipment are many and varied. In the occupational setting, the determinants or influences typically involve those that

are related to the preclusion in entry of the hazardous substance into the environment or the prevention of the hazardous agent from reaching the worker, also known as *exposure*. For purposes of the current research, *hazardous substances* were defined as substances that the U.S. Department of Labor, Occupational Safety and Health Administration has listed as being harmful to humans. A focus on the prevention of exposure was utilized.

Because the behaviors involved in the use of personal protective equipment are complex and multiple influences are involved and interact, it was useful to examine determinants at the individual, social/cultural, and environmental levels. A multilevel approach was necessary in order to conduct a comprehensive examination of the determinants of behavior. Salazar et al. (1999) conducted credible research into factors that determine the use of respiratory protective equipment among hazardous waste workers. The study was a qualitative investigation that used a descriptive, cross-sectional design to examine workers' perceptions and other determinants that impact the use of respiratory protective equipment. The study was conducted at a U.S. Department of Energy facility that employs 12,000 employees, 30% of whom are required to use personal protective equipment. A convenience sample of 28 subjects was used in the study to assess worker determinants. The workers represented a well-educated and healthy population of hazardous waste workers. The results indicated that even though organizational and environmental factors such as supervisory influence, policies, coworker influence, weather, task duration, and organizational culture are

important to workers, individual determinants such as perceived susceptibility to disease, health effects, usefulness of personal protective equipment, level of personal comfort, fatigue, ability to communicate, and visual effects were the most mentioned by the respondents during the interviews (Salazar et al.). Salazar et al. used the information to identify several determinants at the individual, social/cultural, and environmental levels. In addition, the International Safety Equipment Association (2001) identified workplace policies and employer enforcement as significant determinants of personal protective equipment use. Their investigation was a retrospective cohort study using telephone interviews and "faxed-back" questionnaires. The subjects were safety professionals in the construction industry, with a sample size of 215. The vast majority of respondents identified employer enforcement as an important determinant (International Safety Equipment Association). A summary of significant determinants identified in the literature is included in Table 1.

Although determinants have been studied using a variety of study methodologies, weaknesses in the data are due to a lack of utilization of theory-based experimental designs, small sample sizes, and sponsorships of research by associations interested in the outcome. More research is needed to properly identify determinants and to ensure their validity. The need for more research is particularly important in the case of small shops where little if any research has been conducted to identify important determinants. The study by Salazar et al. (1999) is considered to be a significant standard in the identification of

Table 1

Determinants by Category as Identified in the Literature

Individual	Social/cultural	Environmental
Training	Organizational culture	Job task requirements
Knowledge of the hazard	Coworker influence	Task duration
Perceived susceptibility	Supervisor influence	Work-site ergonomics
Perceived and experienced health effects	Workplace policies	Weather conditions
Perceived effectiveness of personal protective equipment	Employer enforcement	Availability of personal protective equipment
Comfort	Incentives	
Impact on work performance		

determinants involved in the use of personal protective equipment in spite of its qualitative design and small sample size. Based on a review of the literature, it appears as though the factors that influence the use of personal protective equipment have been adequately identified. Requiring further study is the link between those factors and the actual decision to employ personal protective equipment. In addition, requiring further study is the effectiveness of interventions, which are theoretically based, to influence health behavior towards the employment of personal protective equipment.

The importance and effectiveness of utilizing theoretically based interventions have been widely demonstrated in multiple disciplines. For instance, Gioiella (1996) found that theoretically based interventions are vital in educating patients and modifying health behaviors in the nursing profession. However, the

lack of studies involving theory-driven interventions in the occupational setting is striking.

One such theory, the health belief model, has constructs that closely fit the identified determinants for the use of personal protective equipment. It is particularly noteworthy that factors identified with the use of personal protective equipment closely match the constructs of the health belief model.

The Health Belief Model

The health belief model was developed in the 1950s by social psychologists Irwin Rosenstock, Godfrey Hochbaum, and Stephen Kegels in response to a failed free tuberculosis health screening program and other widespread failures of people to accept disease preventives and screenings offered by the U.S. Public Health Service (Rosenstock, 1974). The model is designed to explore a variety of health behaviors over the long and short term in order to understand how to best influence health behavior and to activate populations toward preventive efforts.

Six constructs are associated with the health belief model. These constructs are (a) perceived susceptibility, belief in the chance of getting a condition; (b) perceived severity, belief in the seriousness of a condition and its consequences; (c) perceived benefits, belief in the effectiveness of the suggested action to reduce the risk or impact; (d) perceived barriers, belief in the tangible and psychological costs of the advised action; (e) cues to action, belief in the strategies to activate one's readiness to take action; and (f) self-efficacy, belief in the confidence in one's ability to take action. The constructs interact to bring about

health behavior change. The health belief model was used to establish the relationships between constructs and health behaviors of public concern (Janz, Champion, & Strecher, 2002). A thorough review of the literature indicates that the health belief model has not been directly used in work-site studies, even though its effectiveness in other types of interventions has been demonstrated.

For the purpose of the current study, it was useful to employ measures of the health belief model. Measures of this model have been developed that are considered to be the "gold standard." Champion (1993) conducted extensive research to measure the health belief model. Champion developed and refined an instrument to measure the health belief model constructs in order to evaluate breast cancer screening behaviors. Her instrument, called the Health Belief Model Scale, measures perceived susceptibility, perceived seriousness, perceived benefits, barriers, and health motivation. To validate the instrument, which uses a Likert-type format, a random sample of 581 women was used. The scale was subjected to a content analysis by national experts and established construct validity and predictive validity. Cronbach alpha reliability coefficients for this instrument ranged from .80 to .93 (Champion). The construct put forth by Champion was used as an example to develop the instrument for the current study. In addition, self-efficacy scales were examined and utilized to assist in the development of the self-efficacy portion of the instrument, as self-efficacy has been added since the development of Champion's instrument as an important construct in the health belief model.

In terms of personal protective equipment use, relatively few measures exist that directly target the determinants. The research conducted by Lusk et al. (1998), Lusk et al. (1997), and Lusk et al. (2003) was pioneering in terms of research in the use of hearing protection by workers. Measurements on the use of other types of personal protective equipment are lacking. Measurement of the Health Belief Model Scale (Champion, 1993) is more understood and has been widely used (Janz et al., 2002). The Health Belief Model Scale is the principle instrument of choice in assessing the health belief model. As noted in both types of measurements, the quality of the instruments in terms of validity and reliability has been established and found to be solid with Cronbach alpha coefficients of .73 and .95, respectively, for the Predictors of Hearing Protection Wear Survey (Ronis et al., 2006) and alpha coefficients of .80 to .93, respectively, for the Health Belief Model Scale (Champion). The hearing protection instrument, developed by Lusk et al. (1997), and the Health Belief Model Scale, developed by Champion, had the utility for the current research.

Measurements of the Use of Personal Protective Equipment

Two types of measurements are involved in the use of personal protective equipment: (a) outcome and (b) process. Outcome measurements are employed to estimate whether workers are compliant with the use of personal protective equipment following known workplace exposure to hazardous noises or chemicals. Biological markers are used as the most definitive method of detecting whether a worker has been compliant with using personal protective equipment and are

considered the gold standard, including blood tests to determine the presence of agents of concern, audiograms (hearing tests) to determine whether hazardous noise has impacted hearing, and occupational physical examinations to detect signs and symptoms of exposure and adverse health effects. The disadvantages with biological markers include their invasiveness and expense (U.S. Department of Health and Human Services, 2001).

Process measurements are measurements that evaluate the use of personal protective equipment during the period of exposure. These measurements include direct observation in which the evaluator observes whether personal protective equipment is being used at the appropriate times and self-reporting in which the workers report compliance with using personal protective equipment. Additional measurements are discussed that specifically target the health belief model constructs because of the utility of these constructs and their close relationship to the determinants identified above.

Relatively few measurements have been developed to evaluate the use of personal protective equipment among workers. However, research has been conducted to develop valid measurements for use. One such measurement is the Predictors for Hearing Protection Wear Survey, which was developed to evaluate construction worker use of hearing protection (Lusk et al., 1997). The instrument used target determinants based on Pender's health promotion model, including perceived control of health, accessibility of hearing protection, benefits of hearing protection, and barriers to the use of hearing protection. In this measurement,

workers self-report on their use of hearing protection on the job site. This measurement employs a 6-point, Likert-type scale, ranging from *strongly disagree* to *strongly agree*, and is presented in a booklet-type format that requires 30 to 40 minutes to complete. An example of an item from this measurement is: "I am sure I can use my hearing protection so that it works effectively" (Lusk et al., 1998, p. 468). The measurement was evaluated using a retrospective cohort design and included 703 subjects. The measurement had good validity and reliability coefficients, with alphas between .73 and .95 for the sample (Ronis et al., 2006).

Interventions and Theoretical Perspectives

A limited number of interventions have attempted to increase the use of personal protective equipment. This section describes the work that has been done to date. A majority of the interventions were individually focused. These interventions primarily targeted increasing the use of hearing protection (Lusk et al., 2003) and increasing the use of personal protective equipment among pesticide applicators and farmers (Perry & Layde, 2003). Although limited studies have attempted to target environmentally focused determinants, they have not demonstrated significance in terms of behavior change (Lazovich et al., 2002). To date, no interventions have been found in the literature that address the use of personal protective equipment in small industrial shop settings. Theoretical constructs have not been widely applied in the majority of the interventions reviewed.

One intervention that is noteworthy and that applied a theoretical construct is an intervention by Lusk et al. (2003). They attempted to increase the use of hearing protection among factory workers. The intervention used Pender's health promotion model and social cognitive theory as its major constructs. These constructs closely follow the health belief model and include elements such as perceived benefits of action, perceived barriers, perceived self-efficacy, interpersonal influences, and situational influences. The intervention employed a randomized controlled design and was conducted over a 48-month period in a large automotive factory in the midwest. The study included 1,325 subjects. The subjects were predominantly male (87%), Caucasian (74%), and high school graduates (91%). The study compared the effects of an individually tailored intervention with two other nontailored types of interventions. The interventions were delivered by computer. Due to time constraints, the participants could take no more than 30 minutes. The tailored intervention, consisting of computer-based training on the importance of hearing protection use specific to the tasks the employee performed (targeted determinants based on the health promotion model), was based on the type of hearing protection used and the self-reported use of the hearing protection. The nontailored intervention did not target individual factors and was delivered in a uniform manner; the controlled intervention was the presentation of a commercially available video. All three interventions met the U.S. Department of Labor, Occupational Safety and Health Administration minimum standard for education on hearing protection devices. The results showed a significant increase in the use of

hearing protection by the group receiving the individually tailored intervention (Lusk et al.).

Another research study involved an effort to increase the use of personal protective equipment among pesticide applicators in a farm setting (Perry & Layde, 2003). The intervention used in this study targeted multiple types of personal protective equipment, including respiratory protection, skin protection using gloves and coveralls, and proper footwear. No theory was reported guiding the intervention. However, the constructs studied involved perceived risk, knowledge of risk, susceptibility to exposure, self-efficacy, peer norms, and skills training. The study employed a randomized controlled design using 400 subjects. The subjects were males, with a mean age of 45.4 years, mean years worked in farming of 40.7, and mean education level of 12.8 years. The study was conducted over a period of 1 year in six adjacent counties in Wisconsin, and it employed an educational intervention using 3-hour educational sessions. The educational sessions were conducted in an education format and were targeted to increase knowledge of cancer risk, susceptibility to pesticide exposure, peer norms for safe handling, and safe-handling skills to increase self-efficacy for safely handling pesticides. The results of the study indicated a significant increase in the use of personal protective equipment in the intervention group compared with the control group. An increase of 20% was reported, with 60% personal protective equipment use in the intervention group compared with 40% personal protective equipment use in the control group (Perry & Layde).

Other studies have used interventions involving the health belief model. Many interventions have utilized this model. However, some of the most significant work has been conducted in the area of mammography screening compliance. One such study involved an intervention to increase mammography among nonadherent older women. In this study, the health belief model was directly used as the theoretical basis. The design was a prospective randomized trial that involved 773 subjects. The study also employed individually tailored interventions, including telephone and personal interviews, a physician's letter about the importance of mammography, a telephone interview with a physician's letter, and an in-person interview with a physician's letter. The purpose of the study was to look at the intervention strategies as cues to action, which is a construct of the health belief model. Cues to action were operationalized by using counseling, personally addressed physician letters, and telephone follow-up. In this study, the intervention group was compared with the "usual-care" group. The usual-care group delivered routine care as a result of physicians' office visits. The study results indicated a significant increase in mammography compliance among nonadherent older women from a rate of 13% to 30% (odds ratios: 1.93 to 3.55). The study is one of only a few found that have attempted to examine the cues to action construct of the health belief model (Champion et al., 2003)

Last, some studies have focused less on the individual level and more on the environmental level to prevent occupational exposure to hazardous substances. One such study developed an intervention to reduce wood dust exposure, a known

carcinogen. Lazovich et al. (2002) attempted to change baseline dust concentrations in 48 businesses by aiding the businesses in implementing administrative and engineering controls. The results of the study were that no significant changes in wood dust concentrations were found as a result of the intervention. The complexities involved in changing environmental determinants were noted. Although environmental interventions may be worthwhile, the researchers noted that the complexities and considerable cost were significant barriers to the effectiveness of these types of interventions (Lazovich et al.).

A majority of cited studies were individually focused. The interventions were met with some success and were particularly successful when employing individually tailored approaches. The studies selected for this literature review had significant strengths in terms of high sample numbers, duration, and applicability.

Limitations to the Research on Personal Protective Equipment

Although research has been conducted in the use of personal protective equipment, there are several limitations to the work that has been performed. In general, based upon a review of the literature, few studies have been conducted to address the use of personal protective equipment. Studies that have been conducted have had limited focus, concentrating primarily on specific types of personal protective equipment or on specific occupations. For example, the use of personal protective equipment by farmers and pesticide applicators has been studied, whereas other types of occupations have been largely ignored. The use of hearing

protective devices has also been studied, whereas respiratory protection and other types of personal protective equipment use have not been extensively researched. The Centers for Disease Control and Prevention has recognized the need to improve research and to focus on research objectives as well as to implement those objectives through the National Institute of Occupational Safety and Health: the National Occupational Research Agenda. The agenda is specifically geared to reduce occupational illness (U.S. Department of Health and Human Services, 2001). Specific limitations in the research are found in many areas and are discussed by category.

Occupational illness is a problem in the United States. Multiple studies have shown that the use of personal protective equipment can significantly prevent exposure and resulting illnesses. What is much less clear and much less studied is why some workers choose not to use personal protective equipment and others use it faithfully. Only one qualitative study was found that specifically addressed determinants for the use of personal protective equipment.

In terms of measurements, relatively few instruments have been developed to assess the use of personal protective equipment. These instruments are primarily self-reporting tools that are limited to a specific type of personal protective equipment such as hearing protection in the workplace. Only one self-report instrument was found that addresses the use of hearing protection in the workplace. An instrument was developed to measure the health belief model constructs, but it is specific to breast cancer screening and has not been utilized in the workplace

setting. Valid and reliable theory-based instruments are needed to assess the use of all types of personal protective equipment in the workplace.

Another problem in the research is that occupational health interventions targeting the use of personal protective equipment have not had theoretical models guiding the intervention. The lack of theoretical model use has resulted in less focused interventions. Ronis et al. (2006) pointed out this need, stating: "Yet the vast majority of work-site studies do not have theoretical models guiding their interventions" (p. 4). Based on a review of the literature, no studies could be found that used the health belief model to guide workplace interventions, and no instrument based on the health belief model has been developed to assess the effectiveness of conducted interventions. Although determinants for the use of personal protective equipment fit well into the health belief model and it has been used successfully in other health concern areas, the health belief model is not used in occupational interventions. The cues to action component of the health belief model has not been well studied in any type of intervention and needs further research (Janz et al., 2002).

Last, a majority of the work-site studies have been conducted in large organizations or industries. These studies may be limited by the fact that large industries have the resources to educate and train workers. Conversely, limited studies have been conducted for the use of personal protective equipment in small shops or organizations where the determinants for its use could be markedly different (Lazovich et al., 2002).

Implications for the Current Research

The current research utilized the health belief model to develop an instrument to measure which specific cues to action would be most effective in increasing the use of personal protective equipment in the workplace. The purpose of this research was to contribute to an understanding of ways to increase worker use of personal protective equipment. This research was intended to be innovative and to demonstrate the efficacy of using the model in workplace settings. The intended results are that the current research would contribute to an understanding of the interaction of the determinants and their impact on worker compliance with personal protective equipment. An additional benefit would be a contribution of research that addresses cues to action. The literature reviewed clearly identified a need for more research on the impact of cues to action in influencing health behaviors. The current research also intended to stimulate more study into the small shop or small workplace setting. Although this is a significant proportion of the U.S. workforce, little study has been attempted in this area. In fact, the literature review indicated that no studies using personal protective equipment in small shops have been conducted.

The current research will advance the science by investigating, in more detail, the development of an effective health belief model instrument to assess the determinants that influence the use of personal protective equipment. By tailoring the intervention to the shop rather than to the individual, a greater understanding of workplace determinants can be achieved. By modifying the established

measurement instrument used in health belief model research, an instrument specific to multiple types of using personal protective equipment can be developed that could be employed in future research. By conducting the research through using personnel from small shops, a greater understanding of worker health behaviors in this setting can be achieved. Finally, the discipline of health promotion and education has not been widely used to enhance workers' health in terms of their occupational behaviors. For most of the participants, the discipline has targeted wellness rather than occupational health. In addition, most of the occupational health field has been the purview of industrial hygienists and occupational health nurses. By conducting this research, it is hoped that a niche may open for health promotion and education in the occupational health setting.

CHAPTER 3

METHODOLOGY

The purpose of this study was to develop a valid and reliable instrument that employs the constructs of the health belief model to test employee intention to wear personal protective equipment in the workplace. The study utilized Champion's (1993) Health Belief Model Scale and the Stanford Chronic Disease Self-Efficacy Scale (Stanford Patient Education Research Center, n.d.) as models for the development of the instrument. The instrument was evaluated by two focus groups. The first focus group consisted of subject-matter experts derived from key personnel such as the base safety noncommissioned officer and the bioenvironmental engineer. The second focus group consisted of workers from the shops who previewed the survey before administration to the pilot group. The instrument was refined by these two groups until it was determined to be valid for use. The refined and finalized instrument was tested for reliability by a pilot group. Demographic information for the pilot group was also collected and analyzed to identify any extraneous variables. The study was conducted at the Utah Air National Guard Base, a small military installation. The site was selected because of the accessibility to this population and because of the presence of several small industrial shops at the installation that require the employment of personal protective equipment.

Study Design

The study used three groups to establish the validity and reliability of the instrument. A focus group was made up of a cross-section of key personnel who have expertise on the requirement for and the employment of personal protective equipment. The key personnel focus group population refined the developed instrument to ensure face and content validity. The instrument was presented to a small group of shop employees representing a cross-section of the employee population, including frontline and supervisory employees. The employee-based focus group further established face validity and assisted in assessing the readability of the survey. Reliability of the instrument was accomplished through pilot testing. The questionnaire was given to a pilot group comprised of the small industrial shop employees, and test-retest reliability measures were carried out. The written consent of the installation commander was obtained to conduct the study at the military installation. University of Utah Institutional Review Board approval was obtained to conduct the study. The study was found to be exempt; however, all participants gave informed consent to participate in the study.

Study Population

The expert focus group consisted of the installation environmental manager, former environmental manager, bioenvironmental engineering technician, public health technician, aircraft maintenance squadron commander, and ground safety technician. The employee focus group consisted of the engineering installation squadron vehicle maintenance superintendent, fabrication shop supervisor, aircraft

maintenance quality assurance technician, and two aircraft maintenance crew chiefs who represented the frontline employees. The pilot group consisted of a convenience sample of workers from four organizations in the installation. The organizations represented include the aircraft maintenance squadron, civil engineering squadron, engineering installation squadron, and air control squadron. These organizations were selected to provide the best cross-section of the base industrial worker population. The pilot group participants included supervisors and employees with varying degrees of experience. The pilot group supervisors were between 35 and 55 years old, and all of them had at least 5 years of experience in their assigned career fields. The pilot group employees included all employee volunteers from the selected shops. Their experience levels ranged from less than 1 year to more than 20 years ($N = 23$).

Recruitment

Participants were recruited with the assistance of the installation environmental coordinator, industrial hygiene technician, and aircraft maintenance squadron commander. The impacted organization commanders were notified about the study by personal contact. They were informed about the purpose of the study and the study procedures, and they were given my contact information. Employees were recruited through organizational staff meetings and through e-mail notifications by the key personnel noted above. Interested employees were also provided with a reminder using the installation electronic calendar.

Study Procedures

The methodology for developing the survey followed the health belief model and used strategies developed by Champion (1993) as well as questionnaire construction methods suggested by Lusk et al. (1997) and Radhakrishna (2007). Focus group sessions were conducted by providing focus group members with a draft questionnaire. The focus groups analyzed the questionnaire and provided their expertise to further refine the questions. Four focus group sessions were conducted. Three focus group sessions were conducted with the expert focus group, and one focus group session was conducted with the employee focus group. The focus group sessions lasted less than 1 hour each, and the sessions were conducted at the installation for the convenience of the focus group members. Before participating in the focus group, each participant provided informed consent. Once consent of the members was obtained, the expert focus group began with an orientation on the purpose of the study and the procedures for the focus group. Focus group sessions were held at weekly intervals until the group was satisfied with the survey instrument.

Upon completion of the expert focus group sessions, the instrument was presented to the employee focus group for review. Informed consent was obtained, and all participants agreed to proceed. The employee focus group was presented with the instrument and asked to complete it. Upon conclusion of this process, the employee focus group was asked to provide their suggestions to improve validity and readability.

Pilot group procedures included administration of the instrument in a classroom setting by a trained proctor. To ensure consistency, participants were read the instructions and any clarifying questions were answered prior to survey completion. The instrument was presented in paper format for completion, and it was collected and placed in a locked box to ensure privacy. For retest procedures, the same classroom was used, and the instrument was readministered after a period of 2 weeks, using the same procedures. Attrition of participants was reported through the supervisor to me. Information was gathered with regard to the reason for attrition.

The Instrument

The instrument contained items modified and adapted from Champion's (1993) Health Belief Model Scale and from the Stanford Chronic Disease Self-Efficacy Scale (Stanford Patient Education Research Center, n.d.). A 5-point, Likert-type scale was applied to each question. The instrument contained an introductory letter, which provided a description of the purpose of the study, detailed instructions for survey completion, and an acknowledgment that participation in the survey was voluntary. The instrument was subjected to a Flesch-Kincaid grade-level readability analysis and to a readability assessment by the employee focus group in order to ensure that an appropriate level of readability was used. A brief instruction statement appeared as the header of each page of the survey in order to ensure that respondents were reminded of the instructions as they completed the scale.

The instrument followed the constructs of the health belief model. Questions 1 through 6 were developed to assess the subject's perceived susceptibility to occupational illness. Questions 7 through 13 were developed to assess the subject's perceptions of the seriousness of developing an occupational illness. Questions 14 through 17 were developed to assess the subject's perceived benefits for wearing personal protective equipment. Questions 18 through 25 were developed to assess the subject's perceived barriers to wearing personal protective equipment. Questions 26 through 33 were developed to assess the cues to action that would be most effective to the subject. Questions 34 through 39 were developed to assess the subject's self-efficacy with regard to the employment of personal protective equipment. Finally, a demographics sheet was included at the end of the instrument to collect demographic information about the respondents.

Administration

The instrument was presented to the expert focus group during a focus group meeting. Instructions on the purpose of the study and the constructs of interest were provided to ensure that all focus group members were familiarized with the aim of the instrument's development. The group was asked to evaluate the survey for face validity. A written PowerPoint© slide notes page of instructions was provided to each member of the expert focus group that described the purpose of their participation and reviewed the basics of the constructs being evaluated. The focus group was presented with the instrument and asked to complete the scale and demographics. The focus group provided qualitative input on survey construction,

readability, and validity. Focus group participation was voluntary. Focus group members were provided with a copy of the draft survey that they could mark with their editorial comments. Focus group members were asked to be candid and provide their comments. I kept a journal of all focus group input. The instrument was refined electronically during the course of the meetings until consensus was reached on the content of the instrument and the validity of the items.

Upon completion of the revisions, the revised survey was presented to the two most experienced members of the focus group. These two members were asked to participate as judges to evaluate each item for relevancy using a scaled relevancy rating form (see Appendix A). This scale was used to calculate a content validity index. The content validity index measured agreement between the judges on the relevancy of the items on the instrument. Di lorio (2005) asserted that an index of 0.90 or greater must be achieved in order to validate the instrument.

Once the instrument was fully developed by the focus groups, it was administered to the pilot group by a trained proctor. To ensure consistency, the trained proctor followed specific written guidelines for the administration of the survey (see Appendix B). The pilot group was given the final instrument, including a cover letter (see Appendix C), in a group setting and asked to complete the scale. The instruments were collected and scores were tabulated. After a period of 2 weeks, the same instrument was administered to the same pilot group in the same fashion, and a second set of scores was collected. Scores for the test-retest were tabulated, and a statistical analysis was conducted to determine reliability.

CHAPTER 4

RESULTS

Data Analysis

The validity of the instrument was qualitatively assessed by a focus group of six experts and a focus group of six employees. These two groups assessed the instrument for overall face validity. Content validity was determined by using a two-judge comparison, and a content validity index was calculated for each question and for the overall survey. Reliability was assessed by conducting a test-retest of the same scale. Results of the test-retest were entered into the Statistical Package for the Social Sciences for Windows©, Version 14 (SPSS, Inc., 2006). Descriptive statistics were computed, and a Cronbach's alpha was used to determine reliability. In addition, a *t* test was used to calculate correlations between the two trials. These procedures were used in order to address the three research questions.

Research Question 1

Is the developed instrument applicable and relevant to the occupational setting? The applicability and relevancy of the instrument were qualitatively assessed by the expert and employee focus groups. The expert focus group was oriented to the purpose of the instrument and given an overview of the models used

in the instrument's development. The group was given a copy of the instrument and asked to provide input during the group meetings. The group consensus was that the instrument questions were both applicable and relevant to the occupational setting. Many positive comments were received, indicating that the instrument would give good feedback about the use of personal protective equipment and that it would be a useful survey for future investigations. The following comments were considered in this qualitative assessment of the survey's applicability and relevancy: "This will give us good feedback about the use of personal protective equipment," and "This will be a good survey for future uses; I am excited to see how it turns out."

The employee focus group was presented with the overall purpose of the instrument's development and then asked to complete the instrument. Upon completion, the participants were asked to give their feedback. Comments were received that indicated the instrument was applicable and relevant. Employee focus group participants commented: "This survey really gets to why we do or don't use personal protective equipment," and "Wow, I wish all occupational surveys were written this way." These comments indicated that the instrument was properly focused on determinants that interact in the utilization of personal protective equipment. All participants commented favorably on the applicability and relevancy of the instrument.

In addition to applicability and relevancy, an assessment was made of instrument readability using the Flesch-Kincaid readability scale, which was built

into the MicrosoftWord© word-processing software. The readability of the instrument was measured at a 12.2 grade level. Although this grade level was higher than the desired 8.0 grade level, the employee focus group indicated that the instrument was readable and recommended only minor word changes to two of the scales. These changes did not alter the meaning of the scale but aided clarification.

Research Question 2

What is the reliability and validity of the developed measuring instrument? Face validity of the instrument was determined by the expert and employee focus groups. These groups qualitatively evaluated the instrument for face validity based on their experience and expertise in the occupational setting and with the health belief model. The instrument was qualitatively assessed to be valid. In addition, content validity was determined by using a two-judge content validity index calculation, as outlined by Di Iorio (2005), in which a content validity index form was presented to two of the judges from the expert focus group; responses were tabulated using the content validity index equation. The ratio of the scores rated by the judges as either *quite relevant* or *very relevant* was divided by the total number of scores, and the content validity index was determined. The content validity index was calculated to be 1.0, with both judges agreeing that all items in the instrument were either *quite relevant* or *very relevant*.

The reliability of the instrument was calculated using a test-retest method. The instrument was given to a pilot group of industrial shop personnel, who are required to use personal protective equipment, and then the same instrument was

given to the same group using the same methods 2 weeks following initial administration. The initial pilot group ($N = 46$) completed the instrument, including a demographics page, and were asked to return in 2 weeks. The retest was scheduled for the same setting, during the same day of the week, and for the same hour of the day; the instrument was administered in the same fashion. The retest population, which was derived from the initial pilot group ($N = 23$), completed the survey. The responses were recorded in the Statistical Package for the Social Sciences, Version 14 for analysis (SPSS, Inc., 2006). Descriptive statistics were derived, a *t* test was run for paired samples, and a Cronbach's alpha was determined.

Because the instrument measures various constructs of the health belief model, an analysis of the questions that comprise each construct was conducted. The descriptive statistics for each question are summarized in Tables 2, 3, 4, 5, 6, and 7. A Cronbach's alpha for the test was computed to be .326, a Cronbach's alpha for the retest was computed to be .612, and the result for the composite of the test-retest scores was a Cronbach's alpha of .727. As previously noted, because the instrument measures various constructs of the health belief model, an analysis of Cronbach's alpha for each construct was conducted. The results of the analysis of Cronbach's alpha for the various constructs are summarized in Tables 8, 9, 10, 11, 12, and 13.

Based on the combined analysis, validity and reliability of the instrument were established. In addition, a correlation was conducted as part of the *t* test

Table 2

Descriptive Statistics for Instrument Construct: Perceived Susceptibility

Scale item	*N*	Min.	Max.	*M*	*Mdn*	*SD*
	Test					
I believe my chances of developing an occupational illness are great.	23	2	5	3.70	4.00	.876
I worry about getting an occupational illness.	23	1	4	3.26	4.00	.915
I feel that I have a good chance of getting an occupational illness during my career.	23	2	5	3.35	3.00	.832
I know predecessors in this career field who got an occupational illness.	23	1	5	3.17	3.00	1.029
Small exposures to occupational chemicals or noise won't lead me to an illness.	23	1	5	2.39	2.00	1.158
I can prevent an occupational illness.	23	3	5	4.00	4.00	.522
	Retest					
I believe my chances of developing an occupational illness are great.	23	2	5	3.43	4.00	.992
I worry about getting an occupational illness.	23	1	4	3.13	3.00	.920
I feel that I have a good chance of getting an occupational illness during my career.	23	2	5	3.35	3.00	.935
I know predecessors in this career field who got an occupational illness.	23	1	5	3.26	3.00	1.096
Small exposures to occupational chemicals or noise won't lead me to an illness.	23	1	4	2.65	3.00	.775
I can prevent an occupational illness.	23	2	5	3.61	4.00	.783

Table 3

Descriptive Statistics for Instrument Construct: Perceived Seriousness

Scale item	*N*	Min.	Max.	*M*	*Mdn*	*SD*
	Test					
The thought of developing an occupational illness deeply concerns me.	23	1	4	3.22	3.00	.850
If I developed an occupational illness, my career would be in jeopardy.	23	2	5	4.00	4.00	.853
Problems I would experience from an occupational illness would last a long time.	23	3	5	4.09	4.00	.733
An occupational illness will not lead to permanent changes in my health.	23	1	4	1.96	2.00	.767
My financial security would be endangered if I developed an occupational illness.	23	3	5	4.22	4.00	.518
I believe I could die prematurely if I developed an occupational illness.	23	3	5	3.91	4.00	.596
I am afraid to even think about getting an occupational illness.	23	1	4	2.87	3.00	.815
	Retest					
The thought of developing an occupational illness deeply concerns me.	23	2	5	3.30	3.00	.876
If I developed an occupational illness, my career would be in jeopardy.	23	3	5	3.39	4.00	.706
Problems I would experience from an occupational illness would last a long time.	23	2	5	3.78	4.00	.795
An occupational illness will not lead to permanent changes in my health.	23	1	4	2.30	2.00	.765
My financial security would be endangered if I developed an occupational illness.	23	3	5	4.00	4.00	.522
I believe I could die prematurely if I developed an occupational illness.	23	2	5	3.70	4.00	.765
I am afraid to even think about getting an occupational illness.	23	1	4	2.74	3.00	.752

Table 4

Descriptive Statistics for Instrument Construct: Perceived Benefits

Scale item	*N*	Min.	Max.	*M*	*Mdn*	*SD*
	Test					
Wearing personal protective equipment will prevent future health problems for me.	23	3	5	4.04	4.00	.562
Personal protective equipment prevents exposure to the kinds of hazards I am around on the job.	23	2	5	3.83	4.00	.778
I don't worry about getting an occupational illness when I use personal protective equipment.	23	1	4	3.04	3.00	.825
I benefit by wearing personal protective equipment.	23	3	5	4.13	4.00	.458
	Retest					
Wearing personal protective equipment will prevent future health problems for me.	23	1	5	3.57	4.00	.896
Personal protective equipment prevents exposure to the kinds of hazards I am around on the job.	23	2	5	3.78	4.00	.736
I don't worry about getting an occupational illness when I use personal protective equipment.	23	1	5	3.17	3.00	.937
I benefit by wearing personal protective equipment.	23	3	5	4.09	4.00	.417

Table 5

Descriptive Statistics for Instrument Construct: Perceived Barriers

Scale item	*N*	Min.	Max.	*M*	*Mdn*	*SD*
	Test					
Wearing personal protective equipment is uncomfortable.	23	2	5	3.74	4.00	.864
Personal protective equipment interferes with my ability to do my job.	23	1	5	3.30	3.00	1.020
Personal protective equipment is not always available to me.	23	1	5	2.48	2.00	.947
My coworkers would make fun of me for wearing personal protective equipment.	23	1	4	2.00	2.00	.798
My supervisor seldom wears personal protective equipment when required.	23	1	4	2.17	2.00	.834
My supervisor is aware of my compliance with personal protective equipment guidelines.	23	3	5	3.91	4.00	.515
I would need to develop a new habit for wearing personal protective equipment and this is difficult.	23	1	4	2.43	2.00	.843
Wearing personal protective equipment is just too inconvenient for me.	23	1	3	2.17	2.00	.717
	Retest					
Wearing personal protective equipment is uncomfortable.	23	2	5	3.61	4.00	.722
Personal protective equipment interferes with my ability to do my job.	23	2	4	3.13	3.00	.815
Personal protective equipment is not always available to me.	23	1	4	2.65	2.00	.982
My coworkers would make fun of me for wearing personal protective equipment.	23	1	4	2.26	2.00	.752
My supervisor seldom wears personal protective equipment when required.	23	1	4	2.57	2.00	.896
My supervisor is aware of my compliance with personal protective equipment guidelines.	23	2	5	3.83	4.00	.650

Table 5 (*continued*)

Scale item	*N*	Min.	Max.	*M*	*Mdn*	*SD*
I would need to develop a new habit for wearing personal protective equipment and this is difficult.	23	1	4	2.30	2.00	.765
Wearing personal protective equipment is just too inconvenient for me.	23	1	4	2.26	2.00	.752

Table 6

Descriptive Statistics for Instrument Construct: Cues to Action

Scale item	*N*	Min.	Max.	*M*	*Mdn*	*SD*
	Test					
A reminder on my computer log-in each day would be important to my wear of personal protective equipment.	23	1	5	2.35	2.00	1.112
My supervisor checking up on me would improve my wear of personal protective equipment.	23	1	4	3.00	3.00	.905
The fact that OSHA could fine me or my employer for not wearing personal protective equipment is important.	23	2	5	3.57	4.00	.896
Posters in my shop serve as important reminders to wear personal protective equipment.	23	2	5	3.52	4.00	.790
The threat of disciplinary action is an important factor in ensuring I wear personal protective equipment.	23	1	5	3.83	4.00	.984
Having personal protective equipment at the location of the hazard is critical to making sure I wear it.	23	2	5	4.00	4.00	.798
If I see others in my shop wearing personal protective equipment, it reminds me to use it.	23	2	5	3.96	4.00	.878
Regular and frequent education on the importance of personal protective equipment serves to improve how often I wear it.	23	1	5	3.57	4.00	.945
	Retest					
A reminder on my computer log-in each day would be important to my wear of personal protective equipment.	23	1	4	2.52	3.00	1.039
My supervisor checking up on me would improve my wear of personal protective equipment.	23	2	5	3.04	3.00	.878
The fact that OSHA could fine me or my employer for not wearing personal protective equipment is important.	23	2	5	3.70	4.00	.765

Table 6 (*continued*)

Scale item	*N*	Min.	Max.	*M*	*Mdn*	*SD*
Posters in my shop serve as important reminders to wear personal protective equipment.	23	1	4	3.30	4.00	1.020
The threat of disciplinary action is an important factor in ensuring I wear personal protective equipment.	23	2	5	3.70	4.00	.822
Having personal protective equipment at the location of the hazard is critical to making sure I wear it.	23	3	5	4.04	4.00	.475
If I see others in my shop wearing personal protective equipment, it reminds me to use it.	23	3	5	3.91	4.00	.417
Regular and frequent education on the importance of personal protective equipment serves to improve how often I wear it.	23	2	4	3.30	3.00	.765

Table 7

Descriptive Statistics for Instrument Construct: Self-Efficacy

Scale item	*N*	Min.	Max.	*M*	*Mdn*	*SD*
	Test					
My supervisor sets the example on wearing personal protective equipment when exposed to hazards.	23	3	5	3.52	3.00	.593
I am confident that I will remember to use personal protective equipment when I am exposed to hazards at work.	23	3	5	3.87	4.00	.458
I am confident that I can obtain the proper personal protective equipment when I am exposed to hazards at work.	23	2	5	3.91	4.00	.668
I am confident that my job performance will not be adversely impacted by wearing personal protective equipment.	23	2	5	3.48	3.00	.898
I am confident that the personal protective equipment I use when I am exposed to hazards at work is the proper equipment to protect me.	23	1	5	3.61	4.00	.941
I am confident that wearing proper personal protective equipment throughout my career will help prevent me from getting an occupational illness.	23	3	5	3.78	4.00	.600
	Retest					
My supervisor sets the example on wearing personal protective equipment when exposed to hazards.	23	2	5	3.57	4.00	.728
I am confident that I will remember to use personal protective equipment when I am exposed to hazards at work.	23	3	4	3.83	4.00	.388
I am confident that I can obtain the proper personal protective equipment when I am exposed to hazards at work.	23	2	5	3.78	4.00	.671
I am confident that my job performance will not be adversely impacted by wearing personal protective equipment.	23	2	5	3.65	4.00	.714

Table 7 (*continued*)

Scale item	*N*	Min.	Max.	*M*	*Mdn*	*SD*
I am confident that the personal protective equipment I use when I am exposed to hazards at work is the proper equipment to protect me.	23	1	4	3.48	4.00	.790
I am confident that wearing proper personal protective equipment throughout my career will help prevent me from getting an occupational illness.	23	2	5	3.83	4.00	.778

Table 8

Cronbach's Alpha for Instrument Construct: Perceived Susceptibility

Scale item	*M*	*SD*	*N*	Item total correlation	Alpha if deleted
Test (Cronbach's alpha = .655)					
I believe my chances of developing an occupational illness are great.	3.70	.876	23	.364	.620
I worry about getting an occupational illness.	3.26	.915	23	.578	.538
I feel that I have a good chance of getting an occupational illness during my career.	3.35	.832	23	.741	.485
I know predecessors in this career field who got an occupational illness.	3.17	1.029	23	.735	.453
Small exposures to occupational chemicals or noise won't lead me to an illness.	2.39	1.158	23	.022	.770
I can prevent an occupational illness.	4.00	.522	23	.027	.695
Retest (Cronbach's alpha = .596)					
I believe my chances of developing an occupational illness are great.	3.43	.992	23	.519	.460
I worry about getting an occupational illness.	3.13	.920	23	.675	.392
I feel that I have a good chance of getting an occupational illness during my career.	3.35	.935	23	.826	.307
I know predecessors in this career field who got an occupational illness.	3.07	1.096	23	.559	.430
Small exposures to occupational chemicals or noise won't lead me to an illness.	2.65	.775	23	-.422	.772
I can prevent an occupational illness.	3.61	.783	23	-.011	.664

Table 9

Cronbach's Alpha for Instrument Construct: Perceived Seriousness

Scale item	*M*	*SD*	*N*	Item total correlation	Alpha if deleted
Test (Cronbach's alpha = .093)					
The thought of developing an occupational illness deeply concerns me.	3.22	.850	23	.287	-.207
If I developed an occupational illness, my career would be in jeopardy.	4.00	.853	23	.089	.024
Problems I would experience from an occupational illness would last a long time.	4.09	.733	23	.160	-.032
An occupational illness will not lead to permanent changes in my health.	1.96	.767	23	-.391	.405
My financial security would be endangered if I developed an occupational illness.	4.22	.518	23	-.053	.133
I believe I could die prematurely if I developed an occupational illness.	3.91	.596	23	-.012	.113
I am afraid to even think about getting an occupational illness.	2.87	.815	23	.236	-.132
Retest (Cronbach's alpha = .460)					
The thought of developing an occupational illness deeply concerns me.	3.30	.876	23	.485	.256
If I developed an occupational illness, my career would be in jeopardy.	3.96	.706	23	.411	.329
Problems I would experience from an occupational illness would last a long time.	3.78	.795	23	.438	.300
An occupational illness will not lead to permanent changes in my health.	2.30	.765	23	-.298	.637
My financial security would be endangered if I developed an occupational illness.	4.00	.522	23	.379	.373
I believe I could die prematurely if I developed an occupational illness.	3.70	.765	23	.440	.304
I am afraid to even think about getting an occupational illness.	2.74	.752	23	-.114	.565

Table 10

Cronbach's Alpha for Instrument Construct: Perceived Benefits

Scale item	*M*	*SD*	*N*	Item total correlation	Alpha if deleted
Test (Cronbach's alpha = .490)					
Wearing personal protective equipment will prevent future health problems for me.	4.04	.562	23	.280	.428
Personal protective equipment prevents exposure to the kinds of hazards I am around on the job.	3.83	.778	23	.495	.170
I don't worry about getting an occupational illness when I use personal protective equipment.	3.04	.825	23	.489	.168
I benefit by wearing personal protective equipment.	4.13	.458	23	-.103	.646
Retest (Cronbach's alpha = .582)					
Wearing personal protective equipment will prevent future health problems for me.	3.57	.896	23	.457	.426
Personal protective equipment prevents exposure to the kinds of hazards I am around on the job.	3.78	.736	23	.722	.207
I don't worry about getting an occupational illness when I use personal protective equipment.	3.17	.937	23	.283	.600
I benefit by wearing personal protective equipment.	4.09	.417	23	.052	.665

Table 11

Cronbach's Alpha for Instrument Construct: Perceived Barriers

Scale item	*M*	*SD*	*N*	Item total correlation	Alpha if deleted
Test (Cronbach's alpha = .684)					
Wearing personal protective equipment is uncomfortable.	3.74	.864	23	.586	.600
Personal protective equipment interferes with my ability to do my job.	3.30	1.020	23	.622	.581
Personal protective equipment is not always available to me.	2.48	.947	23	.384	.653
My coworkers would make fun of me for wearing personal protective equipment.	2.00	.798	23	.592	.603
My supervisor seldom wears personal protective equipment when required.	2.17	.834	23	.270	.679
My supervisor is aware of my compliance with personal protective equipment guidelines.	3.91	.515	23	-.585	.781
I would need to develop a new habit for wearing personal protective equipment and this is difficult.	2.43	.843	23	.527	.617
Wearing personal protective equipment is just too inconvenient for me.	2.17	.717	23	.455	.639
Retest (Cronbach's alpha = .626)					
Wearing personal protective equipment is uncomfortable.	3.61	.722	23	.541	.536
Personal protective equipment interferes with my ability to do my job.	3.13	.815	23	.116	.650
Personal protective equipment is not always available to me.	2.65	.982	23	.579	.500
My coworkers would make fun of me for wearing personal protective equipment.	2.26	.752	23	.543	.533
My supervisor seldom wears personal protective equipment when required.	2.57	.896	23	.412	.565

Table 11 (*continued*)

Scale item	*M*	*SD*	*N*	Item total correlation	Alpha if deleted
My supervisor is aware of my compliance with personal protective equipment guidelines.	3.83	.650	23	-.481	.751
I would need to develop a new habit for wearing personal protective equipment and this is difficult.	2.30	.765	23	.581	.520
Wearing personal protective equipment is just too inconvenient for me.	2.26	.752	23	.360	.584

Table 12

Cronbach's Alpha for Instrument Construct: Cues to Action

Scale item	*M*	*SD*	*N*	Item total correlation	Alpha if deleted
Test (Cronbach's alpha = .581)					
A reminder on my computer log-in each day would be important to my wear of personal protective equipment.	2.35	1.112	23	.191	.586
My supervisor checking up on me would improve my wear of personal protective equipment.	3.00	.905	23	-.014	.634
The fact that OSHA could fine me or my employer for not wearing personal protective equipment is important.	3.57	.896	23	.392	.514
Posters in my shop serve as important reminders to wear personal protective equipment.	3.52	.790	23	.112	.594
The threat of disciplinary action is an important factor in ensuring I wear personal protective equipment.	3.83	.984	23	.338	.530
Having personal protective equipment at the location of the hazard is critical to making sure I wear it.	4.00	.798	23	.339	.534
If I see others in my shop wearing personal protective equipment, it reminds me to use it.	3.96	.878	23	.615	.440
Regular and frequent education on the importance of personal protective equipment serves to improve how often I wear it.	3.57	.945	23	.389	.513
Retest (Cronbach's alpha = .269)					
A reminder on my computer log-in each day would be important to my wear of personal protective equipment.	2.52	1.039	23	.246	.126
My supervisor checking up on me would improve my wear of personal protective equipment.	3.04	.878	23	-.072	.354
The fact that OSHA could fine me or my employer for not wearing personal protective equipment is important.	3.70	.765	23	.282	.136

Table 12 (*continued*)

Scale item	*M*	*SD*	*N*	Item total correlation	Alpha if deleted
Posters in my shop serve as important reminders to wear personal protective equipment.	3.30	1.020	23	.028	.305
The threat of disciplinary action is an important factor in ensuring I wear personal protective equipment.	3.70	.822	23	-.071	.345
Having personal protective equipment at the location of the hazard is critical to making sure I wear it.	4.04	.475	23	.136	.238
If I see others in my shop wearing personal protective equipment, it reminds me to use it.	3.91	.417	23	.185	.227
Regular and frequent education on the importance of personal protective equipment serves to improve how often I wear it.	3.30	.765	23	.245	.159

Table 13

Cronbach's Alpha for Instrument Construct: Self-Efficacy

Scale item	*M*	*SD*	*N*	Item total correlation	Alpha if deleted
Test (Cronbach's alpha = .523)					
My supervisor sets the example on wearing personal protective equipment when exposed to hazards.	3.52	.593	23	-0.94	.615
I am confident that I will remember to use personal protective equipment when I am exposed to hazards at work.	3.87	.458	23	.474	.424
I am confident that I can obtain the proper personal protective equipment when I am exposed to hazards at work.	3.91	.668	23	.395	.419
I am confident that my job performance will not be adversely impacted by wearing personal protective equipment.	3.48	.898	23	.366	.422
I am confident that the personal protective equipment I use when I am exposed to hazards at work is the proper equipment to protect me.	3.61	.941	23	.377	.416
I am confident that wearing proper personal protective equipment throughout my career will help prevent me from getting an occupational illness.	3.78	.600	23	.212	.504
Retest (Cronbach's alpha = .740)					
My supervisor sets the example on wearing personal protective equipment when exposed to hazards.	3.57	.728	23	.386	.730
I am confident that I will remember to use personal protective equipment when I am exposed to hazards at work.	3.83	.388	23	.524	.711
I am confident that I can obtain the proper personal protective equipment when I am exposed to hazards at work.	3.78	.671	23	.516	.692
I am confident that my job performance will not be adversely impacted by wearing personal protective equipment.	3.65	.714	23	.428	.717

Table 13 (*continued*)

Scale item	*M*	*SD*	*N*	Item total correlation	Alpha if deleted
I am confident that the personal protective equipment I use when I am exposed to hazards at work is the proper equipment to protect me.	3.48	.790	23	.538	.685
I am confident that wearing proper personal protective equipment throughout my career will help prevent me from getting an occupational illness.	3.83	.778	23	.557	.678

analysis. Correlation between the constructs for the test-retest was determined. The results indicated adequate correlation between the constructs for the two times the instrument was administered. The results of the *t* test are summarized in Table 14.

Research Question 3

Does the developed instrument have sufficient validity and reliability to assess the significance of the determinants that predict the use of personal protective equipment? Based on the analysis previously noted, it was determined that the instrument has sufficient validity to be used in an industrial setting. Qualitative and quantitative analyses were used to support this finding. The instrument is applicable and relevant, and it has sufficient validity to assess the effectiveness of programs or interventions that target personnel in small shops, with the aim of increasing their use of personal protective equipment.

Table 14

t Test for Test-Retest Paired Constructs

Paired sample	Correlation	Sig.	*df*	*t*	Sig. (2-tailed)
Test-retest for perceived susceptibility	.730	.000	22	.872	.392
Test-retest for perceived seriousness	.561	.005	22	1.046	.307
Test-retest for perceived benefits	.435	.038	22	1.033	.313
Test-retest for perceived barriers	.669	.002	22	-.650	.523
Test-retest for cues to action	.798	.000	22	.553	.586
Test-retest for self-efficacy	.710	.000	22	.106	.916

The reliability of the instrument was calculated for the test, retest, combined test, and retest as well as for the constructs of the instrument. Based upon these findings, it was determined that the instrument has many constructs that are reliable; however, some constructs were found to be lower in reliability. These constructs are perceived seriousness and cues to action. The assessment of lower reliability was based upon the lower Cronbach's alpha for the two constructs (.460 and .560, respectively). All other constructs approached or exceeded the .70 criteria for reliability (Di lorio, 2005), particularly if the questions that factor into a lower Cronbach's alpha were deleted. Table 15 demonstrates the change in Cronbach's alpha scores for each construct when items are selected for deletion.

Table 15

Cronbach's Alpha for Instrument Construct: Preitem and Postitem Deletion

		Test		Retest	
Scale item	Construct	Cronbach's alpha	Alpha if deleted	Cronbach's alpha	Alpha if deleted
Small exposures to occupational chemicals or noise won't lead me to an illness.	Perceived susceptibility	.655	.770	.596	.772
An occupational illness will not lead to permanent changes in my health.	Perceived seriousness	.093	.405	.460	.637
I benefit by wearing personal protective equipment.	Perceived benefits	.490	.646	.582	.665
My supervisor is aware of my compliance with personal protective equipment guidelines.	Perceived barriers	.684	.781	.626	.751
My supervisor checking up on me would improve my wear of personal protective equipment.	Cues to action	.581	.634	.269	.354
My supervisor sets the example on wearing personal protective equipment when exposed to hazards.	Self-efficacy	.523	.615	.740	.750

CHAPTER 5

DISCUSSION

The current study was conducted to determine the applicability and relevance of an instrument designed to assess the significance of the determinants involved in the use of personal protective equipment in an occupational setting at an Air National Guard military facility. The study explored the validity and reliability of the instrument, and it assessed the ability of the instrument to measure the significance of the determinants involved in predicting compliance with the use of personal protective equipment.

Major Findings

According to the results of the study, it was found that the instrument was applicable, relevant, and valid for the purpose of assessing determinants that influence the use of personal protective equipment in an occupational setting. Qualitative and quantitative assessment assured instrument validity. Both expert and employee focus groups aided in the establishment of an instrument that has high validity in the setting for which it is intended.

Since this instrument was designed to assess the constructs of the health belief model as they relate to the use of personal protective equipment, six constructs were evaluated: (a) perceived susceptibility to occupational illness,

(b) perceived severity or consequences of developing an occupational illness, (c) perceived benefits of personal protective equipment use, (d) perceived barriers to personal protective equipment use, (e) cues to action that activate the likelihood of personal protective equipment use, and (f) self-efficacy towards taking action to use personal protective equipment. The reliability of the instrument varied by construct; however, the majority of the constructs had reliability sufficient for the intended purpose of the instrument. Although reliability was lower than desired in the perceived seriousness and cues to action components of the instrument, valuable information was gained. This information can aid in the future development of a valid, reliable, and theory-driven instrument designed to assess the effectiveness of interventions in the workplace. A valid and reliable theory-driven instrument is critical to the health educator interested in using the health belief model to develop an intervention that is intended to promote the use of personal protective equipment to protect worker health and to prevent occupational illness.

Research Question 1

Is the developed instrument applicable and relevant to the occupational setting? The instrument was found to be applicable and relevant in the workplace setting. Two focus groups of experts and employees evaluated the instrument. Positive comments were received with regard to relevancy and applicability. These two factors are critical to ensure acceptance of the instrument in the intended setting. In addition, the instrument was found to be readable and not labor

intensive to complete. For both the test-retest, less than 20 minutes were required to complete the survey. Employees in industrial shops are primarily focused on their assigned tasks and, in the opinion of the expert focus group, are more tolerant and accepting of survey instruments that are readable, require a short duration to complete, and are relevant to their workplace. Health educators and other researchers must keep these factors in mind as they develop surveys and conduct survey research. The survey development steps suggested by Radhakrishna (2007) confirmed the importance of targeting the research setting and facilitating the cooperation of participants as key components of survey research. Through their practical experience, the expert focus group found that the instrument sufficiently targets the components of the health belief model and the determinants of personal protective equipment employment behavior established in the literature. The processes and outcomes of the focus groups were vital in the development of a survey that is valid.

Research Question 2

What is the reliability and validity of the developed measuring instrument? The instrument was found to have sufficient validity both qualitatively and quantitatively to meet the objectives of the study. The reliability of the instrument was also assessed. It was found that the instrument has varying degrees of reliability, depending on the construct evaluated as well as an overall reliability that is lower than was hoped for when the instrument was designed. The results were not unexpected. For example, a lower Cronbach's alpha is often found in

evaluating an instrument that has multiple constructs interacting to evaluate behaviors and an instrument that employs a theoretical model with multiple components to derive its constructs (Di lorio, 2005). In particular, Cronbach's alpha was lower than desired in the components of perceived seriousness and cues to action, indicating that more refinement of the instrument is necessary for these particular constructs so as to address this issue. Several sources in the literature suggest additional questions, additional subjects, and additional retesting of the revisions as ways to improve Cronbach's alpha scores in test-retest reliability processes (Di lorio; Radhakrishna, 2007).

Although reliability of the instrument varied, the results were not discouraging. Cronbach's alpha scores were adequate in the context of the study design and setting. The scores indicate that the instrument has sufficient reliability to be useful in the setting for which it was designed.

Research Question 3

Does the developed instrument have sufficient validity and reliability to assess the significance of the determinants that predict the use of personal protective equipment? The findings that assessed validity and reliability indicated that the instrument was sufficient to assess the significance of the determinants involved in the use of personal protective equipment. Valid and reliable theory-driven instruments are crucial to health educators and other researchers; that is, a review of the literature indicated that no instruments exist to evaluate the determinants of behavior acting on the use of personal protective equipment in the

industrial setting that employs health belief model constructs. The findings also indicated that the instrument is sufficient to assess the effectiveness of interventions designed to target the increase in the use of personal protective equipment in small industrial shops. The employment of theory-guided interventions are significant since a majority of work-site studies do not employ theoretical models to direct their interventions (Ronis et al., 2006). Since the developed instrument employs the health belief model as the theoretical basis for its constructs, it follows that the instrument will have particular utility in assessing health-belief-model-based interventions.

Although Cronbach's alpha for reliability was lower than desired in the cues to action construct of the instrument, it could serve as a basis for future research. Since the cues to action component of the health belief model is not well studied (Janz et al., 2002), an instrument to assess the effectiveness of interventions that target cues to action was needed. The designed instrument was intended to partially fill the identified need. Although more research is required to refine this construct of the instrument and to increase its reliability, the cues to action construct of the instrument can serve as a foundation for future research in this important area of health-behavior change.

Recommendations, Limitations, and Conclusions

Although much research has been conducted in the occupational health setting, few studies exist that have theoretical models as the basis of evaluation to determine the effectiveness of interventions. In a review of the literature, no

instruments were found that employed the health belief model to directly and effectively assess workers' beliefs about employing personal protective equipment to prevent occupational illnesses. The purpose of this study was to develop such an instrument. The results of the study are encouraging, but more research is needed to further refine the instrument and to more rigorously assess validity and reliability.

In order to improve the instrument and apply it in the occupational setting, the following recommendations are offered:

1. The validity of the instrument should be further assessed by adding an additional judge or judges to the content validity index process. The addition of judges would bring added perspectives to evaluate the survey. The addition of an outside judge who is not directly involved at the study site would bring a valuable perspective and further validate the instrument. The calculation of the content validity index would remain essentially the same, as the procedure involves a ratio of judge scores.
2. Reliability of the instrument could be improved by employing other methods that are commonly used to test reliability. A split-half test could be employed to further assess instrument reliability, eliminating the logistical concerns associated with test-retest reliability procedures. A larger sample size could also be obtained in future research studies.

3. One of the significant challenges with test-retest reliability is determining the best time to administer the retest. Due to time limitations imposed by the deployment of many of the subjects for a military mission, this study employed a 2-week time frame for retesting the subjects. Reliability may be better determined by allowing a longer time frame between the test-retest phases, which could lessen the chance of subject response recollection from the first test.

4. Reliability factors could be improved by the addition of subjects or the addition of items in the instrument. The current study began with a sample size of 46 subjects and ended with 23 subjects. The attrition of subjects was likely due to preparations for an upcoming deployment. In order to increase reliability, more subjects could be involved from the outset. In addition, the instrument could be expanded to add more items to each of the constructs. Adding items would be particularly crucial in the constructs where reliability was found to be lower than expected. Both of these measures could contribute to a more reliable instrument.

5. The study was conducted at a small military facility that employs a small population of workers who require the use of personal protective equipment. These workers are employed together over a long period of time, and they develop close interpersonal working

relationships. In spite of admonishments to the contrary, it cannot be ruled out that these workers discussed the survey and that the outcome of the reliability assessment was influenced. Conducting the survey at a larger facility could reduce the potential for this occurrence.

6. The instrument assessed multiple constructs simultaneously. Reliability could be improved by limiting the instrument to fewer constructs. Advantages and disadvantages can be seen with this approach. To fully assess the constructs of the health belief model, several surveys would be required, resulting in subject fatigue. However, in the proper setting, this approach could have some utility.

Implications for Further Research

More investigation is necessary to accurately test the research questions put forth in the current study. The following suggestions are offered for future studies to assess validity and reliability of the developed instrument:

1. The researcher should conduct the study at a larger military installation. An active-duty installation is suggested so that the subject pool becomes larger while still having the same types of subject characteristics that influenced the current study.
2. The researcher should expand the scope of the study to the nonmilitary setting. Because the study was conducted at an Air

National Guard facility, which more closely mirrors the private sector than other types of military organizations, it may have more generalizability beyond the study setting. Assessment of validity and reliability in a variety of settings would prove useful in determining the utility of the instrument.

3. The researcher should refine the instrument and adapt the items to the study setting, thus increasing validity and reliability.
4. The researcher should employ the instrument in a pretest-posttest trial to assess the instrument for the intended purpose: to assess the effectiveness of interventions targeting improvements in worker utilization of personal protective equipment.

In conclusion, this instrument could provide researchers with a valuable tool to assess worker beliefs regarding the use of personal protective equipment and to assess the effectiveness of theoretically based interventions in the industrial workplace. The findings of the current study should be employed to further refine the instrument and to employ it to determine which cues to action most effectively prompt workers to use their personal protective equipment. Constructs from the health belief model closely relate to the determinants of behavior that interact to influence the use of personal protective equipment. Thus, this instrument has the potential to guide and evaluate workplace interventions so that they may be effective in the ultimate goal of protecting worker health. Given the seriousness of the occupational illness problem in the United States and globally, dedicating more

research to long-term worker behavior change is essential. Although laws exist that mandate the use of personal protective equipment because of insufficient resources to enforce the laws and because of inconsistent application of the laws by employers, little health behavior change is brought about by putting laws into place. The failure of punitive action to influence behavior creates an opportunity for health promotion and education to discover ways to bring about successful behavior change through promoting the rewards for compliance as those rewards are perceived by each employee. Health educators have a unique opportunity to develop an additional avenue for study by conducting workplace investigations and interventions in the industrial workplace. Clearly, with the occupational illness problems that are being experienced, the prevention-based perspective offered by health educators could be a vital link in protecting worker health. An unstated purpose of the current study was to demonstrate that health educators could have a unique role in the workplace environment that could positively influence health outcomes for industrial workers. Health educators should consider it a professional obligation to conduct further research in the industrial workplace setting and to develop partnerships with other disciplines involved in occupational health so that efforts targeting the prevention of occupational illnesses can be maximized.

APPENDIX A

CONTENT VALIDITY INDEX QUESTIONNAIRE

Relevancy Rating Form

Participation in this rating is completely voluntary. Your answers are important, so please complete each item on the form. Your careful and honest responses are deeply appreciated.

Please use the following form to rate the relevancy of each item to the concept of perceived susceptibility, as defined by the health belief model. Please read each item carefully, and rate each item on the 4-point scale in terms of how relevant you believe it is in measuring the concept of perceived susceptibility.

1 = not relevant
2 = somewhat relevant
3 = quite relevant
4 = very relevant

1. I believe my chances of developing an occupational illness are great.

1 2 3 4

2. I worry about getting an occupational illness.

1 2 3 4

3. I feel that I have a good chance of getting an occupational illness during my career.

1 2 3 4

4. I know predecessors in this career field who got an occupational illness.

1 2 3 4

5. Small exposures to occupational chemicals or noise won't lead me to an illness.

1 2 3 4

6. I can prevent an occupational illness.

1 2 3 4

Please use the following form to rate the relevancy of each item to the concept of perceived seriousness, as defined by the health belief model. Please read each item carefully, and rate each item on the 4-point scale in terms of how relevant you believe it is in measuring the concept of perceived seriousness.

1 = not relevant
2 = somewhat relevant
3 = quite relevant
4 = very relevant

7. The thought of developing an occupational illness deeply concerns me.

1 2 3 4

8. If I developed an occupational illness, my career would be in jeopardy.

1 2 3 4

9. Problems I would experience from an occupational illness would last a long time.

1 2 3 4

10. An occupational illness will not lead to permanent changes in my health.

1 2 3 4

11. My financial security would be endangered if I developed an occupational illness.

1 2 3 4

12. I believe I could die prematurely if I developed an occupational illness.

1 2 3 4

13. I am afraid to even think about getting an occupational illness.

1 2 3 4

Please use the following form to rate the relevancy of each item to the concept of perceived benefits, as defined by the health belief model. Please read each item carefully, and rate each item on the 4-point scale in terms of how relevant you believe it is in measuring the concept of perceived benefits.

1 = not relevant
2 = somewhat relevant
3 = quite relevant
4 = very relevant

14. Wearing personal protective equipment will prevent future health problems for me.

1 2 3 4

15. Personal protective equipment prevents exposure to the kinds of hazards I am around on the job.

1 2 3 4

16. I don't worry about getting an occupational illness when I use personal protective equipment.

1 2 3 4

17. I benefit by wearing personal protective equipment.

1 2 3 4

Please use the following form to rate the relevancy of each item to the concept of perceived barriers, as defined by the health belief model. Please read each item carefully, and rate each item on the 4-point scale in terms of how relevant you believe it is in measuring the concept of perceived barriers.

1 = not relevant
2 = somewhat relevant
3 = quite relevant
4 = very relevant

18. Wearing personal protective equipment is uncomfortable.

1 2 3 4

19. Personal protective equipment interferes with my ability to do my job.

1 2 3 4

20. Personal protective equipment is not always available to me.

1 2 3 4

21. My coworkers would make fun of me for wearing personal protective equipment.

1 2 3 4

22. My supervisor seldom wears personal protective equipment when required.

1 2 3 4

23. My supervisor is aware of my compliance with personal protective equipment guidelines.

1 2 3 4

24. I would need to develop a new habit for wearing personal protective equipment and this is difficult.

1 2 3 4

Please use the following form to rate the relevancy of each item to the concept of cues to action susceptibility, as defined by the health belief model. Please read each item carefully, and rate each item on the 4-point scale in terms of how relevant you believe it is in measuring the concept of cues to action susceptibility.

1 = not relevant
2 = somewhat relevant
3 = quite relevant
4 = very relevant

25. Wearing personal protective equipment is just too inconvenient for me.

1 2 3 4

26. A reminder on my computer log-in each day would be important to my wear of personal protective equipment.

1 2 3 4

27. My supervisor checking up on me would improve my wear of personal protective equipment.

1 2 3 4

28. The fact that OSHA could fine me or my employer for not wearing personal protective equipment is important.

1 2 3 4

29. Posters in my shop serve as important reminders to wear personal protective equipment.

1 2 3 4

30. The threat of disciplinary action is an important factor in ensuring I wear personal protective equipment.

1 2 3 4

31. Having personal protective equipment at the location of the hazard is critical to making sure I wear it.

1 2 3 4

Please use the following form to rate the relevancy of each item to the concept of cues to action susceptibility, as defined by the health belief model. Please read each item carefully, and rate each item on the 4-point scale in terms of how relevant you believe it is in measuring the concept of cues to action susceptibility.

1 = not relevant
2 = somewhat relevant
3 = quite relevant
4 = very relevant

32. If I see others in my shop wearing personal protective equipment, it reminds me to use it.

1 2 3 4

33. Regular and frequent education on the importance of personal protective equipment serves to improve how often I wear it.

1 2 3 4

Please use the following form to rate the relevancy of each item to the concept of self-efficacy, as defined by the health belief model. Please read each item carefully, and rate each item on the 4-point scale in terms of how relevant you believe it is in measuring the concept of self-efficacy.

1 = not relevant
2 = somewhat relevant
3 = quite relevant
4 = very relevant

34. My supervisor sets the example on wearing personal protective equipment when exposed to hazards.

1 2 3 4

35. I am confident that I will remember to use personal protective equipment when I am exposed to hazards at work.

1 2 3 4

36. I am confident that I can obtain the proper personal protective equipment when I am exposed to hazards at work.

1 2 3 4

37. I am confident that my job performance will not be adversely impacted by wearing personal protective equipment.

1 2 3 4

38. I am confident that the personal protective equipment I use when I am exposed to hazards at work is the proper equipment to protect me.

1 2 3 4

39. I am confident that wearing proper personal protective equipment throughout my career will help prevent me from getting an occupational illness.

1 2 3 4

APPENDIX B

TRAINED PROCTOR GUIDELINES

Instructions for Administration of the Personal Protective Equipment Survey

1. Greet each participant at the door and thank them for their participation. Hand them the unique-numbered survey and ask them to sign the log next to the control number. Ask them not to put their name anywhere on the survey.

2. Once this step is complete, ask them to be seated at a table in the conference room.

3. After all are seated, close the door to the conference room.

4. Ensure that all personnel are seated comfortably and at a sufficient distance to ensure privacy. Offer a privacy screen (three-part folder) if anyone wishes it.

5. Ensure that everyone has signed the log and has been given the corresponding numbered survey (double-check from step 1). Ensure that no one has put their name on the survey. Ensure that they can participate in the retest on 18 February 09 and will not be on leave or temporary duty.

6. Read the instructions noted below to the group:

In accordance with Air Force Instruction 36-2601, Air Force Personnel Survey Program, the installation commander has given permission to conduct a project involving the development of a survey to assess employee beliefs about the use of personal protective equipment as part of a University of Utah thesis research study. You are being requested to participate in this project by taking the survey on two occasions. Your participation is entirely voluntary, and you may choose, without negative consequences, not to participate. Your responses to this survey will be kept strictly confidential. This study has been approved by the installation commander and the University of Utah Institutional Review Board.

We would appreciate your completion of the attached survey. Do not put your name on the questionnaire, but we request that you sign the log next to the unique number that corresponds to the survey number you have been given. This unique number system is designed to preserve your confidentiality.

We realize that your time is valuable. However, we hope that the 20 minutes that it takes to complete this survey will help lead to a valid questionnaire that can be used to develop ways to better protect employees by using personal protective equipment.

Thank you in advance for your participation. If you have any questions about the study, please feel free to contact LTC Jack M. Wall at 801-245-2226.

7. Ask if there are any questions.

8. If anyone wishes to be excused from the survey, do so at this time. Collect the participant's survey and annotate it in the log.

9. Request that all personnel refrain from talking during the survey or discussing the questions.

10. Instruct participants to begin the survey.

11. As participants complete the surveys, ask them to place the survey in the locked box or in the envelope provided.

12. After all respondents have completed the survey, remind them that their responses will be kept strictly confidential and once again thank them for their participation.

13. Ensure that all surveys are turned in.

14. Inform participants that they are free to go. Remind them that they will be asked to return in 2 to 3 weeks to take the survey again. For confidentiality reasons, ask them not to discuss the survey until after the second session.

15. Remind participants that they can contact the researcher if they have any questions or concerns.

16. Answer any questions, and allow participants to return to their workcenters.

APPENDIX C

THE INSTRUMENT

Personal Protective Equipment Survey

February 18

2009

TR2-048

Dear Survey Participant

In accordance with Air Force Instruction 36-2601, Air Force Personnel Survey Program, the installation commander has given permission to conduct a project involving the development of a survey to assess employee beliefs about the use of Personal Protective Equipment (PPE) as part of a University of Utah thesis research study. You are being requested to participate in this project by taking the survey on two occasions. Your participation is entirely voluntary and you may choose, without negative consequences, not to participate. Your responses to this survey will be kept strictly confidential. This study has been approved by the Installation Commander and the University of Utah Institutional Review Board.

We would appreciate your completion of the attached survey. Do not put your name on the questionnaire, but we request that you sign the log next to the unique number that corresponds to the survey number you have been given. This unique number system is designed to preserve your confidentiality.

We realize that your time is valuable. However, we hope that the 20 minutes that it takes to complete this survey will help lead to a valid questionnaire that can be used to develop ways to better protect employees by use of personal protective equipment. By returning this completed survey, you are giving your consent to participate.

If you have any questions or concerns about the study, please feel free to contact LTC Jack M. Wall at 801-245-2226 or 801-891-1715. You may also contact the University of Utah at 801-581-3655. Thank you in advance for your participation. Your willingness to assist with this project is deeply appreciated.

Instructions

The purpose of this survey is to assess worker beliefs about occupational illness and the personal protective equipment they wear at work. Examples of personal protective equipment are ear plugs and muffs, respirators, chemical resistant gloves, face shields, safety glasses, chemical resistant aprons, and regular coveralls just to name a few. Examples of occupational illness include diseases like hearing loss from exposure to loud noise, respiratory illnesses from exposure to dust or chemicals, skin disorders from exposure to chemicals, and some cancers.

Participation in this survey is completely voluntary. Your answers to this survey are important, so please complete each item on the survey. Your careful and honest responses are deeply appreciated.

Circle the number that corresponds most closely to the extent of your agreement with each statement.

1. I believe my chances of developing an occupational illness are great.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

2. I worry about getting an occupational illness.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

3. I feel that I have a good chance of getting an occupational illness during my career.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

4. I know predecessors in this career field who got an occupational illness.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

5. Small exposures to occupational chemicals or noise won't lead me to an illness.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

Circle the number that corresponds most closely to the extent of your agreement with each statement.

6. I can prevent an occupational illness

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

7. The thought of getting an occupational illness deeply concerns me.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

8. If I developed an occupational illness, my career would be in jeopardy.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

9. Problems I would experience from an occupational illness would last a long time.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

10. An occupational illness will not lead to permanent changes in my health.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

11. My financial security would be endangered if I developed an occupational illness.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

12. I believe I could die prematurely if I developed an occupational illness.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

13. I am afraid to even think about getting an occupational illness.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

Circle the number that corresponds most closely to the extent of your agreement with each statement.

14. Wearing personal protective equipment will prevent future health problems for me.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	2	3	4	5

15. Personal protective equipment prevents exposure to the kinds of hazards I am around on the job.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	2	3	4	5

16. I don't worry about getting an occupational illness when I use personal protective equipment.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	2	3	4	5

17. I benefit by wearing personal protective equipment.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	2	3	4	5

18. Wearing personal protective equipment is uncomfortable.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	2	3	4	5

19. Personal protective equipment interferes with my ability to do my job.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	2	3	4	5

20. Personal protective equipment is not always available to me.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	2	3	4	5

Circle the number that corresponds most closely to the extent of your agreement with each statement.

21. My coworkers would make fun of me for wearing personal protective equipment.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

22. My supervisor seldom wears personal protective equipment when required.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

23. My supervisor is aware of my compliance with personal protective equipment guidelines.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

24. I would need to develop a new habit for wearing personal protective equipment, and this is difficult.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

25. Wearing personal protective equipment is just too inconvenient for me.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

26. A reminder on my computer log-in each day would be important to my wear of personal protective equipment.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

27. My supervisor checking up on me would improve my wear of personal protective equipment.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

Circle the number that corresponds most closely to the extent of your agreement with each statement.

28. The fact that OSHA could fine me or my employer for *not* wearing personal protective equipment is important.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

29. Posters in my shop serve as important reminders to wear personal protective equipment.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

30. The threat of disciplinary action is an important factor in ensuring I wear personal protective equipment.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

31. Having personal protective equipment at the location of the hazard is critical to making sure I wear it.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

32. If I see others in my shop wearing personal protective equipment, it reminds me to use it.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

33. Regular and frequent education on the importance of personal protective equipment serves to improve how often I wear it.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

34. My supervisor sets the example on wearing personal protective equipment when exposed to hazards.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	**2**	**3**	**4**	**5**

Circle the number that corresponds most closely to the extent of your agreement with each statement.

35. I am confident that I will remember to use personal protective equipment when I am exposed to hazards at work.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	2	3	4	5

36. I am confident that I can obtain the proper personal protective equipment when I am exposed to hazards at work.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	2	3	4	5

37. I am confident that my job performance will not be adversely impacted by wearing personal protective equipment.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	2	3	4	5

38. I am confident that the personal protective equipment I use when I am exposed to hazards at work is the proper equipment to protect me.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	2	3	4	5

39. I am confident that wearing proper personal protective equipment throughout my career will help prevent me from getting an occupational illness.

Strongly Disagree	*Disagree*	*Neither Agree nor Disagree*	*Agree*	*Strongly Agree*
1	2	3	4	5

Personal Protective Equipment Survey
General Employee Information

Please circle the response that most closely corresponds to you. As with the survey, all responses will be kept confidential.

Current age:

18-25 26-30 31-35 36-40 41-45 46-50 51-55 56-60

Gender: Male Female

Total time in the Air National Guard:

Less than year 1-5 years 6-10 years 11-15 years 16-20 years Over 20 years

Total time in your current career field:

Less than year 1-5 years 6-10 years 11-15 years 16-20 years Over 20 years

Type of training on Personal Protective Equipment during your career (circle all that apply):

Familiarization training

Basic safety training

Hazard communication training

Supervisor safety training

Advanced personal protective equipment training (OSHA courses, manufacturer courses, etc.)

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