

Effects of a Worker Participatory Program for Improving Work Environments on Job Stressors and Mental Health among Workers: A Controlled Trial

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Abstract: Effects of a Worker Participatory Program for Improving Work Environments on Job Stressors and Mental Health among Workers: A Controlled Trial: Yuka KOBAYASHI, et al. The Health Support Center, West Japan Works, JFE Steel Corporation—The Mental Health Action Checklist for a Better Workplace Environment (MHACL) is a tool for a worker participatory approach to improve work environments for worker mental health. The present study investigated the effects of an organizational intervention using the MHACL on reducing job stressors and the psychological distress of workers of a manufacturing enterprise in Japan with a controlled study design. Nine of 45 departments participated in a work environment improvement program, including planning workshops, implementation and monitoring, between July and December 2005 (intervention group, n=321). The remaining 36 departments served as the control group (n=750). Outcomes (job stressors, worksite support, psychological distress, etc.), measured using the Brief Job Stress Questionnaire, as well as sick leave days taken from the company record, were recorded before and six months after the program for both groups. Among women, skill underutilization, supervisor and coworker support, psychological distress, and job satisfaction changed more favorably in the intervention group than in the control group ($p<0.05$). No significant favorable effect of the program was observed among men. Improvements in the outcomes were more prominent among departments with a 50% or higher rate of worker participation in the planning workshops and among departments with a 50% or higher rate of implemented

vs. planned actions. A worker participatory organizational intervention using the MHACL seems effective for promoting mental health among Japanese white-collar women.

(*J Occup Health* 2008; 50: 455–470)

Key words: Occupational mental health, Organizational intervention, Intervention process, Intervention study

An organizational or work environment-oriented approach to the prevention of job stress involves the reduction of environmental psychosocial job stressors and the enhancement of buffering factors at work¹. In a review of several good practices using this approach, it was identified as an effective way to reduce job-related strain and improve health among workers, providing better and more sustaining effects than an alternative, individual-focused approach². Indeed, previous studies have also reported that organizational interventions had favorable effects on the reduction of job stressors, depression, and sick leave, as well as an increase in job satisfaction^{3–8}. These interventions included a wide variety of approaches including improved workplace layout³, improved communication and ways of supervision^{4, 6}, and increased frequency of meetings^{7, 9}. These approaches can be categorized into three categories in terms of their focus of intervention¹⁰: (1) task characteristics, (2) work conditions (ergonomic issues, workhours, etc.), and (3) role clarification and social relationships. Some were controlled trials^{4, 6}, some were randomized controlled trials^{7, 9}, but most were a before-after comparison without a control group. Several literature reviews have suggested that organizational interventions have insignificant effects on individual well-being and organizational outcomes^{10–12}. This is mainly due to the limited number of well-designed studies, the large heterogeneity of organizational approaches, and

Received Dec 10, 2007; Accepted Aug 1, 2008

Published online in J-STAGE Nov 21, 2008

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inconsistencies in intervention effects among studies¹⁰).

As recent reviews of organizational interventions for job stress¹⁰ have suggested, organizational interventions using a worker participatory program^{4, 13} with guidance by experts are more likely to produce a positive effect. This is in concordance with previous experiences in ergonomic interventions that found that a worker participatory approach was useful for effective ergonomic improvement^{14, 15}. It is quite reasonable to expect workers to be able to find ways of improving their workplaces if they are fully empowered, given a chance to do so, and appropriately guided by occupational health staff. In addition, a worker participatory approach would be beneficial for enhancing the inner psychological resources of workers, in addition to improving work environments¹⁶. In combination with a participatory approach, tools for the assessment of psychosocial work stressors and distress have often been used, and work environment improvements based on such psychosocial assessment have been reported to be effective in promoting worker health and productivity¹⁷. Such an approach could be even more effective if it were implemented within an occupational safety and health management system with a Plan-Do-Check-Act cycle¹⁸.

The Mental Health Action Checklist for a Better Workplace Environment (MHACL) is a newly developed tool for facilitating a worker participatory approach to improve work environments for the better mental health of workers¹⁹. The tool was developed as a guide for improving work environments for worker mental health based on collecting, sorting, and classifying more than 250 good practices obtained from successful cases of improvement of work environments and work organizations among workplaces in Japan. The MHACL is primarily designed for use with small group activities by workers, guiding them to discover effective and feasible ways to improve their work environments. The tool has been applied in several workplaces, and the results have shown that the tool encouraged worker participation in developing ideas and plans for work environment improvement¹⁹. To date, however, no controlled intervention trial has been conducted to ascertain the effectiveness of this tool in reducing job stressors or enhancing worker mental health.

Another problem of previous interventions using an organizational approach is that researchers have not paid much attention to the intervention process (or the process evaluation)^{10, 20–23}, and only a limited number of studies have reported a great impact of the process factors (such as motivation, participation, and role clarification during an intervention) on the effectiveness of intervention programs^{24–26}. Even when one uses a potentially effective procedure to improve environmental job stressors, an intervention may not be effective if it is not fully implemented. One should thus monitor the

implementation process during an intervention and relate it to the observed findings. Few previous studies have reported such a process.

The aim of the present study was to investigate the effects of a worker participatory organizational intervention on the reduction of job stressors and the enhancement of the mental health of workers. A controlled study design, using the MHACL with assessment-based interventions, was used in white-collar departments of a large manufacturing enterprise in Japan. The primary outcomes investigated were selected job stressors, psychological distress, and sick leave among workers. We also assessed the implementation of the intervention using two process indicators, i.e., the proportion of workers who participated in an intervention workshop and the proportion of actions actually implemented to those planned.

Subjects and Methods

This study was conducted at a large-scale manufacturing enterprise located in western Japan. It included 45 worksites with 10 or more employees (27 engineering departments, 14 clerical departments, and 4 research departments), and excluded departments operating on rotating shifts because of apparent difficulties in applying a worker participatory intervention program. A work environment improvement program was conducted in 9 of these departments (393 employees) as the intervention group; the remaining 36 departments (1,041 employees) were used as a reference group. Participation in the intervention (or the control group) was determined based on a decision by each section head.

A worker participatory program for the improvement of psychosocial work environments was developed and applied to the intervention departments between July and December, 2005. No particular activity for the improvement of work environments was conducted in the control departments during this period.

All employees in both the intervention and control departments were asked to fill in a self-report questionnaire and return it twice, once in June 2005 (a baseline worker survey) and one year later in June 2006 (a follow-up worker survey) for most departments (for some departments, in September 2005 [baseline] and September 2006 [follow-up]). The questionnaire measured job stressors and stress reactions over the past month. For the intervention group, 348 employees returned the questionnaire in 2005 (response rate, 89%), and of these, 321 employees responded to the follow-up worker survey (follow-up rate, 92%). For the reference group, 918 employees completed the questionnaire in 2005 (response rate, 88%), and of these, 750 employees responded to the follow-up worker survey (follow-up rate, 82%).

The questionnaire data along with information on the

sick leave of the workers were merged and set up as a database by the Occupational Health Department responsible for conducting this program (YK, AK). The database was sent to one of the authors at the University of Tokyo (NK) for analysis after removing all identifiers (e.g., employee number and name) of individual workers and obtaining approval from the company. All workers in the participating departments were informed of the study aim, procedures, and confidentiality policy regarding individual worker information by a notice posted on a bulletin board. Further, all workers were given the chance to ask about any part of the program and withdraw their individual data from the study at any time during a two-month period after the start of the study. The entire study procedure was reviewed and approved by the Ethics Committee of the Graduate School of Medicine/Faculty of Medicine of the University of Tokyo.

Intervention program

1) A work environment improvement team

A work environment improvement team provided support for each department throughout the intervention, including the preparation, a planning workshop, and the follow-up. The team consisted of an occupational physician, an occupational mental health specialist (a clinical psychologist), and occupational health nurses. In the preparation phase, the team developed a workplace stress profile for each department based on the baseline survey as a risk assessment and risk communication tool. Then the team met a section head of each department, reported the stress profile, and motivated him/her to improve the work environment. Then, the team invited the whole department to a planning workshop for work environment improvement using the MHACL¹⁹⁾. In the follow-up phase, the team provided help and advice for a section head to implement plans for work environment improvement in each department on request.

2) Mental Health Action Checklist for a Better Workplace Environment (MHACL)

The MHACL is a list of 30 action items used to improve work environments for better worker mental health, which covers a wide variety of work environments, including psychosocial work environments (e.g., participation and mutual support) and non-psychosocial work environments (e.g., physical environments and workplace layout) which might cause psychosocial stress or distress among workers (see Appendix)²⁷⁾. These action items are categorized by six technical areas: (A) Sharing work planning, (B) Work time and organization, (C) Ergonomic work methods, (D) Workplace environments, (E) Mutual support at work, and (F) Preparedness and care. The MHACL was developed by a group of researchers¹⁹⁾, including one of the authors (NK), through a four-step process: (1) Document review, in which cases of

successful improvement were collected, classified according to the type of improvement, and adjusted for the MHACL model; (2) Site application, in which trials were conducted in the form of workshops, sometimes including industrial health staff; and (3) Review of improvement phases and the re-composition of the improved areas. The MHACL was designed for use in a group-based workshop as a guide or reference, with which employees could efficiently discuss and find out how they could improve the work environment of their department. Although the MHACL already provides specific action items, the intention is not to recommend workers to do some of these action items as they are, but to facilitate a discussion by workers and the development of their own ideas of actions relevant to their departments, by using these action items as a cues or “good practice” examples, to reduce stress at work and achieve better mental health among them.

3) Planning workshops

Employees in each of the nine intervention departments were asked to participate in a workshop using the MHACL which was held between July and December, 2005. A total of 239 of the 321 employees attended the workshop (an overall participation rate of 61%, ranging from 24% to 100% by department). The proportion of the employees who participated in each workshop was used as an indicator of the degree of employee participation in the program. The workshops were organized and held by the departments, and they consisted of three parts: (1) 30-min introductory lecture, (2) 60-min group work, and (3) presentation and overall discussion. In the introductory lecture, occupational health staff gave three types of materials to employees: objectives and schedule of the workshop, the MHACL, and a blank summary sheet for each group to record their discussions. Then, occupational health staff gave a 30-min lecture, with questions and answers, which included lectures on basic knowledge about stress and mental health at work, concepts related to improving work environments, and how to use the MHACL in group work. The lecture also included feedback of the results of the job stress survey for that particular department at baseline. Then, participating employees were divided into groups of 4–10 each for group discussions. The occupational health staff also participated in each group to facilitate the discussion, answer questions, and give advice if necessary. Each group was asked to nominate a chair, presenter, secretary, and timekeeper, and start a discussion about their work environment based on the results of the job stress survey for the department. Then each group was asked to work with the MHACL to discuss possible measures to improve their work environment by identifying MHACL action items and prioritizing them. Each group was given specific instructions to first list no

more than three action items that had already been introduced or conducted in their department (that is, the “good features of the department”), and then list no more than three action items that might be useful and that group members would like to use for better worker mental health in their department. This procedure was done to facilitate group discussion. Also participants were instructed to put more focus on low-cost improvements for immediate change of their work, daily stress, and mental health. At the end of each workshop, a presenter from each group made a presentation describing their selected action items and relevant discussion, using a summary sheet with a projector. This was followed by a question and answer session, and overall discussion. A department section head then made some comments on proposed action plans from employees. Finally, with advice from the work environment improvement team, a final decision was made by the section head on which plans should be implemented for each department. About 90% of proposed action plans on average (100 action plans in total for all departments) were approved for implementation by section heads. Proposed but not approved action plans tended to be less specific, or needed big budget, or had already been taken but had not been well-recognized by employees.

4) Follow-up

The work environment improvement team encouraged and monitored the implementation of action plans in each department after the workshop, and gave advice if requested. To facilitate the implementation, each section head was required to report on the implementation status in November 2005, if they had already completed a planning workshop, and in November 2006 for all intervention departments. On both occasions, we conducted a follow-up workplace survey of the intervention departments to find out how the action plans were implemented. We obtained information from a section head on which action plans had been implemented from among the action plans proposed in the workshop. In the present study, we calculated the implementation rate, i.e., the ratio of the number of implemented action plans to proposed action plans, for each intervention department, based on the information obtained from the November 2006 survey.

Outcome measures

1) Job stressors and psychological distress

The primary outcome measures in the present study were job stressors and psychological distress. The information was collected using a self-report questionnaire in June 2005 (at baseline) and in June 2006 (at one-year follow-up) (for some departments, in September 2005 [at baseline] or September 2006 [at one-year follow-up]). The questionnaire included the original

(Japanese) version of the Brief Job Stress Questionnaire (BJSQ)²⁸⁾, which is a 57-item multi-dimensional job stress questionnaire using a 4-point Likert-type response option (from “strongly agree”=4 to “strongly disagree”=1) to measure job stressors, worksite support, and psychological distress among workers. For job stressors, we calculated scores of quantitative job overload (three items), qualitative job overload (three items), physical demands (one item), job control (three items), skill underutilization (one item), interpersonal conflict (three items), poor physical environment (one item), suitable jobs (one item), intrinsic rewards (one item), as well as scores for the individual items constituting these scales. Supervisor support and coworker support were measured using three-item scale scores, ranging from 3 to 12, for which a higher value was indicative of greater supervisor or coworker support. An 18-item scale from the BJSQ was used to measure five aspects of psychological distress or mood: vigor (3 items), anger-irritability (3 items), fatigue (3 items), anxiety (3 items), and depression (6 items). The BJSQ also measures job satisfaction (1 item). We calculated the scale scores, with a higher score indicating a greater tendency for a particular construct. All of these scales have been proven to show acceptable or high levels of internal consistency, reliability and factor-based validity²⁸⁾.

2) Health risks associated with job stressors

As additional indicators of possible health hazards associated with job stressors, we used the “health risks” associated with job stressors estimated by the Job Stress Assessment Diagram (JSAD)²⁹⁾ based on the job demand-control-support model^{30, 31)}. These risks included the “health risk associated with job strain” and the “health risk associated with worksite support,” for which the calculation parameters were estimated based on the combinations of job demand and job control, and that of supervisor and coworker support, respectively, using logistic equations to predict depression derived from a larger sample of Japanese workers (relative risks associated with job stressors x 100%) in a previous study²⁹⁾. Part of the validity of these health risks was proven by the predictability of sick leave in a previous cohort study²⁹⁾. A greater health risk score is indicative of a higher possibility of health problems associated with job stressors, with a score of 100 as an average risk in a normative sample in Japan. Further, the “total health risk” was calculated by multiplying these two health risks and dividing by 100, so that the normative score was 100.

3) Sick leave

The sick leave data of all workers were obtained from the company registries. Sick leave data during the previous 12 months in the year the program started

(January to December, 2005) and during the previous 12 months in the year of follow-up (January to December, 2006) were collected. Sick leave days per year were categorized into two groups: none and one or more days.

Statistical analysis

An analysis of covariance (ANCOVA) with repeated measures was used to assess the intervention effect (group [intervention vs. reference group] \times time [baseline vs. follow-up] interaction) on the scores of job stressors and psychological distress measured by the BJSQ and the health risks estimated by the JSAD, after controlling for age, separately for men and women given a possible gender difference in the intervention effect as observed in a previous study⁶⁾. Generalized logit analysis with repeated measurements was used to assess the intervention effect on sick leave days, after controlling for age and occupation (white- or blue-collar), separately for men and women.

In order to examine the possible effect of the intervention process on the intervention outcomes, we divided the intervention departments into those with high (50% or greater, $n=6$) and low (less than 50%, $n=3$) participation rates of employees in the workshop; the intervention departments were also divided into those with high (50% or greater, $n=5$) and low (less than 50%, or with no proposed action plan, $n=4$) ratios of the number of implemented to proposed action plans. This analysis was done for both genders of intervention departments, and men and women together because of the small number of women. An ANCOVA with repeated measures was again used to assess the effect of high employee participation (group [high participation intervention group vs. reference group] \times time interaction) and low employee participation (group [low participation intervention group vs. reference group] \times time interaction), separately, on the scores of job stressors and psychological distress measured by the BJSQ and the health risks estimated by the JSAD, after controlling for gender, age, and occupation (white or blue-collar) among the intervention departments. Similar analyses were conducted to assess the effect of high implementation ratio (group [high implementation ratio intervention group vs. reference group] \times time interaction) and low implementation ratio (group [low implementation ratio intervention group vs. reference group] \times time interaction), separately. Generalized logit analysis with repeated measurements was used to assess the effect of employee participation and the implementation ratio on sick leave days, after controlling for gender, age, and occupation, among the intervention departments.

These analyses were conducted using the Statistical Package for Social Sciences (SPSS) version 11.0 (SPSS Inc., Chicago, USA).

Results

Baseline characteristics of intervention and control departments

Characteristics of the intervention and control departments are shown in Table 1. For men, the intervention group had a greater proportion of blue-collar workers than the control group; all women were engaged in white-collar jobs. Men in the intervention departments tended to have more stressful psychosocial work environments at baseline than men in the control departments ($p<0.05$); they had greater levels of quantitative job overload, qualitative job overload, and physical demands; lower levels of job control, supervisor support, coworker support, and job satisfaction; and poorer physical environments (data not shown, but available upon request). Women in the intervention departments also tended to have more stressful psychosocial work environments at baseline than women in the control departments ($p<0.05$): they had greater levels of skill underutilization and interpersonal conflict; lower levels of job control, supervisor support, and job satisfaction; and greater anger-irritability as well as poor physical environments (data not shown, but available upon request).

Process of the intervention

In the workshops, 100 action plans in total were proposed and approved from the nine intervention departments. Area-specific action plans were most frequently made for the areas of "mutual support at work" (37 action plans) and for "sharing work planning" (36 action plans), and less frequently for the other areas of "working time and organization" (12 action plans), "workplace environment" (9 action plans), "ergonomic work methods" (6 action plans), and "preparedness and care" (no action plan). Each department proposed 11 action plans on average, ranging from 6 to 32. At the follow-up workplace survey in November 2006, each department had implemented 7.2 of these plans on average, ranging from 3 to 20. The implementation rate, i.e., the ratio of the number of implemented action plans to proposed action plans, was 65% on average, ranging from 33% to 100%.

Intervention effects by gender

For men, a marginally significant favorable intervention effect was observed for poor physical work environments (Table 2, $p=0.075$). A significant deteriorating intervention effect was observed for intrinsic rewards ($p=0.040$). No significant effect was observed for sick leave among men.

For women, a significant favorable intervention effect was observed for skill underutilization, supervisor and

Table 1. Characteristics of the intervention and control group departments

Type of department	Number of workers	Number of respondents	Men				Blue-collar occupation (%)
			N	Men (%)	Mean age	SD	
Intervention group (9 departments)							
Engineering departments (6)	339	284	269	94.7	41.4	11.5	71.0
Clerical departments (3)	54	37	23	62.2	44.0	7.1	0.0
Total	393	321	292	91.0	41.6	11.3	65.4
Control group (36 departments)							
Engineering departments (18)	595	418	381	91.1	42.4	10.8	49.6
Clerical departments (14)	330	236	192	81.4	41.9	11.2	0.0
Research departments (4)	116	96	91	94.8	44.4	9.4	0.0
Total	1041	750	664	88.5	42.5	10.7	28.5

Type of department	Women				Blue-collar occupation (%)
	N	Female (%)	Mean age	SD	
Intervention group (9 departments)					
Engineering departments (6)	15	5.3	43.0	6.0	—
Clerical departments (3)	14	37.8	39.3	5.7	—
Total	29	9.0	41.2	6.1	—
Control group (36 departments)					
Engineering departments (18)	37	8.9	38.7	8.8	—
Clerical departments (14)	44	18.6	38.3	6.6	—
Research departments (4)	5	5.2	38.6	5.6	—
Total	86	11.5	38.5	7.6	—

coworker support, and job satisfaction, as well as for the score of total health risk and the health risks associated with job strain and worksite support (Table 3, $p<0.05$). A significant favorable intervention effect was observed for depression and vigor ($p<0.05$). No significant effect was observed for sick leave among women.

Effects of the intervention processes on outcomes

We compared the differences in the changes of outcome variables for the intervention departments with high or low proportions of employee participation in the workshop with those for the control departments (Table 4). Significantly favorable effects of high participation intervention were observed for quantitative job overload, supervisor support, coworker support, and depression, as well as for the total health risk and the health risk associated with job strain and worksite support ($p<0.05$). Marginally significant favorable intervention effects were observed for poor physical environment, anger-irritability, and anxiety ($0.05<p<0.10$). On the other hand, a significant deterioration effects of low participation intervention were observed for job control, supervisor support, as well as for the total health risk and the health risk associated with job strain ($p<0.05$).

Similarly, when we compared the differences in the changes of outcome variables for the intervention departments with high or low implementation ratios of action plans with those for the reference group, significantly favorable effects of high implementation ratio intervention were observed for poor physical environment, supervisor support, and coworker support, as well as for the total health risk and the health risks associated with worksite support ($p<0.05$, Table 5). On the other hand, significant deterioration effects of the low implementation ratio intervention were observed for job control; and marginally significant deterioration effects were observed for interpersonal conflict, and supervisor support, as well as for the health risk associated with job strain ($0.05<p<0.10$).

When we restricted the analyses to men only, similar findings were observed in analyses comparing the intervention effects between subgroups classified on the basis of employee participation or the implementation ratio (data available on request). We did not conduct these analyses for women because of the small number of women workers in the present sample and the skewed distribution of women (e.g., there was only one woman in the groups with low participation and implementation

Table 2. Comparison of job stressors, psychological distress, and sick leave at baseline and one-year follow-up between intervention and control group departments among men

Variable	Intervention group (N=292)						Control group (N=664)						Intervention effect	
	Baseline			Follow-up			Baseline			Follow-up			F	<i>p</i> [†]
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD		
Age		41.6	11.25					42.5	10.75					
BJSQ scales														
Job stressors														
Quantitative job overload		9.2	1.74		9.1	1.88		8.9	1.96		9.0	1.94	1.26	0.262
Qualitative job overload		9.2	1.55		9.1	1.56		8.7	1.78		8.7	1.72	0.03	0.857
Physical demands		2.0	0.76		1.9	0.76		1.8	0.81		1.7	0.78	0.24	0.627
Job control		7.5	1.77		7.5	1.80		7.9	1.76		8.0	1.71	2.01	0.157
Skill underutilization		2.2	0.77		2.3	0.76		2.2	0.76		2.2	0.75	0.89	0.346
Interpersonal conflict		7.3	1.19		7.4	1.16		7.2	1.19		7.3	1.16	0.28	0.596
Poor physical environment		2.5	1.00		2.4	0.98		1.9	0.90		1.9	0.88	3.17	0.075
Suitable jobs		2.7	0.73		2.7	0.70		2.8	0.70		2.8	0.66	0.18	0.676
Intrinsic rewards		2.8	0.71		2.8	0.67		2.8	0.73		2.9	0.69	4.24	0.040*
Psychological distress														
Vigor		6.2	1.98		6.2	2.03		6.4	2.07		6.5	2.06	0.49	0.486
Anger-irritability		6.1	2.05		6.0	2.01		6.2	1.97		6.2	2.00	0.71	0.400
Fatigue		6.1	2.01		6.1	1.98		6.1	2.00		6.1	2.02	0.19	0.663
Anxiety		6.0	2.03		5.8	1.84		5.8	1.94		5.8	1.84	0.71	0.400
Depression		10.1	3.45		9.8	3.37		9.8	3.17		9.6	3.05	0.31	0.579
Buffering factors														
Supervisor support		7.3	2.03		7.4	2.05		7.8	2.00		7.9	2.01	0.11	0.741
Coworker support		7.9	1.74		8.0	1.82		8.4	1.78		8.3	1.81	1.90	0.169
Job satisfaction		2.7	0.72		2.7	0.74		2.8	0.75		2.8	0.72	0.00	0.953
Health risks associated with job stressors [‡]														
Total health risk		123.2	55.35		121.1	57.18		106.2	49.24		106.0	53.58	0.66	0.416
Health risk associated with job strain		110.4	23.00		109.9	24.45		104.9	25.30		104.2	24.97	0.12	0.733
Health risk associated with worksite support		109.9	36.07		108.1	35.92		100.4	33.39		100.4	34.41	1.34	0.248
Sick leave in the past year														
One or more days (number with proportion)	17	(6%)		8	(2%)		22	(2%)		27	(3%)			0.318

[†]*p* value for intervention effect (group*time interaction) was estimated by repeated measures ANCOVA after adjusting for age and occupation (white or blue-collar); Generalized logit analysis for sick leave after adjusting for age and occupation (all white-collar). [‡]Estimated by the Job Stress Assessment Diagram based on the demand-control-support model (see text).

* *p*<0.05.

Table 3. Comparison of job stressors, psychological distress, and sick leave at baseline and one-year follow-up between intervention and control group departments among women

Variable	Intervention group (N=29)						Control group (N=86)						Intervention effect	
	Baseline			Follow-up			Baseline			Follow-up				
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	F	p [†]
Age		41.2	6.22					38.5	7.65					
BJSQ scales														
Job stressors														
Quantitative job overload		7.5	2.82		6.8	2.54		7.3	2.10		7.0	2.29	1.50	0.223
Qualitative job overload		7.8	2.83		7.7	2.59		7.3	1.98		7.2	1.90	0.02	0.884
Physical demands		1.4	0.72		1.6	0.67		1.3	0.60		1.3	0.57	1.76	0.187
Job control		6.8	2.02		7.2	1.71		7.7	1.62		8.0	1.83	0.32	0.571
Skill underutilization		2.7	0.76		2.4	0.89		2.3	0.61		2.5	0.73	3.99	0.048*
Interpersonal conflict		7.4	1.47		7.3	1.02		6.8	0.98		6.8	1.08	0.05	0.821
Poor physical environment		2.7	0.74		2.5	0.86		2.0	0.83		1.9	0.76	1.00	0.320
Suitable jobs		2.5	0.90		2.5	0.90		2.7	0.71		2.6	0.70	0.18	0.677
Intrinsic rewards		2.4	0.85		2.4	0.81		2.7	0.71		2.6	0.66	1.55	0.217
Psychological distress														
Vigor		6.0	2.67		6.4	2.41		6.5	2.29		5.9	2.22	5.11	0.026*
Anger-irritability		6.9	2.57		6.4	1.83		5.9	2.22		6.0	2.31	2.37	0.126
Fatigue		6.6	2.50		6.3	1.86		6.3	2.34		6.0	2.05	0.00	0.950
Anxiety		5.7	2.77		5.0	1.88		5.2	1.96		5.1	2.07	1.51	0.221
Depression		10.0	3.70		8.7	2.91		9.4	3.10		9.7	3.08	6.79	0.010**
Buffering factors														
Supervisor support		5.3	2.00		6.5	2.31		7.1	2.00		6.8	1.86	22.25	0.000**
Coworker support		7.4	2.28		7.6	2.34		8.2	1.98		7.7	1.96	4.52	0.036*
Job satisfaction		2.4	0.93		2.7	0.99		2.8	0.64		2.7	0.67	4.21	0.043*
Health risks associated with job stressors‡														
Total health risk		152.4	74.31		119.1	60.12		104.1	49.58		110.3	59.29	16.21	0.000**
Health risk associated with job strain		107.1	36.59		94.5	21.31		94.3	21.52		91.2	27.33	4.81	0.030*
Health risk associated with worksite support		142.4	49.20		126.3	49.82		109.1	36.47		118.9	39.63	14.55	0.000**
Sick leave in the past year														
One or more days (number with proportion)	2	(7%)		0	(0%)		1	(1%)		2	(2%)			–

[†]p value for intervention effect (group*time interaction) was estimated by repeated measures ANCOVA after adjusting for age and occupation (all white-collar); Generalized logit analysis for sick leave after adjusting for age and occupation (all white-collar). [‡]Estimated by the Job Stress Assessment Diagram based on the demand-control-support model (see text). * $p<0.05$, ** $p<0.01$.

Table 4. Comparison of job stressors, psychological distress, and sick leave at baseline and one-year follow-up by participation rates of employees in workshop for work environment improvement in intervention group departments

Variable	Participation rate in department, 50% or greater (N=178)						Participation rate in departments, less than 50% (N=143)						Control group (N=750)						Group difference in intervention effect (Participation rate in department, 50% or greater * Control group)		Group difference in intervention effect (Participation rate in department, less than 50% * Control group)	
	Baseline			Follow-up			Baseline			Follow-up			Baseline			Follow-up			F	p [†]	F	p [†]
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD				
Age	42.5	11.00					40.4	10.66					42.0	10.51								
Gender (women, %)	28 (16%)						1 (1%)						86 (12%)									
BJSQ scales																						
Job stressors																						
Quantitative job overload	8.8	2.08		8.5	2.12		9.4	1.65		9.4	1.87		8.7	2.04		8.8	2.08		4.13	0.042*	0.00	0.982
Qualitative job overload	8.8	1.88		8.8	1.84		9.4	1.53		9.2	1.56		8.6	1.86		8.6	1.82		0.07	0.793	0.00	0.971
Physical demands	1.7	0.71		1.7	0.70		2.3	0.75		2.2	0.71		1.7	0.80		1.7	0.77		0.15	0.704	0.00	0.996
Job control	7.2	1.89		7.5	1.88		7.7	1.67		7.5	1.68		7.9	1.74		8.0	1.72		0.45	0.501	10.22	0.001**
Skill underutilization	2.3	0.78		2.2	0.80		2.2	0.79		2.4	0.72		2.2	0.75		2.2	0.75		0.27	0.607	0.99	0.321
Interpersonal conflict	7.3	1.25		7.3	1.14		7.4	1.17		7.5	1.14		7.2	1.18		7.2	1.17		0.05	0.821	2.12	0.145
Poor physical environment	2.4	1.05		2.3	1.02		2.7	0.88		2.5	0.87		1.9	0.89		1.9	0.87		3.72	0.054	1.60	0.206
Suitable jobs	2.6	0.74		2.7	0.77		2.8	0.76		2.7	0.65		2.8	0.70		2.8	0.67		0.01	0.912	0.20	0.656
Intrinsic rewards	2.7	0.75		2.7	0.70		2.9	0.70		2.8	0.66		2.8	0.73		2.8	0.70		0.74	0.392	2.47	0.116
Psychological distress																						
Vigor	6.1	2.17		6.3	2.12		6.3	1.89		6.2	2.01		6.3	2.12		6.3	2.07		0.50	0.482	0.53	0.467
Anger-irritability	6.2	2.08		5.9	1.93		6.2	2.15		6.2	2.06		6.2	2.01		6.2	2.03		3.38	0.066	0.02	0.884
Fatigue	6.0	2.12		5.9	1.87		6.2	1.98		6.4	2.07		6.1	2.04		6.1	2.03		0.09	0.765	1.62	0.204
Anxiety	5.9	2.16		5.6	1.68		6.0	2.05		5.9	2.04		5.7	1.96		5.7	1.88		3.50	0.062	0.00	0.992
Depression	9.9	3.41		9.2	2.97		10.3	3.53		10.3	3.68		9.8	3.16		9.6	3.05		4.72	0.030*	0.06	0.800
Buffering factors																						
Supervisor support	6.8	2.23		7.4	2.19		7.5	1.88		7.2	1.95		7.7	2.01		7.7	2.03		15.39	0.000**	5.27	0.022*
Coworker support	7.7	1.86		8.0	1.93		8.0	1.72		8.0	1.82		8.3	1.81		8.2	1.84		7.52	0.006**	0.01	0.929
Job satisfaction	2.6	0.75		2.7	0.79		2.7	0.74		2.7	0.73		2.8	0.74		2.8	0.71		1.53	0.216	0.06	0.803
Health risks associated with job stressors [‡]																						
Total health risk	133.4	65.01		117.0	59.33		116.3	45.94		125.7	54.65		106.0	49.26		106.7	54.33		18.18	0.000**	4.02	0.045*
Health risk associated with job strain	110.4	26.88		104.7	23.38		109.8	21.31		113.2	25.23		103.7	25.07		102.7	25.60		4.93	0.027*	5.52	0.019*
Health risk associated with worksite support	118.4	41.28		109.7	39.99		105.8	33.68		109.9	34.76		101.4	33.89		102.6	35.58		16.78	0.000**	1.49	0.223
Sick leave in the past year																						
One or more days																						
(number with proportion)	9	(5%)		4	(2%)		10	(7%)		4	(3%)		23	(3%)		29	(4%)			0.251		0.939

[†]p value for the group difference (group*time effect) was estimated by repeated measures ANCOVA after adjusting for age, gender, and occupation (white or blue-collar); Generalized logit analysis for sick leave after adjusting for age, gender, and occupation (all white-collar). [‡]Estimated by the Job Stress Assessment Diagram based on the demand-control-support model (see text). * $p < 0.05$, ** $p < 0.01$.

Table 5. Comparison of job stressors, psychological distress, and sick leave at baseline and one-year follow-up by ratios of planned and implemented actions for work environment improvement in intervention group departments

Variable	Implementation ratio [§] , 50% or greater (N=215)						Implementation ratio [§] , less than 50% (N=106)						Control group (N=750)						Group difference in intervention effect (Participation rate in department, less than 50% *Control group) or greater * Control group)				
	Baseline			Follow-up			Baseline			Follow-up			Baseline			Follow-up			F	p [†]	F	p [†]	
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD					
Age		41.9	11.18					40.8	10.26					42.0	10.51								
Gender (women, %)	28 (13%)							1 (1%)						86 (12%)									
Proposed action plans	84							16															
Practiced plans after the intervention	59							6															
BJSQ scales																							
Job stressors																							
Quantitative job overload		9.1	2.07		8.8	2.17		9.1	1.58		9.0	1.84		8.7	2.04		8.8	2.08	2.58	0.109	0.07	0.793	
Qualitative job overload		8.9	1.84		9.0	1.82		9.4	1.51		9.0	1.54		8.6	1.86		8.6	1.82	0.85	0.357	1.34	0.248	
Physical demands		1.8	0.80		1.8	0.78		2.2	0.67		2.1	0.65		1.7	0.80		1.7	0.77	0.09	0.767	0.01	0.935	
Job control		7.3	1.82		7.5	1.86		7.7	1.74		7.5	1.66		7.9	1.74		8.0	1.72	0.00	0.970	8.64	0.003**	
Skill underutilization		2.3	0.79		2.2	0.79		2.2	0.77		2.4	0.71		2.2	0.75		2.2	0.75	0.26	0.610	1.49	0.223	
Interpersonal conflict		7.3	1.27		7.3	1.16		7.3	1.09		7.5	1.11		7.2	1.18		7.2	1.17	0.08	0.776	3.14	0.077	
Poor physical environment		2.6	1.07		2.4	1.05		2.5	0.78		2.3	0.76		1.9	0.89		1.9	0.87	4.28	0.039*	0.70	0.402	
Suitable jobs		2.6	0.76		2.6	0.75		2.9	0.70		2.8	0.63		2.8	0.70		2.8	0.67	0.01	0.942	0.30	0.584	
Intrinsic rewards		2.7	0.77		2.7	0.72		3.0	0.61		2.9	0.59		2.8	0.73		2.8	0.70	1.44	0.231	1.64	0.201	
Psychological distress																							
Vigor		6.0	2.13		6.2	2.10		6.5	1.84		6.4	2.00		6.3	2.12		6.3	2.07	1.09	0.296	0.06	0.800	
Anger-irritability		6.3	2.21		6.1	2.03		6.0	1.89		5.9	1.91		6.2	2.01		6.2	2.03	1.76	0.186	0.33	0.567	
Fatigue		6.1	2.17		6.1	1.98		6.1	1.81		6.1	1.95		6.1	2.04		6.1	2.03	0.09	0.762	0.35	0.555	
Anxiety		6.0	2.16		5.8	1.91		5.8	1.99		5.6	1.74		5.7	1.96		5.7	1.88	1.38	0.241	0.46	0.499	
Depression		10.1	3.65		9.7	3.41		10.0	3.09		9.8	3.21		9.8	3.16		9.6	3.05	2.43	0.119	0.03	0.856	
Buffering factors																							
Supervisor support		7.0	2.26		7.4	2.14		7.4	1.75		7.1	1.96		7.7	2.01		7.7	2.03	8.03	0.005**	2.94	0.087	
Coworker support		7.7	1.85		7.9	1.93		8.1	1.68		8.1	1.77		8.3	1.81		8.2	1.84	5.88	0.015*	0.03	0.860	
Job satisfaction		2.6	0.78		2.6	0.82		2.8	0.66		2.8	0.63		2.8	0.74		2.8	0.71	0.38	0.540	0.15	0.700	
Health risks associated with job stressors [‡]																							
Total health risk		131.8	63.05		120.6	60.19		113.7	43.35		121.4	51.46		106.0	49.26		106.7	54.33	10.32	0.001**	2.49	0.115	
Health risk associated with job strain		111.9	26.36		108.1	24.91		106.6	19.97		109.4	23.89		103.7	25.07		102.7	25.60	1.80	0.180	3.79	0.052	
Health risk associated with worksite support		115.9	40.98		109.6	39.35		106.4	32.29		110.0	34.28		101.4	33.89		102.6	35.58	11.27	0.001**	1.06	0.305	
Sick leave in the past year																							
One or more days																							
(number with proportion)	13	(6%)		7	(3%)		6	(6%)		1	(1%)		23	(3%)		29	(4%)		0.617			0.295	

[§]Ratio of the number of implemented actions to that of planned actions in a department. [†]p value for the group difference (group*time effect) was estimated by repeated measures ANCOVA after adjusting for age, gender, and occupation (white or blue-collar); Generalized logit analysis for sick leave after adjusting for age, gender, and occupation (all white-collar). [‡]Estimated by the Job Stress Assessment Diagram based on the demand-control-support model (see text). * $p<0.05$, ** $p<0.01$.

rates). We excluded the research department from the control group, to make it more similar to the intervention group, which did not include a research department. However, excluding the research department from the control departments did not change the results.

Discussion

In this controlled trial we observed significant favorable changes in psychosocial job stressors (decreases in skill underutilization), supervisor and coworker support, job satisfaction, and psychological distress (increases in vigor and decreases in depression) among women in the worker participation program for work environment improvement using the MHACL. The results provide additional evidence for a worker participation approach to improve work environments to reduce job stressors and enhance mental health among workers, and in particular they provide evidence for the usefulness of the MHACL in such an approach. The analyses also showed that the degree of worker participation and implementation of planned actions heavily influenced the intervention effect. However, we failed to find a significant favorable effect of the intervention for men as a whole.

Among women, the most prominent and significant effect of the intervention was on supervisor support. For women in the intervention departments, supervisor support had increased at follow-up, whereas it had decreased in the control departments. Coworker support also slightly improved among women in the intervention departments. This is consistent with previous findings that the work-environment-oriented approach interventions increased workplace support in offices^{17, 32, 33} and in hospital settings^{7, 34}. Some improvements that were implemented in the intervention departments may be related to this positive finding. These improvements included 1) increasing meeting opportunities to achieve a more equal distribution of information for members working in isolated areas; 2) planning a recreation activity, such as a group sports event or an informal dinner party with department members; 3) displaying the work-related schedules of all department members for easier communication; and 4) clarifying the information flow within a department and each member's responsibilities. These activities may have improved communication between supervisors and women workers. In addition, the experience of participating in the planning workshops to improve the work environment may have provided a good opportunity for women workers and their supervisors (as well as coworkers) to further develop mutual understanding and improve their communication.

Skill underutilization was slightly improved among women in the intervention departments, while it deteriorated in the control departments. This is consistent with previous study findings of the effect of an organizational intervention program for skill utilization³³

and skill development¹⁷, even though not many studies have reported such results. In the departments of the present study, women tended to be in supportive positions at work, with relatively low authority; thus, they may have had difficulty in finding ways to use their skills and abilities at work. Women in the intervention group, therefore, may have found opportunities to match their skills and abilities together with workplace goals through the planning workshops, and following the redesign of their workflows. The effect was not clear for men, whose skills might have already been utilized to some extent before the intervention. Better communication with and timely feedback from supervisors may also be a key for improving feelings of skill utilization among women workers. There were no significant intervention effects for job overload or job control. However, the estimated health risk associated with job strain (the combination of job overload and job control) improved among women in the intervention departments, suggesting that the intervention was also effective in improving job strain as defined in the job demands-control model³⁰.

Some indicators of psychological distress, such as depression and vigor, and job satisfaction, also improved among women in the intervention departments. This is attributable to the favorable changes in worksite support and job stressors in this group. It is also consistent with previous findings of the effectiveness of work environment-oriented stress reduction programs for the improvement of psychological distress, including depression^{3-7, 17, 34}. However, a previous intervention study in Japan with supervisor participatory work environment improvement failed to show the effectiveness of such programs in reducing depression among women, while there was a clear effect among men⁶. In contrast to this previous study, which only included supervisors (all men) in a planning phase, the present intervention, in principle, invited all workers to participate in the planning workshops. This is one likely reason for the significant intervention effects for psychological distress and job satisfaction among women observed in the present study. In fact, in the present study women were more likely to participate in the planning workshops (28 out of 29) and were more likely to be members of departments with a high implementation ratio of action plans (28 out of 29). A worker participation approach to improve work environments may therefore be more beneficial for women workers, because it gives women workers a chance to get more involved in work environment improvement activities, since women workers tend to engage in more supportive jobs and may have little chance to do so in their daily work.

Among men, intrinsic rewards remained stable in the intervention departments, while they slightly increased in the control departments, with a significant group x time interaction. The reason for this is not clear.

Semmer¹⁰⁾ has suggested that work environment improvement may result in deterioration (a side effect) in some groups because some groups gained benefits while others lose their benefits or vested rights. However, this does not seem to be the case for the present unexpected finding, because intrinsic rewards remained stable in the intervention departments. This may be a “by chance” finding and needs to be re-examined at a longer follow-up. Poor physical work environment was slightly improved in the intervention departments, with a marginally significant intervention effect. Since the planning workshops targeted improvements of the physical work environment as well as the psychosocial work environment, it was possible for participants at the workshop to focus more on the physical work environment. In general, almost no clear intervention effect was observed for the outcome variables prepared in the study among men. This may be attributable to the fact that the changes made through this intervention program were not sufficient to significantly change job stressors and psychological distress among men. As noted earlier, men were less likely to participate in the planning workshops and more likely to be members of departments with a low implementation ratio of action plans.

Among the intervention departments with a high rate (50% or higher) of worker participation in the planning workshops, quantitative job overload, supervisor support, coworker support, and depression improved compared to the reference group, while job control and supervisor support deteriorated among departments with a low rate of worker participation. The total health risk and health risks associated with job strain and worksite support also improved in the high participation departments while it decreased in the low participation departments. The more workers participating in the planning workshops for their department, the more likely they developed links to a better understanding of the program, better attitudes toward the program, and also larger improvements in their work environments. These results suggest the importance of involving a higher proportion of workers from a workplace in activities of work environment improvement, as seen in previous studies^{24–26)}. Such workshops provide participants with learning opportunities to become more aware of and to better understand their psychosocial work environments, and to work with co-workers to identify problems and develop ideas to solve them. It seems important to include as many workers as possible in planning workshops in order to utilize the understanding and experiences gained from them in real workplaces and to maximize the effectiveness of the intervention program.

Similarly, among the intervention departments with a high ratio (50% or higher) of implemented actions to planned ones, that is, among departments in which a greater proportion of action plans were implemented,

supervisor support and coworker support, as well as physical environment, significantly improved compared to the reference group, while job control deteriorated among the departments with low implementation rates. The total health risk and health risks associated with worksite support also improved in the high implementation ratio departments. A wide variety in the implementation rate (33–100%) may also be a reason for no clear intervention effect as a whole in our study.

The intervention did not have a significant effect on sick leave days over the course of a year. This is contrary to previous findings of decreased sick leave days in work environment-oriented interventions^{6, 17)}. Among departments with high worker participation rates for the planning workshop or with high implementation rates of action plans, the number of people with one or more sick days during the last year decreased slightly more than among those with low worker participation rates or with low implementation rates, while the group difference was not significant. A more intensive program for improvement in the work environment might be successful at decreasing sick leave. Further, the frequency of sick leave was very low at baseline and at follow-up. In addition, sick leave data at follow-up were collected for the previous 12 months during which the action were still being implemented. This may have made it difficult to detect the intervention effect on sick leave in this study.

This is the first controlled trial of work environment improvement programs using the MHACL. Previous experience and case studies using the MHACL reported positive intervention outcomes and the usefulness of the MHACL to motivate and involve workers in the work environment improvement activities^{35, 36)}. Moreover, in our experience working with the MHACL in planning workshops, the MHACL seemed to be a good guide for helping participants, and even supervisors, to focus on and discuss possible actions to improve the work environment and enhance mental health. The usefulness of the MHACL in planning workshops was reflected in the fact that 11 action plans on average were proposed by each department. In addition, the results of the present study show that the proportion of workers who participate in a planned workshop and the successful implementation of action plans in a real workplace are key factors in work environment improvement programs using the MHACL.

We used the same MHACL form for all the departments. Because the MHACL covers a wide variety of action items covering basic physical environments to psychosocial work environments, it can be used in a wide variety of workplaces, and is not limited to those with poor physical and ergonomic environments. This was also our experience in this study. However, the MHACL includes a greater number of action items for physical and ergonomics areas than for psychosocial ones, which

may have been seen as having less merit for departments with initially good physical and ergonomic environments. The preparation of MHACLs tailored to different groups of workplaces (such as production lines, clerical offices, etc.) might be useful. The MHACL includes some action items which may need higher management decisions to be implemented. For instance, “taking paid annual leave and childcare leave as entitled” can be sometimes implemented as a workplace group decision if the section head agrees, but it will take a whole company decision process if it is closely related to the characteristics of a company’s production system. The current MHACL does not focus on the latter type of improvement of work environment. In addition, while leadership styles are also an important element of psychosocial work environment, the MAHCL does not directly address changes in leadership styles, i.e., attitude and behaviors of supervisors and managers, unless they decide to change their leadership styles themselves, while some action items, such as ones in areas of participation in work planning and mutual support at work, may be related to changes in leadership styles.

It has been argued that the distinction between a program error (intervention which was not carried out as planned) and a theory error (error which lies in the intervention theory itself) is important for understanding the result of an intervention²¹⁾. In addition to the issues described above related to “theory failure”²¹⁾, issues related to “program failure” should also be raised. The results of the present study suggest that high participation rates in planning workshops and high implementation rates of proposed actions are key issues. It is essential to encourage as many workplace members as possible to participate in the workshop, by motivating supervisors and workers themselves and arranging convenient workshop hours, to make the intervention successful. A participation rate of 50% seems a good criterion. In some intervention departments, only a limited number of action plans were implemented, which weakened the effect of the whole intervention. This may have been due to a less intensive approach by the work environment improvement team to follow-up the implementation, suggesting a need for the team to provide greater support during the implementation phase to refine and rebuild action plans, and also greater involvement by top management in facilitating actions in order to motivate supervisors/managers for the intervention. Another way of providing support for workplaces during the implementation phase is also needed to achieve effective outcomes in this approach with the MHACL.

Limitations

In addition to the limitation described above, several additional limitations should be mentioned with respect to the interpretation of the present results. First, the

present study was not a randomized controlled trial. Allocation to the intervention or control group was made by department supervisors, and could have reflected their subjective interest in the program, the time and workload possibly needed to complete the program, and their expectations for enhancing workplace mental health. The intervention departments tended to have more stressful psychosocial work environments in general, such as greater workloads, less job control, and less coworker support at baseline. While we adjusted for baseline values in the analyses to test the intervention effect, there may have been some other organizational differences between these two groups of departments that might have affected the findings. Second, our one-year follow-up assessment was done 6–12 months after the planning workshops (July–December, 2005), with a minimum implementation period of six months in some departments. This time frame might have been too short to detect some changes. Therefore, we will continue the follow-up of these departments to examine the long-term effects of the program. Third, all outcome variables except for sick leave were assessed by self-report. There is the possibility that the intervention departments received more attention because of their participation in the intervention program and thus returned more socially desirable (i.e., more favorable) responses to the self-report questionnaire at follow-up. Further, some scales of the BJSQ (such as poor physical work environment, intrinsic rewards, and job satisfaction) were single-item scales, and thus their reliability is not fully clear. Fourth, we did not monitor activities in the control groups in terms of work environment improvement. If supervisors in the control group departments had been aware of the importance of work environment improvement and voluntarily started relevant activities, then the intervention effects may have been underestimated. Future research should include a randomized controlled trial design and process evaluation in both the intervention and control groups, using more reliable and standardized measures of self-report and objective outcomes.

Acknowledgments: The preparation of the present manuscript was partly supported by a Grant-in-Aid for Scientific Research (A) 2008 (No. 20240062) from the Ministry of Education, Culture, Sports, Science and Technology, Japan.

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Appendix: The Mental Health Action Checklist for a Better Workplace Environment

How to use the checklist

1. Define the workplace to be checked. In the case of a small enterprise, the whole workplace can be checked. In the case of larger enterprise, particular work areas can be defined for separate checking.
2. For each action item, tick a box that best suits your option. Look for a way to apply the action. If that action has already been applied or it is not necessary, tick NO under “Do you propose action?”. If you think the action is worthwhile, tick YES. You can put your brief suggestion in the space nearby.
3. You may write any additional items that you think are appropriate on page 3, and tick them accordingly.
4. Make sure that for each item you have marked NO or YES, and that you have chosen PRIORITY items.
5. Discuss the results in small groups and agree on improvements that should be done immediately.

A. Participation in work planning

1. Hold a brief meeting before work to jointly plan the work assignments and time schedules.
2. Assign to each work team the responsibility to decide how to do the work.
3. Re-arrange the allocation of tasks so as to avoid excessive workload of particular workers.
4. Increase multi-skilled jobs to raise the sense of accomplishment by each worker.
5. Use a notice board to be used by each team for informing all workers of the team correctly.

B. Working time arrangements

6. Set target hours of work and introduce measures to reduce overtime work, e.g., by “non-overtime days”.
7. Discuss in each team if some tasks can be done prior to or after busy or peak-workload periods.
8. Make sure that all workers can take paid annual leave and childcare leave as entitled.
9. Secure enough resting periods between workdays and short breaks in each shift.
10. Allocate flexible work hours to accommodate personal needs of workers.

C. Ergonomic work methods

11. Provide multi-level storage shelves, mobile racks, trolleys and lifters for handling materials and files.
12. Improve workplace layout and workstations for easy access to work items and natural work postures.
13. Use labels, signs and colours for making it easy to distinguish different materials, switches or displays.
14. Reduce repetitive or monotonous tasks by combining tasks or by job rotation.
15. Attach proper guards to dangerous machines and use safety devices and alarms to prevent mistakes.

D. Workplace environment

16. Adjust air temperature, ventilation, lighting and noise levels for more comfortable work.
17. Isolate or enclose sources of hazardous dust or chemicals.
18. Provide a separate smoking room or place to avoid passive smoking at work.
19. Provide hygienic toilets, lockers and washing facilities and relaxing resting facilities.
20. Properly mark evacuation routes and put on the wall proper emergency procedures.

E. Mutual support at work

21. Make sure workers feel at ease in talking to their supervisors or bosses about their work or troubles.
22. Encourage a mutually supportive climate in which workers can consult each other about their concerns.
23. Organize informal or social gatherings and recreational activities more often.
24. Ensure that all workers receive timely feedback about their work results.
25. Use newsletters, e-mails or bulletin boards for exchanging information among different sections.

F. Preparedness

26. Set up a privacy-protecting contact point for counseling about health or troubles of a worker.
27. Organize training sessions for learning self-care in order to cope with stress at work.
28. Make future plans of changes in jobs known to all workers.
29. Inform workers of fair chances of promotion and qualifications they can obtain.
30. Establish emergency communication procedures for assuring appropriate health care of workers.