

A Job Safety Program for Construction Workers Designed to Reduce the Potential for Occupational Injury Using Tool Box Training Sessions and Computer-Assisted Biofeedback Stress Management Techniques

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This project was conducted with a multicultural construction company in Hawaii, USA. The job duties performed included drywall and carpentry work. The following objectives were selected for this project: (a) fire prevention training and inspection of first aid equipment; (b) blood-borne pathogen training and risk evaluation; (c) ergonomic and risk evaluation intervention program; (d) electrical safety training and inspection program; (e) slips, trips, and falls safety training; (f) stress assessment and Personal Profile System; (g) safety and health program survey; (h) improving employee relations and morale by emphasizing spirituality; and (i) computer-assisted biofeedback stress management training. Results of the project indicated that observed safety hazards, reported injuries, and levels of perceived stress were reduced for the majority of the population.

job safety ergonomics biofeedback stress computer-assisted training

1. INTRODUCTION

There are more than 6 million construction workers in the USA (approximately 6% of the labor force) and construction workers experience some of

the highest rates for fatal and non-fatal injuries resulting in lost work days (Sweeney, Becker, Bryant, & Palassis, 1999). Therefore, programs that focus on reducing risk factors for injury and managing stress are an important topic for researchers in the field of public health.

1.1. Population

The research demonstration project involved in this paper was conducted with the employees of JDH Construction, a small residential sub-contractor that builds single-family dwellings for Gentry Homes in Ewa Beach, HI, USA.

1.2. Sources of Stress

Stressors can be either internal or external demands that create a physical or psychological strain on the organism. Physical demands can be created by such diverse stimuli as illness caused by viral and bacterial agents, fatigue resulting from sleep disorders, excessive workload, nutritional deficiency, and traumatic injuries. Psychological situations can be viewed as positive or negative depending on the extent to which the demand is perceived as a short-term or chronic threat to the individual. Categories of psychological demands include attitudes, perceptions, emotional responses, and cognitive abilities.

Current research indicates that construction workers are exposed to a variety of health risk factors due to the nature of the work involved. Strains and sprains are the leading compensable injury for construction workers (Welch, Hunting, & Nessel-Stephens, 1999). Other sources of injury include fire hazards, improper first aid; blood-borne pathogens; electrical safety issues; slips, trips, and falls; and musculoskeletal injuries (Welch et al., 1999). More than 50% of all traumatic injuries can be attributed to having contact with or being struck by an object, and musculoskeletal skeletal injuries. Another specific source of injury involves pneumatic nail guns (Beaver & Cheatham, 1999). The rapid-fire speed of these guns, lack of safety devices in their design, and the repetition of motion constitute the high number of puncture wounds and subsequently carpal tunnel problems faced by many workers. Working in a multicultural workforce also can contribute to additional stressors related to diversity issues. Workplace

violence between workers can arise for a variety of reasons, some of which may involve cultural or ethnic traditions, customs, and methods of communication (Askari, 1996).

1.3. Stress Response Outcomes

As indicated in the previous section, sources of stress can create demands on an individual. In turn, the individual responds. Stress response outcomes include physiological, psychological, and behavioral reactions to demands. The reaction can be temporary, short-term strains (a few minutes, hours, or days), or chronic (weeks, months, and years). Although some stress may have a positive effect by stimulating productivity or fostering feelings of self-efficacy and self-worth, prolonged stress has been established as a potential risk factor in both physical and psychological illnesses. Disease states that have been related to stress include heart disease, stroke, suicide, cancer, and impaired immunologic competence associated with increased vulnerability to infection and neoplasm. Heightened levels of stress can result in dysfunction that produces such disorders as hypertension, arrhythmia, angina, migraine headache, and Raynaud's syndrome. Stressful situations and life events can also have a short-term, temporary but adverse effect on health status and daily functioning (Dohrenwend & Dohrenwend, 1974). Specific negative outcomes include shortness of breath, increased perspiration, loss of confidence, increased use of alcohol, tobacco, or drugs; declining productivity and absenteeism from work (Goldberger & Brenitz, 1982). These negative outcomes also contribute to the escalating health care costs.

1.4. Measuring Occupational Stress

The increased interest in occupational stress has exposed problems of definition and measurement. Researchers at the National Institute for Occupational Safety and Health (NIOSH) selected specific variables for inclusion in a General Stress Inventory (GSI; Hurrell & McLaney, 1988) appropriate for occupational situations according to content analysis of recent job stress literature. The major categories of factors related to job stress that were used to develop the NIOSH GSI questionnaire include (a) Job Stressors: Physical Environment, Role Conflict, Role Ambiguity, Interpersonal Conflict,

Job Future Ambiguity, Job Control, Employment Opportunities, Quantitative Workload, Variance in Work Load, Responsibility for People, Underutilization of Abilities, Cognitive Demands, Shift Work; (b) Individual Factors: Age, Gender, Marital Status, Job Tenure, Type A Behavior, Self-Esteem, Perceived Value, Preferred Format; (c) Acute Reactions: Psychological (Depression, Anger); Physiological Conditions (Somatic Complaints, Poor Interpersonal Skills, Job Related Injuries, Substance Abuse, Absence From Work); (d) Illnesses: Work-Related Disability, Physician-Diagnosed Conditions; (e) Buffer Factors: Social Support, Positive Lifestyle Habits, Spirituality; (f) Non-Work Factors: Domestic Concerns, Family Demands, Childcare, Elderly, Community Involvement.

1.5. Buffers

Buffers are factors that can reduce the negative effects of exposure to stressors. Whereas training programs can provide valuable information on injury prevention, ergonomics, health and safety, other non-work factors have also been identified. Some of the most common buffers include a positive lifestyle, social support, spending time away from work, being involved with leisure activities, and stress management. Another buffer is spirituality. The concept of spirituality is an evolving area of investigation. Spirituality for the purposes of this paper will be defined as a personal system of beliefs and practices that enhance an individual's feeling of connectedness to self, others, the environment, and to a higher power (which has been referred to as God, Supreme Being, The Way, etc.). There have been many attempts to assess spirituality through self-report questionnaire items (Kass, Friedman, Leserman, Zuttermeister, & Benson, 1991; McBride, Pilkington, & Arthur, 1998).

2. THE RESEARCH PROJECT

The purpose of this research project was to design and implement a job safety program for construction workers that would reduce the potential for occupational injury. After analyzing the workers, job duties, and work schedule, it was decided that the preferred method incorporated Tool Box Training Sessions and Computer-Assisted Biofeedback Stress Management Techniques. The first step in creating an appropriate set of workshops was

to enlist management cooperation for any intervention and follow-up study. Once this was accomplished, the next step was to study the population and employee job duties. Analysis of the employee population demographics and the nature of the work performed provided valuable information necessary for creating a series of workshops designed to reduce the risk of injury and manage stress.

2.1. The Population

The workforce consisted of five administrators and approximately 50 union employees comprised primarily of carpenters and drywall tapers. All of the union employees were male, ranging in age from 20 to 55 with a mean average of 36 years. The workforce was comprised of individuals from a variety of ethnic backgrounds including Caucasians (31%), Filipinos (17%), Hispanics (9%), Hawaiian or part Hawaiian (18%), Japanese (9%), and people with two or more ethnic groups in their background (16%). The primary job duties for the carpenters and drywall tapers involved in this project included exterior structural, framing, sheathing, and siding carpentry work; hanging and taping of drywall; and other interior finish carpentry work.

2.2. Specific Sources of Stress

The next step in the process was to assess the sources of stress experienced by the workers. Initial data was collected through OSHA (Occupational Safety and Health Administration) 200 occupational safety and health logs, company records, a survey instrument, which included the NIOSH GSI, a Spiritual Assessment Inventory designed for this study (adapted from Kass et al., 1991), and the Perceived Stress Scale (Cohen & Williamson, 1988).

The major sources of stress for this population included the following: fire hazards, improper first aid; blood-borne pathogens; electrical safety issues; slips, trips, and falls; repetitive stress injuries; musculoskeletal injuries; high work demands; cultural differences; communication styles; non-work demands involving interpersonal relationships, responsibility for the care of family members, financial concerns, and lifestyle habits.

2.3. Workshop Design

Workshop presenters would need to be familiar with multiethnic issues and cultural communication styles common with this population. In addition, workshops would have to be provided by experts in the area within the first hour of employment (7–8 a.m.). Attendance would have to be mandatory due to the importance that management placed on job safety. Workshop topics included (a) fire prevention training and inspection of first aid equipment; (b) blood-borne pathogen training and risk evaluation; (c) ergonomic and risk evaluation; (d) electrical safety training and inspection; (e) slips, trips, and falls safety training; (f) stress assessment and Personal Profile System; (g) safety and health program survey; (h) improving employee relations and morale by emphasizing spirituality; and (i) computer-assisted biofeedback stress management training.

2.4. Training Sessions

Beginning in 1998, mandatory comprehensive training sessions were conducted weekly. Major topics addressed included fire prevention training, inspection of equipment, and emergency action plans; blood-borne pathogens, hepatitis B, and inspection of first aid equipment; ergonomic and risk evaluation intervention program with specific focus on pneumatic nail guns; job stress, stress identification and coping behaviors at home and at work; slips, trips, and falls safety training, which concentrated on preventing and treating soft tissue injuries; and electrical safety.

Through all formal and informal training sessions, the safety manager enhanced workplace spirituality and facilitated a feeling of connectedness in the following ways: maintaining daily contact with the workers; inquiring about supply and safety needs; following up on health and performance concerns (at work and at home); and communicating informally (referred to in the Hawaiian culture as “talking story”). Although the construction industry is not considered to be a high-risk occupation, this project included measures to reduce the potential for violence on the job site. Each session focused on enhancing a feeling of connectedness within and between workers. Other measures included hazard inspection checklist, field security, record review, policy and procedure reviews, incident report forms, incident follow-up reports. A description of the training sessions follows.

Fire prevention. The Honolulu Fire Department provided an educational speaker for this session. Fire hazards on all job sites were reviewed. Each type of fire and the associated hazards were discussed. Employees were given an emergency action plan in case of a fire emergency. A question and answer period after the presentation addressed specific questions regarding fire accidents and stress related factors. All employees attended this session.

Blood-borne pathogen. Dr. Sussman from the Medical Corner gave a presentation regarding the different types of hepatitis including the high incidence rates in Hawaii and available treatments. An inspection of first aid equipment and a review of first aid practices and safe guards were included in the training. All employees attended this session.

Ergonomics. Joan Ruppe addressed the intervention program and evaluated the risks involved in using pneumatic nail guns. Each type of tool was discussed in detail with manufacturer specifications and safety precautions. Past injuries sustained by the use of these tools were examined and safeguards to prevent such occurrences from happening again were addressed. All employees attended this session.

Job stress. This training session consisted of 3 separate training days. Joan Ruppe began the training session by speaking about and having the employees complete a personal profile system. The next session of the 3 separate training days, was held on November 17, 1999. Don Sepe conducted the training session on the personal profile system and identified different personalities. The last session was held on November 22, 1999. Don Sepe concluded the training session by speaking about personalities and people's behaviors at work. All JDH employees attended these sessions.

Slips, trips, and falls. Dr. Masters spoke in regards to preventing and treating soft tissue injuries. Topics included the relationship between stress and accidents, incident reporting, and prevention techniques including awareness and exercises. All employees attended this session.

Electrical safety. Hawaiian Electric provided two educational speakers, Norman Hong and Moses De Mello, who spoke about electrical safety. Specific electrical hazards associated with construction safety were discussed. Electrical hazards can be life threatening to all employees. Electrical

injuries and emergency response issues were covered extensively. All employees attended this session.

Biofeedback. Employee stress levels were determined using the Perceived Stress Scale. Personal counseling sessions were conducted with interested workers. Each session involved background discussion, identification of stressors, stress management techniques and computer-assisted biofeedback using the ProComp System (Biomedical Instruments, Warren, MI, USA; electromyography [EMG], galvanic skin response [GSR], heart rate, blood volume, pulse, respiration, electrocardiogram [EKG], electroencephalogram [EEG] measures). All participants indicated a positive response to the sessions.

3. THE RESULTS

Ultimately, results of the safety and ergonomic training program were reflected in the number of injuries and illnesses. Each year there was an average of approximately 50 full-time employees at any time. In 1997, prior to initiation of the formal safety program, employees worked 59,600 hrs and there were 8 injuries with 7 lost-days cases. In 1998, after initiation of the safety and ergonomic training program, employees worked a total of 68,700 hrs with only 4 first aid injuries and no lost days reported. In 1999, employees worked a total of 85,000 hours with 6 reported injuries and only 2 lost-days cases. Overall morale was high, participation in the training sessions was active, and employees worked well together. Results of the Spirituality Assessment Inventory indicated that 84% of the employees felt a close relationship to themselves; 89% felt close to their environment; and 82% felt close to God (defined individually for each person).

This demonstration project supports the practice of providing occupational safety and ergonomic training to employees in an effort to reduce the incidence of workplace injuries and illnesses. It is also important to consider health related factors, sources of stress, non-work stressors, and buffers when designing systematic training programs. Application of the Spiritual Assessment Inventory presents an area for future work with respect to reducing workplace violence and improving morale and productivity, and computer-assisted biofeedback has the potential of becoming a useful tool for improving performance and managing stress.

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