Safety in the Construction Industry: Linking Types of Accidents to Task, Trade, Context and Postural Constraints

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THE STUDY

In 1984-1985 the Work Organization Program from Quebec's Occupational Health and Safety Research Institute conducted a survey among recently injured construction workers. The study was carried out with the collaboration of employers' and workers' representatives in the industry. 357 accidents to construction workers were studied; participation was voluntary. Interviewing lasted 6 months, covering a period in which southern Quebec's various climatic conditions were represented; the Island of Montreal district is representative of all types of work and of construction sites in Quebec save for exceptional engineering works such as large dams. The face-to-face interviews consisted of approximately one hundred questions related to: the account of the accident and of its consequences (injuries, absence from work), the task at the time of the accident, the worker's trade, the characteristics of both the site and the work environment, the postural constraints and a few individual characteristics such as age and experience.

OBJECTIVES

The objective was to describe all types of accidents that can occur in this industry and to show the link between these diverse types of accidents and work organization factors. The ultimate objective was to use these results to help the industry's workers and contractors structure prevention efforts to reduce the number of accidents. The general hypothesis was that, even in an industry as diversified and complex as construction, accidents do not occur by chance and that general trends and common denominators can be used as basis for prevention strategies.

METHODS

Multivariate analysis was used to sift through large quantities of data. Ascending hierarchical classification (AHC) classifies together similar cases, using as descriptors data which maximize intra-group homogeneity and inter-group heterogeneity. Starting with a large number of variables that are difficult to deal with simultaneously (for the accident: 12 variables; for the context of work: 21 variables) the method creates a synthetic variable which in itself summarizes and replaces the ones used at the outset.

AHC was used first to identify and describe 9 main types of accidents from the injuries and events reported by the workers. It was used again to produce a synthetic variable from information more ergonomic in nature, describing various characteristics of the work context and environmental constraints at the moment of the accident.

Using crosstabs the types of accidents were successively linked with the trade and the task of the injured workers and the characteristics of the construction sites. Finally, accidents were also linked with the synthetic variable summarizing the main characteristics of the various environmental contexts and postural strains.

RESULTS

The AHC method described 9 main types of accidents:
1. back injuries following excessive strain
2. collisions and shocks involving the limbs
3. falls causing fractures
4. back or lower-limb sprains following movement
5. serious cuts to the hands
6. eye irritations or scratches
7. slips and stumbles
8. serious burns to the hands and arms
9. crushing of the feet

The other synthetic variable produced, called "context", groups cases in five categories according to ergonomic constraints at the time of the accident. The principal characteristics of the five groups are as follows:

Group 1: 133 cases (37%) representing in some ways the ideal working context; stationary work done on the ground without technical problems, without encumbrance (congestion and/or clutter), without tardiness, without postural constraint, without fatigue or danger or stress. Yet the workers in this group, as in all others, have had an accident! (most often: a minor eye injury, a cut or a collision).

Group 2: 74 cases (21%) involving stationary work done on the ground in a rather bent position with moderate constraints regarding the encumbrance of the work areas, fatigue, stress and danger.

Group 3: 40 case (11%) of displacement in constrained postures in the midst of enormous time constraints and in very cluttered space. Work is running behind schedule and the workers consider themselves tired and stressed.

Group 4: 54 cases (15%) which involve displacement while working in heights, without loads to handle but where there is an important difficulty in maintaining equilibrium.

Group 5: 56 cases (16%) of stationary work in an extremely bent position where the biggest problems involve the technical organization of work (i.e. availability of proper tools and equipment). In these conditions the task is very demanding and tiring.

The analyses were structured so as to produce "accident scenarios", showing where (the construction sites), how (the tasks), to whom (the trades) and in what context (environmental and postural constraints) the 9 main types of accidents occur. Accidents are most strongly associated with the task and specific gesture, but the findings also point to a link between risks and some typical contexts and postural strains, which proves useful to produce a detailed and complementary information on the circumstances in which the accidents occur. Here are two examples of the importance of the context in the accident scenarios.

Whatever the task is, back sprains following excessive strain (scenario 1) often occur when the worker is in a stationary position while bending over. In the cases where the specific gesture consists in lifting, or holding back heavy material or equipment, the workers describe their jobs as very exacting, stressful and demanding because of the lack of adequate lifting supply. For this particular type of accident, not necessarily associated with any trade or construction site, having access to clear information on the task (handling lifting, installing material) and the context (postural constraints, lack of equipment or proper tool) in which they tend to occur becomes crucial.

Collisions and shocks involving the limbs (scenario 2), although they occur in various situations and tasks, seem particularly associated with a work context where the worker has to move while bending over in a very uncomfortable position; he has difficulty in maintaining his balance because his work space is congested and there may also be schedule problems and pressure. In these cases, the workers describe their job as extremely tiring, stressful and dangerous.

CONCLUSION

The study of the trade and the task immediately appear most useful to describe accidents and to concretely organize prevention. However, the study of the context of work and of postural constraints
proves to be useful as well. On the other hand, individual characteristics proved to be insignificant among the factors considered.

When the type of accident, the task and movements, the site, the material and organizational environment as well as the postural strains are put together in a global perspective, a very nuanced portrait of the risks involved in construction is obtained. Such portraits can help people in the field to organize their prevention. For instance, the detailed study of the “context” has allowed for very good documentation of the constraints affecting the practice of certain tasks in certain trades at the time of restorative work.

The results of this study in the construction industry have been handed to health and safety people and to union and employer representatives in the sector. They are the ones who use the results and establish priorities for training and intervention.

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