POTENTIAL TRAUMA IN THE WORK PLACE

BEHAVIORAL - PSYCHOLOGICAL FACTORS AS RELATED TO THE OCCURRENCE AND PREVENTION OF OCCUPATIONAL TRAUMA

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INTRODUCTION

Behavioral and motivational research within the National Institute for Occupational Safety and Health (NIOSH) is organized into three program areas. These are:

(1) Behavioral Toxicology which is assessing behavioral and neurologic responses to chemical and physical agents found in industry for their usefulness as early warning indicators of potentially hazardous exposures.

(2) Psychological Stress which seeks to characterize the health impact of job demands as distinct from the threat posed by exposures to known chemical and physical hazards.

(3) Behavioral Safety which is aimed at researching behavioral and motivational factors influencing accident risk at work and testing the merits of psychological approaches to accident control.

This paper will focus on the behavioral safety program area by offering examples of on-going research dealing with causal factors in worker accidents, psychological strategies for accident control, and management approaches to workplace safety. Those interested in the behavioral toxicology and psychological stress areas will find them described in several recent NIOSH publications[1,2,3]. Needless to say, the thrust for much of the aforementioned types of NIOSH activity has come from the Occupational Safety and Health Act of 1970[4] which explicitly directed the Institute to include psychological, behavioral and motivational factors in researching problems of worker safety and health and in developing needed corrective measures.

CAUSAL FACTORS IN WORKER ACCIDENTS

That human error, may lead to work accidents is without question. Aside from a variety of human factors, organizational, machine environmental and work process considerations may also contribute

to accident occurrence at work. The frequent assertion that human errors underlie most of these mishaps remains utter speculation since an adequate data base for indicating the significance of different kinds of factors to accident causation in industry does not exist.

Moreover, reasons for the performance failures of workers or risk-taking behavior have not been studied in any systematic way. Indeed, the bulk of accident investigations in industry and reports of worker injuries acknowledge little more than the type of accident, e.g., slip, fall; the agent or source of injury, e.g., floor, ladder; and the part(s) of the body affected. Statistical surveys, essentially collating the data found in these injury reports, suffer from the same shortcomings.

Recognizing that data on accident causation are basic to realizing suitable and effective safety control measures, attention is being given to promoting accident investigation and data reporting procedures that could yield more useful information. One suggestion holds that concentrated in-depth studies of fewer worker accidents of a select type might prove more useful in identifying causal factors than low-key examinations of a greater number of mishaps[5]. In this regard, successful use of accident investigation teams in analyzing aircraft, highway, fire, and explosive accidents is noteworthy.

Recognizing these needs, NIOSH has initiated a contract study to develop and apply an investigation methodology suitable for determining accident causal factors. Essential features of the study include:

(1) The use of a multi-disciplinary team in investigating workplace accidents. The investigations are being performed by several specialists all with pertinent expertise and experience, including a physiologist, M.D./epidemiologist, industrial psychologist, safety engineer, records specialist, and the safety official at the plant where the mishap is reported.

(2) The development of a conceptual framework for organizing and classifying information about accident causation which takes account of factors pertaining to the worker (e.g. physical condition, attitude); the company (e.g. work policies, practices); job requirements; equipment used; and the workplace surroundings. These data will be obtained from interviews with the injured worker, witnesses to the accident, the worker's supervisor, plant safety official, attending medical personnel and other

management staff, as well as from physical measurements at the accident site, and review of available company records.

(3) The application of the methodology on a quick-response basis and its use in investigating specific types of accidents of high frequency and severity. The present study is focussing on occupational falls which, according to available figures, represent over 20 percent of all injury cases and 11 percent of all work deaths.[6] In-depth investigations of these accidents necessitate the multidisciplinary team being at the accident site within 24 hours after the mishap occurred. For this reason, such accidents are being studied at establishments fairly close to the contractor's location. All work establishments cooperating in this study have past accident experience suggesting fall-type injuries to be a recurring problem in their facilities. Plans for applying this same type of approach in defining the causes of other serious types of industrial accidents and injuries are envisioned in future studies.

(4) An analysis of the data collected during the investigations appropriate for defining common elements as either primary or contributing factors in the types of accidents studied. With regard to occupational falls, the current contract is expected to yield important insights into their occurrences bearing on needs for new or improved safety standards (e.g., frictional coefficients of work floor surfaces, design of work stairs) and recommended safe work practices.

In a parallel effort, NIOSH is accompanying local OSHA compliance officers in the quick-response investigation of worker fatalities in the Cincinnati area. Highlighting behavioral factors, one recent investigation involved an electrocution when a truck operator's hydraulic boom came into contact with a high voltage line while unloading bricks at a home construction site. Although the operator had ample room to maneuver his load, he nevertheless parked the truck too close to the power line. Under the weight of the first load of bricks, the boom tipped into the wire. Interviews with company management, other boom operators, and review of company records revealed that the deceased operator was known, and twice previously reprimanded, for taking risks to himself and company property in order to do the customer a favor by dropping loads at more convenient locations. This time the favor cost the driver his life. This incident deserves mention to dramatize the significance of human factors in accident occurrence and the importance of in-depth examination of accident causal factors.

PSYCHOLOGICAL STRATEGIES FOR ACCIDENT CONTROL

A second project is aimed at demonstrating the utility of behavioral science principles in reducing worker accidents. An initial effort resulted in the development of an index of over 80 safety guidelines derived from psychological principles in the field of organizational behavior, engineering psychology, learning and motivation, and behavior modification.[7] The index was the product of psychological experts who reviewed established concepts in each of these fields for their potential application and value in enhancing worker safety.

An example of a guideline drawn from the field of organizational behavior states: To promote safety, organizational actions should suggest to employees that safety is an important objective of the work establishment.

In elaborating on this idea, it is asserted that companies cannot rely on a single action or event such as an annual safety campaign to convince employees that their employer values safety. Rather safety should be an ever present consideration clearly perceived by the workers in company policies and practices. One large chemical manufacturer has had considerable success with its policy that "safety is a condition of employment." All employees of this company are aware that safety is a valued part of their job and that their continued employment is dependent on their safety performance. The safety record of this company ranks best in the chemical industry.

An example of a safety guideline embodying a principle of engineering psychology states: Worker expectations concerning the physical placement, direction of movement, and relationships between task events and responses should always be met in order to reduce the likelihood of error or accident. For example, depressing an accelerator pedal on a vehicle is expected to result in increasing speed; turning the steering wheel clockwise anticipates movement to the right. Whenever equipment is designed without consideration for user expectations, the potential for operator error is heightened. An actual case involved a power industrial crane in which a joy stick control moved the boom in different directions. The crane was designed so that when the stick was pulled toward the operator, the boom moved outward. When the stick was pushed away from the operator, the boom moved inward. In other words, the directional correspondence between operator control and boom movement was completely reversed. On an occasion when an experienced operator was working in a hurried manner, he

reverted back to the more natural but improper control response of moving the stick away from him when he actually wanted to move a load outward. This caused the load on the boom to swing backward, smashing into the cab of the crane and killing the operator.

A training guideline taken from the learning literature states: Proper responses to emergencies should be practiced to the point of being overlearned. Overlearning refers to extensive training on a particular task or procedure to the point where correct responses or behavior become more or less automatic. Overlearning can be particularly useful in training for emergencies (e.g. fire, disasters) so as to insure correct actions despite the evident stress.

A guideline taken from the behavior modification field states: Through appropriate use of reinforcers, behaviors related to safe work performance can be increased and behaviors related to unsafe performance can be decreased. A NIOSH study, currently in progress, is attempting to show how social-type reinforcers, chiefly recognition and praise from one's supervisor, can enhance the wearing of safety glasses among workers in a shipyard where eye accidents are quite common as well as improve certain other aspects of their safety performance. First-line supervisors, shipfitters and safety personnel are being given training through lectures and use of manuals stressing the importance of rewarding the desired safe behavior and the optimum conditions for reinforcing these acts. After training, these techniques will be applied to the shipfitter work crews in an attempt to shape safer job behavior. The effectiveness of this approach will be monitored by recording the frequencies of the specified safe behaviors, e.g. wearing of safety glasses, observed in the shipyard crews before and after the initiation of the reinforcement plan. In addition, the frequency of eye accidents and other worker injuries will be compared on a similar before/after basis. The total period of these observations will be three years. The study design includes suitable control groups of shipfitter crews who will have equal contact with supervisors and safety personnel providing the usual emphasis to safety matters.

As a means of selecting which of the above mentioned behavioral safety guidelines or other means should be prescribed in reducing job hazards, a diagnostic safety form has now been drafted.[8] The form consists of a set of checklists inventorying information about a given job such as job task characteristics, extent of job training, safety supervision, physical work environment, equipment used, relevant company policies, etc. Responses to

items on the checklists are pooled from those individuals best suited to provide the data including the plant safety officer, job supervisors, and the job holders. The scoring procedure enables different remedial actions to be rank-ordered in terms of their importance relative to satisfying the apparent safety needs of the job in question. The diagnostic safety form is intended to be used by plant safety personnel without the need to resort to costly outside consultants. In this regard, a number of safety practitioners in industry are presently reviewing the form for its ease of application and interpretation. Subsequent plans involve field trials in select work settings.

MANAGEMENT APPROACHES TO WORKPLACE SAFETY

With regard to management-oriented approaches to worker safety, NIOSH is comparing the safety program practices of work establishments with good safety records versus similar companies with poorer records in an effort to uncover insights into effective safety programming. In a first phase of this project, just completed, questionnaires were mailed to 96 pairs of manufacturing plants in one state.[9] The members of each pair were matched in type of industrial operation, work force size, and geographic locale but differed by better than 2 to 1 in injury frequency rates based on 1972 and 1973 reports. The questionnaire inquired into aspects of management commitment to safety, safety promotions and training, hazard control, accident investigations, and workforce characteristics. Returns received from 42 pairs of respondents suggested rather subtle differences between the program practices of the high versus low accident companies. The more notable of these are as follows:

(1) Company Commitment to Safety: More of the low accident companies had their highest safety officials at top management levels of their firms, and more employed one or more full-time safety personnel relative to their high accident cohorts. Though the high accident companies indicated more persons involved in directing safety efforts, these were predominately part-time responsibilities with the amount of time spent per staff person on safety being less than that indicated for part-time persons with similar assignments in the low accident companies. These findings suggest a rather fragmented safety effort in the high accident establishments.

(2) Motivational Practices: More noteworthy than differing types of promotional practices was the finding that the low accident companies appear to use more varied incentives and promotional

techniques than their high accident counterparts. With regard to disciplinary actions for unsafe acts and safety rule violations, verbal and written reprimands were the predominant methods of choice for both the high and low accident companies. However, more high accident companies deemed harsher measures, such as disciplinary layoffs and suspensions, as being most effective in dealing with these problems. These results suggest a harsher disciplinary stance toward workers in the high-accident companies, than their low-accident counterparts.

(3) Job Safety Training: More of the low accident firms had (a) formalized and special training programs to meet specific job needs, (b) augmented supervisors' instruction with other techniques, such as group discussions and lectures by safety specialists, (c) provided continuing safety training to all employees as opposed to the high accident companies who tended to offer such training only to those persons in jobs showing recurrent accidents and especially to those who had accidents recently. In short, safety training programs tended to be more expansive, and available to more workers, in the low accident companies, versus the high accident companies.

(4) Hazard Control: Overall, more high accident than low accident companies indicated that they always included safety considerations in new facility design and process planning, in purchase and installation of new plant equipment. This finding suggests greater concern with physical controls on the part of the high accident companies at the expense, perhaps, of a more balanced safety program emphasizing both engineering and non-engineering measures. More low accident companies performed informal, daily worksite inspections while high accident companies used formal, written checklists more often than the low accident companies for inspection purposes.

(5) Accident Investigation and Reporting: Both high and low accident companies were equally responsive to major, lost-time accidents, but more low accident companies reported investigating minor injuries and narrow escapes as well.

(6) Workforce Make-up: On the average, the production workforce of the low accident companies was slightly older and had somewhat more company tenure and experience than the workforce in the high accident companies. The low accident companies also indicated a slightly greater percentage of their workforce as married. These findings suggest slightly more stabilizing qualities among the low accident company workforce.

Site visits have recently been completed to a subsample of companies who responded to the questionnaire survey. These data are being analyzed to amplify on the questionnaire results as well as provide first-hand observations of particularly effective hazard control measures. It is hoped that the over-all findings from this project can serve as a source of suggesting, on an empirical basis, techniques for improving company safety programs and plant safety performance.

SUMMARY

This paper has described a number of NIOSH research projects emphasizing behavioral and psychological approaches to the study of workplace accidents and their control or prevention. Such efforts include attempts to: (a) provide methodology and data for better defining causal factors in frequent, serious types of worker accidents; (b) demonstrate the utility of psychological principles drawn from organizational psychology, engineering psychology, learning and motivation, and behavior modification as techniques for enhancing worker safety; and (c) analyze the nature of successful safety programs in industry and their implications for management policy and practices. Initial work and results are promising, and give indications that their stated objectives will be met.

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