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Musculoskeletal Complaints, Ergonomic Aspects And Psychosocial Factors in Two Different Truck Assembly Concepts

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Introduction

Musculoskeletal complaints are prevalent among workers in assembly plants. In many situations, the background to these problems is unclear, and the industries concerned have difficulties to identify adequate preventive measures. The present project aimed at (a) developing a methodological basis for acquisition of adequate information, (b) analyzing the relation between musculoskeletal complaints, ergonomic qualities at the worksite, efficiency of the production system, and psychosocial factors. The project was carried out as a case study of assembly of truck shafts, performed according to two different production concepts.

Material and Methods

The subject of the study was the workers (all men) in two assembly workshops of a Swedish truck factory (System A and B). System A can be characterized as a conventional non driven production line with cycle times of 6-12 minutes. The System A workshop was considered old and outdated, and was replaced by the new System B workshop. In System B the shafts were transported on carriers through a number of parallellized work stations. Two assembly workers followed each axis from beginning to end. The study of System A comprised 17 workers and System B 28 workers. Average age was 30 and 25 years respectively. The study of System B was performed more than one year after the completion of the new assembly hall.

In the project, ergonomists, production engineers and psychologists participated with methods drawn from their respective areas of expertise.

Ergonomic methods included: - 12 months prevalence questionnaire concerning musculoskeletal complaints (1); - video observation of occurrence (frequency and time) of deep forward flexion, work with elevated arms, and manual handling of tools or objects;

Production engineering methods included: - production loss analysis, zero system calculation (2)

Psychological methods included: - questionnaires concerning (a) psychosocial climate, (b) job satisfaction, and (c) physical work environment (3).

Results

The prevalence of musculoskeletal complaints was generally high: for the shoulders 71 per cent in System 1 and 60 per cent in System 2; for the hands 35 per cent in System 1 and 54 per cent in System 2; for the low back 53 per cent in System 1 and 72 per cent in System 2.

The ergonomic analysis showed that work with elevated arms was about as common in System 2 as in System 1. Handling of objects showed a tendency towards increase, whereas deep forward flexion of the back was more common in System 1.

With the exception of physical work environment factors, the psychological instruments showed lower (less satisfying) ratings for System 2 than System 1. This was particularly clear in the items concerned with relations to work supervisors, sense of participation, stress, and stimulation from the job as such.

The production engineering analysis showed about equal figures for different aspects of loss in the production systems, except that System 1 had large losses due to imbalance between work stations along the line; these losses were eliminated in System 2. Work-up was an evident goal in both systems.

Discussion

The results show clearly that the new production system provided a better physical environment, and that there was a potential of higher efficiency. The load on the low back was lower in the new system, whereas load on shoulder and hand was the same or increased. The prevalence of musculoskeletal complaints were in many cases higher in the new system.

Comparison of data from the different instruments showed that there was strong co-variation in ergonomic and psychological data. For instance, those who reported complaints in the shoulders were also less content with the physical and psychological workload; those with complaints in the hands reported also more often that the work was tedious and that they had poor relations to the work supervisors; those who reported complaints in the back found also to a higher degree the work more demanding psychologically.

The results emphasize the need for an interdisciplinary approach when "taking the ergonomic temperature" in a production system. In this case, prioritizing on the basis of a questionnaire for musculoskeletal complaints alone may have been grossly misleading.

The results show also that group assembly does not always give a better situation than does conventional line assembly, neither regarding psychosocial factors, nor regarding factors relating to physical workload and its effect.

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