

PREVENTIVE EFFECTS OF WORK PLACE INVESTIGATIONS IN CONNECTION WITH MUSCULO-SKELETAL OCCUPATIONAL INJURIES

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ABSTRACT. One hundred and ninety-five reports on musculo-skeletal occupational injuries were collected and randomised into two groups: one group where the work places of the injured were visited by *labour inspectors* (LIs) and one control group. The inspectors were instructed to issue *inspection notices* (INs) where appropriate. Ninety-two such visits were paid and resulted in 20 INs. Approximately 15 months later all 195 work places were visited by 3 ergonomists and the ergonomic situations were assessed. When compared with the control group neither the visits from the LIs nor the INs issued were associated with reduced work load among the injured. However, at most work places also other employees were performing the same tasks as the injured persons. Among these employees there was a significant reduction of work load where INs had been issued to the employers. Thus, the main effects of the LI interventions were in primary preventive measures.

Key words: ergonomics, labour inspection, musculo-skeletal occupational injury, prevention.

Each occupational injury (13) reported to the Swedish social insurance system is registered by the *Information System on Work Injuries*, ISA (4). According to the ISA statistics, musculo-skeletal accidents and diseases constitute more than one third of all reported occupational injuries (16, 17). Musculo-skeletal diseases result in sick-leave periods on average 129 days each (17), but the injured often suffer from symptoms for longer periods (9).

Since a reported work injury is regarded as an indicator of unsatisfactory conditions in the work environment (1, 5, 16, 17), the local Labour Inspectorate is automatically provided with a copy of each report (4). Instructions (5, 6) recommend the inspectors to keep informed about injuries reported from work sites for which they are responsible. However, individual reports seldom serve as starting points for

preventive activities (8, 10, *National Social Insurance Board* (NSIB) and *National Board of Occupational Safety and Health* (NBOSH): unpublished papers). It has also been established that preventive measures at work places in general are rare in connection with such injuries (8, NSIB: unpublished papers).

More than 70% of all employees in Sweden have access to occupational health service (2, 4, 10) and, according to the Work Environment Act, every work place with at least 5 employees must have a safety steward (4). Thus, large numbers of professionals are responsible for ensuring a good work environment. However, only the LIs has the legal right to enforce ergonomic and other improvements at work places.

The aim of the present study was to analyse whether preventive ergonomic measures at work places were more often undertaken after investigations performed by LIs than at work places that had not been subject to such investigations, and if there was a difference between employers who had been requested to make such ergonomic improvements as written in an *inspection notice* (IN), and those who had not.

MATERIALS AND METHODS

Study design

During a short period 195 reports on musculo-skeletal occupational injuries were collected consecutively at three Labour Inspectorate offices. Both accidents and diseases, causing over 8 days of sick-leave, were included. Such reports supply data on the injured person and on the characteristics of the injury. The reports covered persons employed in all main occupational groups (16, 17). The reports were randomly subdivided into two groups: the work places in the first group were to be investigated by LIs and the reports in the other group were gathered for control (Fig. 1).

LIs made official visits and assessed the work places of their group within 2-3 months after the time for the reports. Demands on ergonomic and other improvements were made in INs where this was considered necessary. After another 15 months all work places were assessed by 3 ergonomists in order to establish if improvements had taken place (Fig. 1). Recently, a 3-year follow-up study of health, well-being and

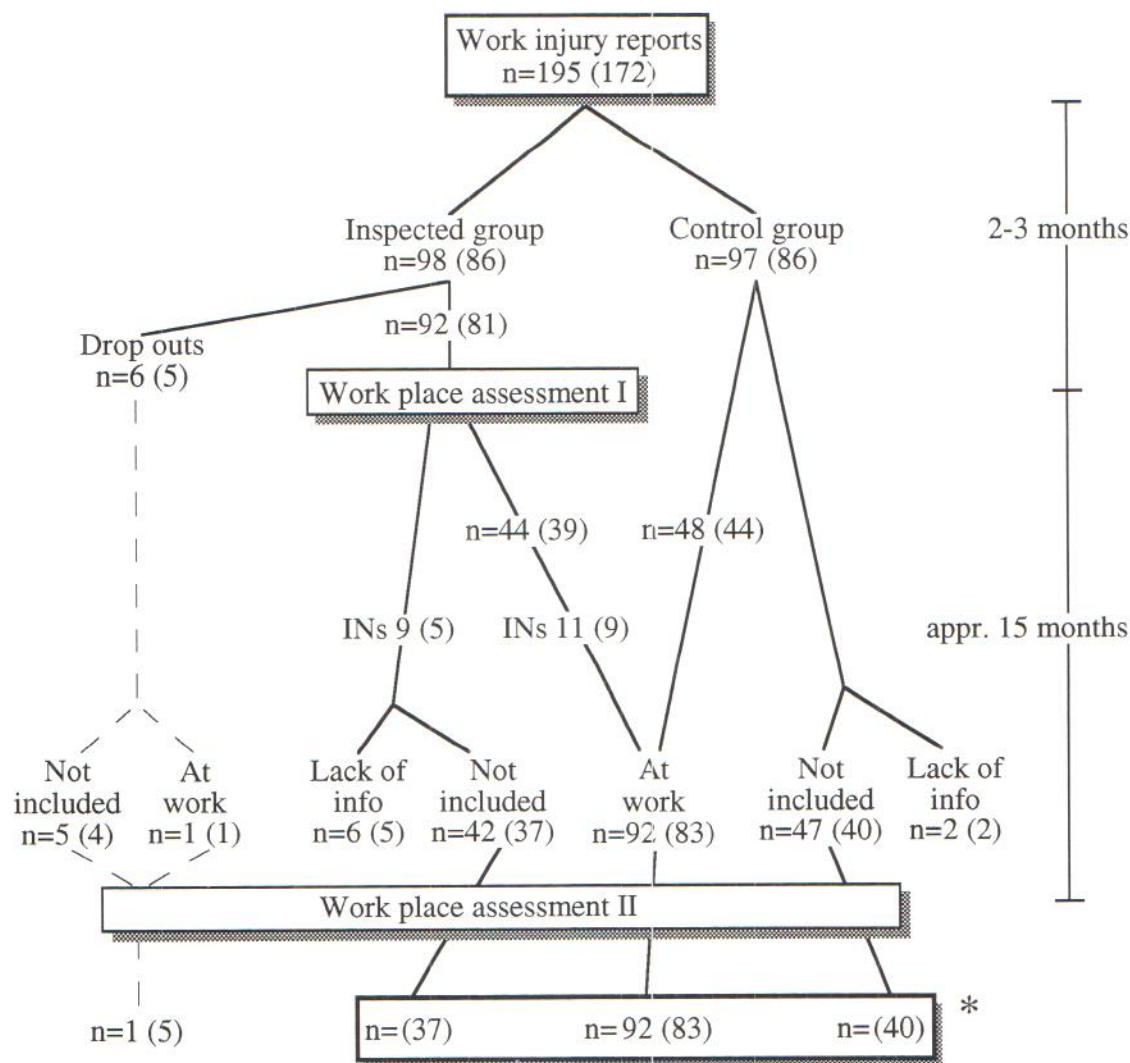


Fig. 1. Flowchart of work place investigations in connection with 195 reported musculo-skeletal occupational injuries. The numbers of work places where work-mates performed tasks equivalent to the injured are given within brackets. IN = Inspection Notice, * = Basis for the analyses in the present study.

functional capacity in the entire study group was published (9).

Investigators and method of investigation

Fifteen IIs from three districts took part in the work place investigations. They had all received general training for 8 weeks, one of which was assigned to ergonomics (10, 14). Most of them had also attended complementary courses in ergonomics. To further increase the level of competence the inspectors attended 2 days of training in identification of musculo-skeletal stress factors. At the same time a special method for the ergonomic work place assessments was introduced (7). The method is based on a check-list of factors documented to be potential risks for musculo-skeletal injur-

ies. The time required to make such assessments is approximately 1 hour (8). Three ergonomists trained the inspectors and also performed the second work place assessments (Fig. 1). For preparation and in order to formulate a standardised approach, the ergonomists had made some twenty assessments together using the same method as the inspectors.

Studied groups

Assessment I (the inspected group). The inspectors assessed the ergonomic conditions at 92 work sites by means of the check-list (Fig. 1). The visits were announced in advance and appointments made with employers and safety stewards as prescribed in the instructions "Methods for inspection" (6). The inspectors were recommended to deliver INs to the

employers following the customary principles of describing insufficiencies and expressing demands in the IN (6). Twenty INs were issued to the employers (15).

Drop outs: Six persons' work places remained uninvestigated (Fig. 1). For 4 persons, after studying the reports, the inspectors decided that individual visits were not required. Two reports were put aside in connection with staff changes at one of the inspectorates.

Assessment II (the inspected group and the control group). **Injured at work:** Approximately 1½ years after the date of the reports all 195 work places were visited by 1 of the 3 ergonomists, who did not know which work places had been visited by the inspectors (8). Information on the ergonomic conditions at the time of the report was obtained through interviews with the injured person, the employer or supervisor, the safety steward and sometimes with other employees. These working conditions were assessed by means of the check-list mentioned above (7). Where the injured were still employed and had been at work during the year also current working conditions were assessed in the same manner (Fig. 1). The two standardised assessments performed by the ergonomists were used to establish whether the ergonomic conditions had improved. *Reduced work load* was considered to have been achieved where physical or organisational measures had been performed in such a manner that the harmful situation described in the injury report and at the interview no longer existed.

Injured not included, lack of information: Individual assessments of current ergonomic conditions could not be performed at several work places, since many of the injured had left their employment or had been on prolonged sick-leave ($n=94$). In 8 cases, information on the background of the injuries was not sufficient for assessments (Fig. 1).

The following analysis of the effects of the inspectors' visits concerns primarily 92 work places where the injured person was at work. Forty-four of these had been visited by the inspectors and 48 work places belonged to the control group (Fig. 1).

Work-mates: At 172 of the work sites, on average 20 persons were performing the same tasks as the injured person (8). The ergonomic conditions were also assessed for these groups. The present analysis of the extent of primary prevention associated with the LI visits applies to 160 of these (Fig. 1).

Selection and analysis of data

The analysis is based on background data from:

the occupational injury report

- personal data
- employment data

the work place assessments

- conditions mentioned in the injury report assessed and related to current ergonomic working conditions

Statistics

Differences in background conditions and in reduction of work load between groups have been tested by χ^2 calculations. Odds ratios (OR) have been calculated as estimates of the likelihood of work place improvements for different groups. To demonstrate the precision of these estimates the OR values are supplemented with 95% confidence intervals (CI) (11).

RESULTS

Background conditions

There were no significant differences in background characteristics between the cases visited by the inspectors and the control group. Thus, in general, the groups were similar and no factors that might have influenced the outcome of the present study were found.

Reduced work load

The injured. At the 92 work stations, the ergonomists established that 91% of the reported situations included tasks which might have injurious effects to the musculo-skeletal system (8). Furthermore, they assessed that a reduction of work load (definition above) had been achieved for 47 of the injured, while 45 injured were working in unchanged conditions or still had a considerable work load. There was no difference in reduction of work load between those previously visited by the LIs and those belonging to the control group (OR; 0.77, CI; 0.34–1.77).

The inspectors had issued 20 INs in connection with their work place visits (15). Eleven INs were issued on behalf of the injured whose work places were later assessed (Fig. 1). Nine of these comprised detailed instructions with reference to the work environment legislation (12) and two were of advisory character. The character of the INs did not differ between the work places that achieved work load and those who remained unchanged. In comparison with the control group, the OR-values did not demonstrate any significant differences as regards the chance of reduced work load, neither where INs were delivered (OR; 1.02, CI; 0.27–3.78), nor where inspection visits were performed without INs (OR; 0.71, CI; 0.29–1.71) (Table I).

Work-mates. Indications of increased preventive activities could only be found among employees who were performing the same tasks as the injured person at the work places that had been visited by the LIs (OR; 1.84, CI; 0.89–3.82). Of the 20 INs issued to the employers, 14 contained demands and advice concerning the working conditions of work-mates. A test of the chance for reduced work load among work-mates demonstrated a significant difference where INs had been delivered ($p < 0.01$). For this sub-group, reduction of work load occurred considerably more often than in the control group (OR; 5.67, CI; 1.87–17.16), whereas inspection visits without INs showed no

Table I. Reduction of work load among injured at 92 work places 18 months after reported musculo-skeletal occupational injuries

	Inspection group		Control-group
	Inspection notice		
	Yes	No	
Reduced work load	6	15	26
Unchanged conditions	5	18	22
Total	11	33	48

Table II. Reduction of work load among work-mates at 160 work places 18 months after reported musculo-skeletal occupational injuries

	Inspection group		Control-group
	Inspection notice		
	Yes	No	
Reduced work load	8	15	16
Unchanged conditions	6	47	68
Total	14	62	84

significant effects (OR; 1.36, CI; 0.61–3.00) (Table II).

To sum up, there was no evidence of a positive effect on secondary prevention for the injured related to LI visits. There was, however, a significant positive association between delivered INs and primary preventive measures for work-mates.

Drop outs. In all the 6 cases not visited by the inspectors, the ergonomists estimated that the working conditions could have had injurious consequences (8). Due to long sick-leaves or turn-over, current ergonomic conditions could be assessed only for one of these injured persons. However, no reduction of work load could be verified. For work-mates, organisational changes had been performed to reduce the work load at one of the work places. Thus, in general, the conditions for these cases did not differ from those for the rest of the study group.

DISCUSSION

The aim of the present study was to analyse whether inspectorate work place visits and issued INs in connection with reported musculo-skeletal occupational injuries would entail obvious preventive measures. Thus the extent of reduced work load was studied for a

group of injured persons. However, LI visits were not associated with an increased rate of work place improvements. Even where INs were delivered to the employers, reduced work load had not been implemented.

Background factors among the injured visited by the inspectors and in the control group were investigated and no unique circumstances were found that could have balanced out expected positive effects from the inspectors' visits. However, the study population was reduced due to lengthy sick-leaves and turn-over, which limited the possibility of conclusive analyses. Further, the low number of INs issued also diminished the power in calculations.

The study among the injured was complemented with equivalent studies of work place improvements among work-mates. This enabled the ergonomists to assess work places similar to those that were vacant due to sick-leave, or turn-over. Further, the potential for primary prevention, in connection with occupational injury reports, could be assessed. Among work-mates, improvements of working conditions were found where INs had been issued to the employers. Thus, mere visits from the inspectors, not followed by any formal demands, did not have any influence on the

working conditions neither among the injured nor among work-mates.

The inspectors delivered detailed work place reports to the ergonomists in charge of the project and at 93% of the work place visits they had identified great or very great risks of injuries to the musculo-skeletal system (15). Despite this, and in spite of instructions given in "Methods for inspection" (6) and in the preparation of the project, INs were issued after only 22% of the work place visits. This proportion was lower than in a study of INs issued after general inspections during the same time period (18).

Demands concerning ergonomic problems are generally rare (2, 10, 15). The NBOSH has recommended that at least one out of three points in INs should deal with ergonomics (NBOSH: unpublished papers) in order to correspond to the proportion of musculo-skeletal disorders registered at ISA. In 1987, after a period of intensified ergonomic education at the Labour Inspectorates, an evaluation made by the supervision department at NBOSH showed that about 12% of the total number of points raised in INs dealt with ergonomic problems (10, 15).

The explanation for the low number of INs in the present study might be that:

- The inspectors did not find the consequences of the inappropriate ergonomic conditions severe enough to warrant a notice.
- The inspectors did not find the ergonomic conditions to be in conflict with the Work Environment Act or did not find applicable regulations.
- The inspectors have had previous experiences that notices in the field of ergonomics have little influence and are not worth issuing.

If these suppositions are true, then education and training seem to be most important to achieve a change of attitudes. An improved knowledge among inspectors concerning causes of work-related musculo-skeletal disorders and of the benefits of improved ergonomic conditions would probably increase the incidence of INs issued and of subsequent legal demands on employers issued from the inspection committees. Cases would be tested and henceforth trigger activity related to ergonomics.

The fact that the impact of INs was apparent only among work-mates might be explained in several different ways, e.g.:

- The assessments of improvements were performed in

a more rigorous and detailed way for the injured persons, thereby giving the impression of less improvement there than for other employees performing the same tasks. However, the same method for the assessments of the ergonomic conditions was used (7) both for the injured and for work mates, and the subsequent analyses were performed in the same manner.

- Preventive ergonomic measures were undertaken where the injuries were severe enough to cause long sick-leaves and where working conditions had been unsatisfactory enough to cause changes of employment. Recent studies (3, 19) have shown that many who quit an employment do so because of experienced or expected health problems. Eriksson (3) suggested that such protests can have a positive influence on work-mates.
- The employer was better motivated for primary than for secondary prevention, i.e., the situation for those already injured was not considered to be worth improving.

There were employees performing the same tasks as the injured persons at most work sites. These groups comprised on average 20 persons (8, 15). Thus, the influence that inspectors may have in primary prevention is not to be neglected. To focus on work-mates rather seems to be an effective method to improve working conditions. To investigate and understand the origin of reported injuries for the purpose of primary prevention is an appropriate task for inspectors (5, 6). Secondary prevention and rehabilitation, on the other hand, devolves on the employer in co-operation with the occupational health service as stipulated in the Swedish Work Environment Act (12).

Thus, the study demonstrates that when assessing the effects of Labour Inspectorate visits it is of importance to remember that they may differ for different target groups. The results indicate that positive effects are mainly to be found in the field of primary prevention.

In the present study the inspectors renounced four visits as perusals of the injury reports indicated to them that individual visits were not required. This attitude is understandable in view of the instructions given for LIs (5, 6). The aim of the project was, however, that the inspectors should visit all the work places. Later, the ergonomists found out that also the excluded work places had ergonomic shortcomings.

When time is limited it is rational, and maybe even

necessary, to give priority to certain inspections and to issue notices only where positive effects can be expected. However, such strategies may gradually limit the criteria for interventive activities. Hence, hesitation to deal with musculo-skeletal occupational injuries and to issue INs of ergonomic character must be counteracted.

Ergonomic matters are not easy to enforce and the implementation of the Swedish ordinance concerning ergonomics is still in process (2, 10, 14). For example, a system for the verbalisation of ergonomic demands and recommendations has been developed during the last years (NBOSH: unpublished papers). This has resulted in a more widespread application of ergonomic regulations (2). Gradually notices of this kind will achieve a more positive outcome (NBOSH: unpublished papers). Quantitative and qualitative improvement of ergonomic interventions by the LIs has thus been established.

REFERENCES

- Andersson, R.: The role of accidentology in occupational injury research. Thesis. Karolinska Institute, Solna, 1991.
- Bjurvald, M.: Governmental strategies for preventing musculoskeletal disorders in Sweden. Newsletter 2 (1988). National Board of Occupational Safety and Health, Solna, 1988.
- Eriksson, K.E.: I QUIT! Individual dispute resolution in working life. (Jag slutar! Individuell konfliktlösning i arbetslivet). Thesis (In Swedish, English summary), Dept. of Sociology of Law, Lund University, 1991.
- Fact sheets on Sweden. Occupational safety and health. Swedish Institute, Stockholm, 1990.
- Instruction for investigations of occupational injuries. (Handledning i arbetsskadeutredning). National Board of Occupational Safety and Health, Solna, 1986.
- Methods for inspection. (Inspektionsmetodik). National Board of Occupational Safety and Health, Solna, 1983.
- Kemmlert, K. & Kilbom, Å.: Identification of musculo-skeletal stress factors which may have injurious effects. Proceedings: 401-404. XIth World congress on the prevention of occupational accidents and diseases. Stockholm, 1987.
- Kemmlert, K., Nilsson, B., Kilbom, Å. & Bjurvald, M.: An investigation of 195 cases of occupational overexertion injuries with special regard to ergonomic working conditions. (Ergonomiska förhållanden och arbetsskadehantering) (In Swedish, English summary). Arbete och Hälsa 1989:33. National Institute of Occupational Health, Solna 1989.
- Kemmlert, K., Dallner Öreljus, M., Kilbom, Å. & Gamberale, F.: A three-year follow-up of 195 reported overexertion injuries. Scand J Rehabil 25: 16-24, 1993.
- Kilbom, Å. & Bjurvald, M.: Ergonomics and musculo-skeletal injuries. International Journal of Industrial Ergonomics 2: 168-172, 1988.
- Kleinbaum, K., Kupper, L. & Morgenstern, H.: Epidemiologic research. Van Nostrand Reinhold Company, New York, 1982.
- Lindh, G.: Amendments to the Work Environment Act etc. with effect from 1st July, 1991. Newsletter 1991; 3: 1-5. National Board of Occupational Safety and Health, Solna, 1991.
- Work injury insurance in Sweden. Ministry of Health and Social Affairs, International Secretariat. Stockholm, 1982.
- Nilsson, B., Bjurvald, M. & Stjernberg, K.: Implementation programme of the Swedish ordinance concerning work postures and working movements. Ergonomics 30: 431-436, 1987.
- Nilsson, B., Kemmlert, K., Kilbom, Å., Andersson, R. & Bjurvald, M.: Prevention of occupational overexertion injuries through systematic investigations. (Prevention av belastningsskador genom riktad arbetsskadeutredning) (In Swedish, English summary). Undersökningsrapport 1990: 9. National Institute of Occupational Health, Solna, 1990.
- Official statistics of Sweden. Occupational accidents 1987-1988. National Board of Occupational Safety and Health, Solna, Sweden, 1990.
- Official statistics of Sweden. Occupational diseases, 1987-1988. National Board of Occupational Safety and Health, Solna, 1990.
- Remaeus, B.: Evaluation of effects. Newsletter 1991; 4: 1-7. National Board of Occupational Safety and Health, Solna, 1991.
- Östlin, P.: Occupational career and health. Thesis. Faculty of Medicine, Uppsala University, 1990.

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