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Ergonomics in small workplaces with special reference to occupational health services

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WALTARI, L., JÄRVENPÄÄ, I., TOLONEN, M. and HASSI, J. Ergonomics in small workplaces with special reference to occupational health services. *Scand. j. work environ. & health* 5 (1979): suppl. 2, 24—29. This ergonomic survey comprised 163 small workplaces with a total of 2,400 employees. In 1976 the establishments reported 15 cases of job-related low-back pain and two cases of upper arm conditions to the insurance companies. Poor work postures related to musculoskeletal strain occurred in all the workplaces surveyed, but the faults differed considerably from those usually encountered in medium-sized and large companies. In small enterprises the jobs can be alternated and are varied, and thus the effects of temporary strenuous postures and movements are alleviated. Characteristically, the production and environmental layout of the small establishments often seems to be temporary and poorly planned, at least from an ergonomic point of view. The concept of ergonomics and its practical applications are not as familiar in small workplaces as in larger ones. A greater part of the problems detected could have been avoided if ergonomic know-how had been available. Be it as it may, most failures could be easily reduced or even eliminated by the promotion of ergonomic information and training among proprietors and employees. From the health point of view the most notable ergonomic problems were those associated with materials handling, i.e., manual lifting and carrying. Only 20 % of the lifting conditions fulfilled recommendations. Some 400 jobs would have required supplementary items, most commonly an auxiliary work top or a seat for resting. Most ergonomic problems were encountered in industrial places of work. Ergonomic faults and defects rarely imperil health and safety, but they quite often affect welfare and comfort at work. It is suggested that the staff providing occupational health services should, in the context of their visits to a place of work, survey the work conditions also from an ergonomic point of view and alert the establishment to ergonomic problems. They should also help to review plans for new, expanded, or remodelled facilities. Lifting and carrying postures and the opportunity for relaxation need the most medical attention, particularly in monotonous jobs, precision work, and other jobs causing sustained exertion to one part of the body.

Key words: ergonomics, occupational health services, small enterprises.

The ergonomic survey focused on work postures and movements and the assess-

ment of local physical stress on the musculoskeletal system. The purpose was to determine the compliance of actual work conditions with recommended ergonomic practices.

Furthermore, the kind of corrective measures needed was of primary interest, i.e., whether only purely technical improvements would have to be made or whether complete job redesigning and

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ergonomic training and education of the workers in question were required. In addition, the study included an evaluation of the possibilities for occupational health personnel in health centers to include ergonomics in the offered occupational health services and their role in fulfilling these possibilities, as well as the post-graduate training required for performing ergonomic surveys of workplaces.

It became evident in the planning stage of the project that no suitable ergonomic survey method existed for our purposes. Therefore we also attempted to develop and test a simple and rapid survey method which could be applied generally in municipal occupational health services. The method would consequently focus qualitatively and quantitatively on local stress on the musculoskeletal organs.

Finally, recommendations concerning the correction of ergonomic defects were given to the management of the surveyed workplaces.

THE WALK-THROUGH SURVEY

The survey (8) focused on jobs associated directly with the production of goods. Thus office work, maintenance, cleaning, and transportation were not included. Only work sites with actual activity were studied. [The survey coincided with an economic low in many industries. Many firms worked incomplete weeks or days; also many workers had been laid off. A substantial part of the equipment was not in use. Consequently the survey may give a slightly biased picture of the ergonomic work conditions. It should also be born in mind that, had the number of employees been greater (full-scale production underway), the ergonomic problems may have been enhanced in cramped spaces].

It is stressed that small workplaces were surveyed in which no systematic ergonomic activity whatsoever had been carried out prior to this study. The following items were assessed: work heights, seats, foot space, floor surfaces, pedals, gears and

controls, tools, supplementary items, location of equipment and material, and lifting and carrying conditions.

The number of establishments vary in table 1 since some of the items, for instance, pedals, occurred in only in some places of work.

We assessed the stress attributed to the nature of the tasks by taking the work technique and job design into consideration and paying special attention to work postures and movements. Members of our team observed and evaluated the construction and structure of furniture, equipment, and tools and recorded the dimensions of the work space and the nature of the tasks.

Every work site was observed for about half an hour. Whenever similar jobs were carried out under similar conditions in an establishment, only one or a few work sites and tasks were evaluated, but all of them were recorded (as examined).

The listed items were compared one by one with the respective recommendations published by the Institute of Occupational Health, Helsinki (1, 2, 3, 4, 5, 6, 7, 8), and were scored as follows: 0 = total agreement with recommendation; 0.5 = intermediate deviation from the recommendation; 1 = substantial deviation from the recommendation.

The observers completed the assessment by measuring and photographing the work sites. The jobs and tasks, as well as the equipment within the establishments, were recorded in an interview with the representative of the employer. The employees were interviewed for a description of their jobs and information on the duration and repetition of the various tasks. Thus, a rough evaluation was made of the variation of the work load during a workshift, a workweek, and even during the whole year.

RESULTS

The results indicate the ergonomic level of the items in terms of the respective recommendations and the severity of the detected faults. We also considered the

stress originating from the nature of the job.

The evaluated items differed in significance from the viewpoint of musculoskeletal strain. For example, the effects of bad lifting conditions and a hard floor cannot be compared. Accordingly, a deviation from the recommendation did not, as such, indicate the effect on health because the nature and duration of the load are crucial. An attempt was made to evaluate the effects of ergonomic faults on the workers' health, but it proved unfruitful and hence was abandoned.

Table 1 summarizes the results numerically.

POSSIBILITIES FOR CORRECTING THE OBSERVED FAULTS AND DEFECTS

As the most general but useful simplification, the possibilities for correcting faults were evaluated either as easy or difficult. "Easy" included those immediate measures that could be realized based on the suggestions given to the employer by our team, e.g., acquisition of supplementary items, rearrangement of the work environment, correction of faulty work-site dimensions. "Difficult" were considered solutions requiring reconstruction of machinery, equipment, or workrooms

and those requiring the acquisition of new machines or modernization of the process. Yet some of the "difficult" conditions could be indirectly alleviated by means of job redesign, e.g., by the incorporation of job rotation and workbreaks. Moreover, the workers could be trained to avoid strenuous postures and movements.

Theoretically, a reduction of risks through better work design and the use of better equipment is always possible, but the ergonomic training of foremen and other persons in management (or at least providing them with information) must be regarded as a necessity for continuous ergonomic alertness at a place of work. They must remain alert at all times but particularly when new or altered equipment is about to be operated and when new procedures are started.

Work heights

Two-thirds of the faults detected in work heights could be easily corrected. The difficult problems occurred at industrial places of work, where they were due to structural machine design.

We suggested that general corrections be made in the dimensions of work sites, particularly notching of certain desks, acquisitions of platforms and sinking of high machines so as to fit better ergonomically. Problems difficult to solve were faced in garages and laundries, however.

Table 1. Scores of the items surveyed.

Item	Compliance with recommendation		Intermediate failures		Substantial failures		Total observations (N)
	N	%	N	%	N	%	
Work heights	722	59	346	28	152	13	1,220
Seats	339	55	179	29	96	16	614
Foot space	957	86	125	11	34	3	1,116
Floor surfaces	388	58	162	24	119	18	669
Pedals	156	73	51	24	6	3	213
Gears and controls	201	75	57	21	11	4	269
Tools	536	85	68	11	26	4	630
Supplementary items	268	34	100	13	427	53	795
Location of equipment and material	553	64	238	28	70	8	861
Lifting and carrying conditions	90	20	226	51	127	29	443

Seats

Postural problems related to poor seats could be easily reduced by the acquisition of well-designed seats or by the correction and adjustment of seats already in use. In certain jobs a standing support was recommended instead of a seat.

Foot space

Half of the faults in foot space were difficult to correct. They occurred mostly in industry and were caused by the construction of the machinery. Only one-quarter of the problems encountered in service establishments were difficult. These occurred mostly in garages, service stations, and laundries.

The "easy" problems could be eliminated with the provision of a top thin enough to allow space for the legs and by the removal of cardboard boxes and other hindrances from the foot space.

Floor surfaces

The provision of wooden or plastic gratings, rubber mats, and adhesive gliding hindrances could correct nearly 90 % of the faults found in the floor surfaces. Difficulties arose, however, due to the proximity of a work site to passageways, to the constructions of the work site (sometimes partially on wheels) and to the transportation of articles to and from the work site.

Pedals

All of the problems with pedals were classified as easy to solve. Some workers had already corrected the fault on their own initiative. In cashiers' booths we recommended on-off switches. In some cases, particularly in industry, the reconstruction of pedals would have required engineering skill and expertise.

Gears and controls

The improper location and use of gears and controls caused problems that were

difficult to solve in 65 % of the cases, e.g., the handles and controls of machines. However, new drilling machines were equipped with an adequate handle which could also be installed on older machines. In some cases switches could easily be moved to more accessible locations.

Tools

Half of the ergonomic faults in tools could be easily corrected. In the service establishments the solution required only the replacement of improper cleaning equipment, platters, kettles, stamps, marking devices, etc.

Difficult problems were again associated with the use of power saws, stone drills, grinding machines, and concrete vibrators.

Supplementary items

Nearly all (93 %) of the faults connected with supplementary items could be eliminated easily. Difficulties arose at some work sites because of a lack of space.

Location of equipment and material

Most problems related to the location of equipment and material were amenable with proper advice or the acquisition of auxiliary tops. Once again cramped spaces created the only real difficulty.

Lifting and carrying conditions

The acquisition of devices and other simple arrangements could have eliminated 65 % of the problems involved with lifting and carrying. In 35 % of the cases crowded or cramped spaces and a weak construction of the building caused difficulties, mostly in service establishments.

Musculoskeletal stress associated with job nature

The effect of the type of economic activity, work design, and technological development on work load became evident in the workplaces surveyed. An excellent example of

different loads is the comparison of the handling of concrete products and the manufacture of wooden beads. Yet production characteristics (size, shape, weight and material) were of minor importance in highly developed technological processes, e.g., when the lifting and transporting of articles were mechanized.

Most workplaces studied were small and had no automated or mechanized processes. In a few establishments some jobs included manual gearing and controlling of the process, as well as the reception and packing of goods, and strenuous static postures were observed. Greater task entities were characteristic to small firms, and the workers could, on their own initiative, alternate jobs if, for instance, the production series was long. Some larger companies had arranged systematic job rotation and periodic workbreaks.

In service jobs work stress was temporary since serving the customers included breaks and the rush hours were compensated by quiet periods during the day. Jobs in which the workers continuously sat were noted at cashiers' booths, telephone exchanges, and banks. In these jobs the work movements were rather monotonous, whereas usual office work allowed interruption of the sitting.

DISCUSSION

The survey method used in this study enabled a rapid assessment of the work sites and a classification of the observations into three categories in comparison with ergonomic recommendations. When the results are considered, it should be kept in mind that this survey was carried out in small workplaces where the concept of ergonomics was virtually unknown.

The criteria may also be used elsewhere, i.e., if the user is familiar with ergonomic recommendations and their documentation.

Generally, a major part of the observations tallied with existing ergonomic recommendations, but, on the other hand, ergonomic defects, in terms of the recommendations, were noted at all the work establishments surveyed. Most of the

faults could have been avoided easily with a little planning.

In addition to an obvious lack of ergonomic awareness the survey revealed workplace "blindness": a problem was not "seen" until an outsider pointed it out. Another characteristic feature of the small enterprises was a poorly planned layout which affected both the ergonomic suitability and the productivity of the workplace.

Promotion of ergonomics seems possible only when the participants, i.e., the proprietors and supervisors are motivated and suitably trained. Once the problem is understood, attention can be turned to employee motivation and training. Particularly, the role of the foremen who provide work instruction for new workers is very important, because they must also learn to communicate their experience so that employees understand it and take prompt action to insure proper job habits and practices. The instruction program should stress that ergonomics is an integral part of every job. The supervisor should be instructed to carry out the task of fostering ergonomics in the same manner as he or she attends to other aspects of the job.

The nature of ergonomic failures found in this study indicated that the occupational health personnel might be able to assist supervisors in identifying unnecessary ergonomic stress at small places of work. In order to do so the occupational health personnel should survey the establishments they visit also from the ergonomic point of view. The method used in this project may serve as a screening procedure for factors affecting work postures and movements. Our results indicated that both the occupational health nurses and physicians should be familiar with ergonomic recommendations and be able to give advice concerning the faults they detect.

Companies with absenteeism attributed to disorders of the musculoskeletal system (possibly of occupational origin) should be surveyed specifically for work sites in which materials handling, precision tasks, or monotonous jobs are carried out.

In complicated ergonomic problems the role of occupational health personnel is limited to appraisal of the stress as it

affects individual employees. The solutions, again, often require engineering skill and experience.

The occupational health staff of a municipal health center may also, in cooperation with the regional institute of occupational health in their area, assist in training personnel to be alert to potential hazards and to be aware of methods for controlling common ergonomic problems. Such procedures are essential, particularly in enterprises where new operations are about to be started.

In carrying out these functions, the occupational health staff should periodically, or as the case warrants, visit the work establishment and alert the management to potential hazards. Qualifications of the occupational health staff must therefore include at least basic training in ergonomics pertinent to musculoskeletal strain.

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