Preventive Effects on Low Back Pain and Occupational Injuries by Providing the Participatory Occupational Safety and Health Program

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Abstract: Preventive Effects on Low Back Pain and Occupational Injuries by Providing the Participatory Occupational Safety and Health Program: Shigeki Koda, et al. Department of Public Health, Kochi Medical School—The goal of the study was to estimate the effects of a participatory occupational safety and health (OSH) program on the incidence of low back pain (LBP) and occupational injuries (OIs). This participatory OSH program was introduced in the Tokyo Metropolitan Bureau of Waste Management in 1986. The authors examined the incidence rates of LBP and OIs with lost working time and/or medical care cost. The incidence rate per 100 full-time employees was calculated from 2,297 claimed cases of LBP and 9,272 claimed ones of OIs from 1984 to 1994. The strategy of a participatory OSH program, which developed original rule-based OSH activities, included two factors: OSH activities that involved employees and employers from 1986 to 1990, and have been promoted by employee participation since 1991. The incidence rates for LBP and OIs have decreased from 2.73 and 8.30 per 100 full-time employees in 1986 to 0.87 and 5.02 in 1994, respectively. The participatory OSH program, which has promoted employee-employer involvement and employee participation, is effective in preventing LBP and OIs in the workplaces. (J Occup Health 1999; 41: 160–165)

Key words: Participatory occupational safety and health program, Low back pain, Occupational injuries, Waste management work

According to the statistical data on occupational injuries and diseases in Japan, low back pain (LBP) exceeded the number of occupational diseases due to injuries by 60%, and LBP is one of the most common, costly, and serious problems relating to occupational safety and health in Japan. LBP is reported to be affected by not only many occupational risk factors such as handling heavy materials, working posture, coldness, whole body vibration, overwork, short of resting time, etc., but also by non-occupational factors such as aging, family affairs, interpersonal relationships, etc. In order to prevent LBP, a comprehensive occupational safety and health (OSH) program should be provided in the workplace.

The International Labour Organization provided participatory OSH activities in small-sized enterprises in developing countries. A participatory OSH program is a new approach in contrast with a rule-based program which has been provided in Japan. The participatory OSH program, which is designed for a small group (10 employees or fewer), is mainly based at each worksite and all employees participate in the activities. Joint employee-employer involvement in planning and executing the OSH activities is important. Employees and employers should maintain periodic communication. Employers should guarantee employees’ proposals and actions in meetings, and employees and employers propose improvements in the workplaces, considering the effectiveness, feasibility, priority and cost of these improvements. The participatory OSH program gives impetus to the employee-employer involvement and employee participation.

In recent years a participatory program has been introduced into educational materials and training for workers and residents in handling dangerous and/or hazardous factors in the workplace and communities in the United States. Although a participatory OSH program is reported to promote safety and health awareness among employees and employers, few reports have examined the preventive effects of a participatory OSH program on the incidence of occupational and environmental diseases and accidents.

As there are many common risk factors for LBP and occupational injuries (OIs), especially musculoskeletal
occupational injuries, the authors can expect that improvements in the workplace would have preventive effects for LBP and OIs. The purpose of this study is to discuss the development of the participatory OSH program which the authors have introduced into the workplace, and to examine its effects in preventing LBP and OIs.

**Methods**

A participatory OSH program in the workplace should be supported by employee and employer cooperation and contain explicit objectives on occupational safety and health. And this study was conducted at the Tokyo Metropolitan Bureau of Waste Management (the Tokyo Waste Bureau). As the waste management job is classified as a dangerous one and ruled according to Japanese OSH Acts, the waste operations should be obligated to provide many OSH activities in contrast with operations in other industries. The Tokyo Waste Bureau has been engaged in collecting, transporting, disposing of, incinerating, and landfilling with municipal solid waste and refuse in 23 wards in Tokyo. This bureau consists of forty-four collecting and transporting facilities, ten incinerating plants and one disposing plant. The number of employees and the annual volume of collected waste per employee from 1984 to 1994 are shown in Table 1.

The authors have observed the development of OSH activities in view of employee-employer involvement and employee participation from 1984 to 1994, and provided OSH seminars and training courses in cooperation with the workers’ union from 1992. In the United States, several successful learner-centered training programs have been reported among public employees, workers in automobile industry, hazardous waste workers and so on11, 13, 15). Employee-employer involvement, small class size, explicit learning objectives defined in advance, a realistic prospect of improving the worksite, plenty of discussion, problem-solving exercises, etc., are pointed to as the features of successful safety and health training programs. Considering these successful features, the authors have provided seminars and training courses for OSH committee members, and aimed at increasing the ability of workers to solve problems and to promote occupational safety and health conditions by using practical materials in the workplace.

There are many reports on LBP and its risk factors, which are designed as cross-sectional studies and discuss the prevalence of LBP as a measure of morbidity5–7, 15). A worker sometimes suffers from LBP during his/her working life and the symptoms of LBP go from better to worse, and so the temporal relationship between LBP and affecting factors cannot be established by cross-sectional data16–18). In this study, the authors examined the crude incidence rates of work-related LBP and OIs with lost working time and/or medical care cost, in order to evaluate the preventive effects of the development of a participatory OSH program on the occurrence of LBP and OIs in the workplace. The incidence of work-related LBP and OIs per 100 full-time workers in one year was calculated from 2,297 claimed cases of LBP and 9,272 claimed cases of OIs from 1984 to 1994. In the Tokyo Waste Bureau, all claimed cases of LBP and OIs were accepted and evaluated in view of work-relatedness by employees and employers in advance. As a result, 98.7% of claimed cases of LBP and 100% of claimed ones of OIs were compensated.

**Table 1.** The number of employees, collected waste volume, and incidence of LBP and OIs in the Tokyo Metropolitan Bureau of Waste Management (1984–1994)

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of employees</th>
<th>Collected waste volume*</th>
<th>LBP cases</th>
<th>LBP incidence**</th>
<th>Occupational Injuries cases</th>
<th>Occupational Injuries incidence**</th>
<th>OIs except LBP cases</th>
<th>OIs except LBP incidence**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>12,629</td>
<td>243.7</td>
<td>343</td>
<td>2.72</td>
<td>1,089</td>
<td>8.62</td>
<td>746</td>
<td>5.91</td>
</tr>
<tr>
<td>85</td>
<td>12,422</td>
<td>254.3</td>
<td>332</td>
<td>2.67</td>
<td>1,057</td>
<td>8.51</td>
<td>725</td>
<td>5.84</td>
</tr>
<tr>
<td>86</td>
<td>12,042</td>
<td>275.7</td>
<td>329</td>
<td>2.73</td>
<td>1,000</td>
<td>8.30</td>
<td>671</td>
<td>5.57</td>
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<tr>
<td>87</td>
<td>11,916</td>
<td>286.8</td>
<td>246</td>
<td>2.06</td>
<td>997</td>
<td>8.37</td>
<td>751</td>
<td>6.30</td>
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<tr>
<td>88</td>
<td>11,630</td>
<td>300.6</td>
<td>226</td>
<td>1.94</td>
<td>938</td>
<td>8.07</td>
<td>712</td>
<td>6.12</td>
</tr>
<tr>
<td>89</td>
<td>11,447</td>
<td>318.4</td>
<td>185</td>
<td>1.62</td>
<td>840</td>
<td>7.34</td>
<td>655</td>
<td>5.72</td>
</tr>
<tr>
<td>90</td>
<td>11,234</td>
<td>321.9</td>
<td>142</td>
<td>1.26</td>
<td>759</td>
<td>6.76</td>
<td>617</td>
<td>5.49</td>
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<td>91</td>
<td>11,193</td>
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<td>131</td>
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<td>312.0</td>
<td>119</td>
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<td>592</td>
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<tr>
<td>94</td>
<td>10,621</td>
<td>316.4</td>
<td>92</td>
<td>0.87</td>
<td>533</td>
<td>5.02</td>
<td>441</td>
<td>4.15</td>
</tr>
<tr>
<td>total</td>
<td>127,499</td>
<td>—</td>
<td>2,297</td>
<td>—</td>
<td>9,272</td>
<td>—</td>
<td>6,975</td>
<td>—</td>
</tr>
</tbody>
</table>

*: the annual amount of collected waste (tons) per employee, **: number of cases per 100 full-time employees.
Results

1. Development of a participatory OSH program

There had been many occupational accidents and injuries at the Tokyo Waste Bureau before 1985; for example, 23 workers had died from occupational accidents during the 20 years preceding 1985. In order to cope with occupational safety and health conditions, the workers' union and employers of this bureau promulgated occupational safety and health regulations in 1985, and initiated the OSH activities.

The OSH activities in the Tokyo Waste Bureau have consisted of three steps as shown in Fig. 1. Before 1985, this bureau provided rule-based OSH activities which were dictated by Japanese OSH Acts: walk-through surveys by OSH professionals, OSH committee meetings of representatives of employees and employers, environmental measurements of hazardous chemicals, occupational educational materials for hazardous and dangerous risk factors, periodical medical examinations and specific medical examinations for hazardous chemicals, etc.

At the beginning of the second step, a participatory OSH program was started in 1986, which developed the original and rule-based OSH activities by employee-employer involvement. In order to prevent serious occupational accidents, employees and employers discussed the statistical data on occupational injuries occurring at each worksite and the causes of serious and repetitive accidents. As a result of these discussions, collecting and transporting work has been recognized as the most dangerous job, and the workers' union and employers cooperatively published a safety procedure manual of methods of collecting and transporting waste in 1986 and proposed several improvements. Walk-through surveys by representatives of employees and employers were started in this second step.

The proposals for improvements by the workers' union and employers were discussed as to priority and feasibility, and the improvements were introduced into the workplace. These improvements have been executed and evaluated in the workplaces. For example, garbage carts, trucks for recyclable refuse and garbage pails have been examined and improved to prevent LBP and OIs. The personal protective equipment, such as safety shoes, safety gloves, helmets and clothes, has been re-evaluated in terms of safety and functionality, and introduced into the workplace after a half or one year trial. Safety check-ups in the workplace by all employees from 1992 have promoted employee participation, and information based on these safety check-ups and walk-through surveys has been considered in making new improvements. After the collection of recyclable refuse started in 1992, a revision of the safety procedure manual was published in 1993, which focused on the collection of recyclable refuse. All employees participated in a safety training class once a year based on the revised safety procedure manual. Although these OSH activities involved employees and employers, the authors recommended to the workers' union that employees should plan and execute more practical OSH activities in the workplace.

The authors have provided OSH seminars and training courses for OSH committee members since 1992. These OSH seminars and training courses are held for five days (total 14–20 h) every year. In these seminars, participants could examine safety procedures and accident case studies, discuss potential improvements in the workplace in view of their priority and feasibility, take part in walk-through surveys with check-lists, and have trial discussions on OSH committee and planning OSH activities, etc. The features of these seminars were explicit learning objectives presented in advance, a small

![Fig. 1. Development of OSH activities at the Tokyo Metropolitan Bureau of Waste Management (1984–1994). E-E I*: Employee-Employer involvement, E P**: Employee Participation.](image-url)
discussion group (4 or 5 persons), lots of discussion, problem-solving exercises with many audiovisual materials (video, slide and OHP, etc.) of real workplaces, etc. The promotion of employee participation is the main characteristic of the third step of OSH activities in the Tokyo Waste Bureau.

2. Preventive effects of a participatory OSH program on LBP and OIs

The numbers of full-time employees who claimed cases of LBP and OIs, and the incidence rates per 100 full-time employees of LBP and OIs from 1984 to 1994, are shown in Table 1. Whereas the number of full-time employees has been decreasing gradually since 1984, the incidence of LBP decreased from 2.73 in 1986 to 0.87 in 1994, and the rate of OIs decreased from 8.30 to 5.02 in the same period. As for OIs except LBP, the incidence decreased from 5.57 in 1986 to 4.15 in 1994, but decreased less from 1986 to 1991. In order to examine preventive effects of developments of the participatory OSH activities, the percentages of LBP and OIs except LBP in 1986 are shown in Fig. 2. LBP decreased by 68.1% from 1986 to 1994. The incidence of OIs except LBP decreased less during the second step of a participatory OSH program from 1986 to 1990, but decreased by 23.6% during the third step of this program, from 1991 to 1994.

Discussion

In order to examine the preventive effects of a participatory OSH program, the authors should make a comparison with the same sized and job-titled workplace not provided by a participatory OSH program as a control group, or should divide the Tokyo Waste Bureau into two groups, in which a participatory OSH program is provided and not provided. Because of the difficulty of setting up a control group and the serious condition of occupational safety and health of this bureau in 1986, the authors have examined the incidence of LBP and OIs by intervening with the development of a participatory OSH program.

The authors19) discussed the preventive effects of a participatory OSH program on the number of cases of compensated LBP in the Tokyo Waste Bureau, compared with the nationwide number of cases of compensated LBP. A comparison of these two sets of data might depend on the criteria of workers’ compensation and not reflect the magnitude of the problem of LBP in the workplace. As the cases of LBP in this study were claimed by employees suffering from LBP and accepted by employees and employers, the incidence rates of claimed cases of LBP are reliable as to work-relatedness and reflect the magnitude of the problem of LBP in the workplace. Snook20) reported annual rates of LBP per 100 workers among different industries according to California

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![Fig. 2. The percentages of LBP and OIs except LBP compared with those of LBP and OIs in 1986.](image-url)
workers’ compensation data in 1979. While trucking and warehousing (2.29 per 100 full-time employees), lumber and wood products (2.22) and stone, clay and glass products (2.01) have been reported as very high annual rate groups, the incidence rate of this bureau in 1984 (2.72) was higher than in those other industries. The incidence rate of this bureau decreased to 0.87 in 1994, which was near average for that in all industries (0.78).

As for the aging factor, the U.S. Department of Health and Human Services, Public Health Service proposed to reduce work-related injuries resulting in medical treatment, lost time from work, or restricted work activity from 7.7 per 100 full-time workers in 1987 to no more than 6.0 in 2000. Considering that a participatory OSH program in this study deceased the incidence of OIs from 8.62 in 1984 to 5.02 in 1994, these results indicate that this program is very effective in preventing LBP and OIs.

Although the number of employees has gradually decreased from 1984 to 1994, there might be an association with the healthy worker effect in analyzing the incidence of LBP and OIs. As employees in this study were hired out as local governmental officers and few of them left employment due to ill health before the age limit, the healthy worker effect is less related to this population. As the incidence in this study is not adjusted by age, a gradual decrease in the population due to retirement under the age limit is associated with a gradual increase in the average age of the population. This suggests that the aging factor as a confounding variable might increase the incidence of LBP. As for the work loads in waste management work, the annual volume of collected waste per employee had increased from 243.7 tons in 1984 to 322.0 tons in 1991, and did not change substantially from 310.7 tons in 1992 to 316.4 tons in 1994. This suggests that work loads in waste management work did not decrease during the observation period.

The U.S. National Institute for Occupational Safety and Health published, “A proposed national strategy for the prevention of musculoskeletal injuries” in 1989. Their strategy includes four steps: refining surveillance systems, evaluating causes and effects, controlling occupational risk factors, and increasing awareness and promoting interventions. The first three steps depend on epidemiology, ergonomics, occupational hygiene, safety engineering and so on, but the last step reflects the strong influence of communication models and dissemination in occupational safety and health. A participatory OSH program is one of communication models and promotes joint employee-employer involvement and employees’ participation. The presentation of feasible improvements, building consensus between employees and employers, immediate implementation and evaluation as participatory steps can implant OSH consciousness in employees’ and employers’ minds, and provide them with the ability to solve problems themselves and experiment to make the best improvements.

A rule-based OSH program has provided many regulations and controls for hazardous and dangerous factors in environmental and working conditions, and this program is effective in work-induced disorders such as chemical poisoning and pneumoconiosis. LBP is a typical work-related disorder affected not only by environmental and working conditions but also by psycho-social factors and work organization. Regulations provided by a rule-based OSH program cannot cope effectively with psycho-social factors and work organization. Since a participatory OSH program is based on a small group of people, it can address a broad range of local needs in the workplace, including individual health conditions and job experience, switching to new working procedures, responsible job designs, setting an autonomous group, etc. The incidence of occupational injuries except low back pain since 1991 in this study has decreased in the third step of the participatory OSH program, and this suggests that a participatory OSH program could cope with a broad range of occupational safety and health issues in the workplace.

As a participatory OSH program is a new approach in contrast with a rule-based program, the authors have to examine the effects and possibilities of this program in the workplace.

Acknowledgment: This participatory OSH program has been supported by employees’ and employers’ long time efforts at the Tokyo Metropolitan Bureau of Waste Management, and the authors greatly appreciate their cooperation and challenge. The authors wish to thank Dr. Shingo Nakagiri for his assistance in providing a participatory occupational safety and health program.

References