

## **Effects of Web-Based Psychoeducation on Self-Efficacy, Problem Solving Behavior, Stress Responses and Job Satisfaction among Workers: A Controlled Clinical Trial**

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**Abstract: Effects of Web-Based Psychoeducation on Self-Efficacy, Problem Solving Behavior, Stress Responses and Job Satisfaction among Workers: A Controlled Clinical Trial: Akihito Shimazu, et al. Department of Psychology, Hiroshima University Graduate School of Education**—This study examined

effects of web-based psychoeducation on self-efficacy, problem solving behavior, stress responses and job satisfaction. The program was based on social cognitive theory and was primarily aimed at increasing knowledge of stress, self-efficacy, and the use of problem solving behavior. A total of 225 employees were invited to participate in the study. Participants were assigned to an intervention (n=112) or waiting list control group (n=113). Those in the intervention group were asked to access the website and to complete learning within 1 month. To investigate the intervention effect, the change score in the outcome variable was calculated by subtracting the score at pre-intervention from that at post-intervention (1 week after completion of the learning period). Then, the difference in the scores between groups was examined using analyses of covariance (ANCOVA) with the pre-intervention score as the covariate. We detected a marginally significant difference between groups in changes in job satisfaction from pre- to post-intervention ( $p=0.081$ ). Participants in the intervention group showed an increase in job satisfaction score, while those in the waiting list control group showed a decrease in it. No significant differences were detected between groups in the other indicators ( $p>.10$ ). We detected significant or marginally significant

intervention effects on self-efficacy, problem solving behavior, stress responses, and job satisfaction among males and younger individuals, and those who had initially higher job strain and higher interest in managing stress. Further research is required with longer time periods (controlled follow-up) and a broader sample to fully determine the intervention effect.

(*J Occup Health* 2005; 47: 405–413)

**Key words:** Psychoeducation, E-learning, Controlled clinical trial, Problem solving, Self-efficacy, Workplace, Job stress, Stress response, Job satisfaction

As evidence is accumulating that poor psychosocial job characteristics adversely affect health<sup>1, 2</sup>, stress management interventions to improve employees' health have increased during the past two decades<sup>3–13</sup>. Interventions designed to reduce occupational stress can be categorized according to their focus<sup>3, 11, 14</sup>: one aims to increase individual psychological resources and responses such as coping skills (individual-focused interventions), and the other aims to improve stressful work environments (organization-focused interventions). Our study was conducted on the basis of an individual-focused approach.

There are various kinds of intervention techniques that represent the individual-focused approach. Cognitive-behavioral training, stress measurements and personalized feedback, meditation, relaxation training, and physical fitness training are all examples. Accumulated experiences from individual-focused interventions show that cognitive-behavioral training is more effective than other techniques<sup>12, 13</sup>. However, workplaces have numerous barriers that impede mental health activities. Lack of experts to deliver mental health services to the workplace is among the most prevalent barriers<sup>15</sup>. Given

Received March 7, 2005; Accepted June 3, 2005

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the lack of experts, it is important to find channels, other than occupational mental health experts, to provide employees with the information, knowledge, and skills to manage job stress and improve mental health.

One such delivery channel is mail- or telephone-based programs<sup>16-18</sup>. Pelletier *et al.*<sup>16, 18</sup> showed that both mail- and mail/telephone-based job stress interventions can be effective in increasing employees' knowledge of job stress and possible solutions, altering risk behavior and improving self-efficacy and mental health. These findings can be applied to interventions that make use of other information technologies such as e-mail and the Internet. Tate and Zabinski<sup>19</sup> pointed out the following probable benefits in delivering psychological interventions over the computer. First, computerized interventions can overcome physical and geographical constraints as interventions can be offered independent of geographical locale. Second, they can be implemented in a cost-efficient manner and third, they are not time dependent. These benefits can overcome the lack of experts of occupational mental health.

Most computerized cognitive-behavioral programs that have been developed target psychiatric patients with mood and anxiety disorders, and therefore, are aimed mainly at modifying specific thinking or cognitive patterns<sup>20-26</sup>. However, most employees in the workplace are from normal populations and do not always have distorted thinking or cognitive patterns. Rather, they use various kinds of coping strategies (behavior and cognition) to deal with the wide range of stressors they experience in the workplace. This suggests that programs that help employees to find appropriate coping strategies by themselves rather than to modify specific thinking or cognitive patterns can contribute to reducing their job stressors and improving their mental health. The present study provided the problem solving technique<sup>27</sup> among various cognitive-behavioral programs and participants can adapt their acquired skills to potential problems that they might confront in the future.

The main purpose of this study was to examine the effectiveness of web-based psychoeducation on self-efficacy, problem solving behavior, stress responses and job satisfaction among workers. According to social cognitive theory<sup>28</sup>, we expected that the program exercise would increase self-efficacy and problem solving behavior (primary outcomes), which, in turn, would decrease psychological and physical distress and increase job satisfaction (secondary outcomes) at post-assessment. We also explored which participants benefited from the interventions by subgroup analyses.

## Methods

### *Study participants and procedure*

This study was undertaken as part of a company-wide mental health promotion plan adopted by a construction

machinery company in western Japan. The project mainly consisted of two intervention programs, one being an organization-focused intervention that aims to improve stressful work environments and the other being an individual-focused one that aims to enhance the coping abilities of individual employees. The former was offered to blue-collar workers engaged in the production assembly line and engineers engaged in research and development of new products. The latter was offered to white-collar workers assigned supportive tasks (e.g. clerical and managing tasks). This study reports the results of the latter.

We could not estimate a sample size needed to test the hypotheses due to lack of relevant previous research and lack of quantitative information on the clinical/practical significance of outcome measures. We recruited as many potential participants as possible. A total of 225 employees were invited to participate in the study by industrial health staff. Before entering the study, all participants were informed about the project by the industrial health staff with an informational pamphlet and by their work leaders in meetings. Those who consented to enter the study were assigned to an intervention group (n=112) or a waiting list control group (n=113) according to employee number (odd number=intervention group, even number=waiting list control group).

In September 2003, a baseline survey (*T1*) was conducted with both the intervention and waiting list control groups. After fulfilling the baseline questionnaire, participants in the intervention group were asked to access a website and complete learning within 1 month, while those in the waiting list control group were asked to wait 1 month before participating. A post-intervention survey (*T2*) was conducted 1 week after completion of the learning period (approximately 5 weeks after the baseline survey), and a follow-up survey (*T3*) was conducted 6 weeks after completion of the learning period (approximately 11 weeks after the baseline survey); both groups underwent all surveys. Participants in the waiting list control group were sent an announcement by e-mail just before *T2*, which asked them to fulfill the *T2* survey and complete learning within 1 month. We obtained approval from the ethics review board of Hiroshima University before starting the study.

### *Intervention*

Participants in both groups were given individual IDs and passwords before starting learning. The program is self-paced and consists of the following 3 phases (5 chapters):

*Chapters 1 and 2: Cognitive preparation and motivation.* The aim of this phase was to motivate participants to learn the program, to provide them with basic knowledge about stress, and to help them recognize the importance of coping with stress. In chapter 1, a

fictitious case about two employees who confronted the same stressful situation and coped in different ways was illustrated. The different ways of coping led to different consequences, such as personal growth and depressive state. In chapter 2, an explanation of the nature of stressors, coping, and stress responses, and the relationships among them was presented according to the psychological stress model<sup>29</sup>.

*Chapters 3 and 4: Skill acquisition and rehearsal.* This phase assisted participants to learn new and more constructive methods for problem solving in coping with stress. Chapter 3 consisted of six interactive modules, each of which was compatible with six stages of problem solving<sup>27</sup>: 1) describing and defining problems, 2) deciding which problem has priority, 3) working out as many strategies as possible to deal with the problem, 4) expecting that a certain strategy will lead to certain outcomes, 5) estimating which strategy one can successfully perform, and 6) deciding the strategy to apply to the 'real' workplace. In chapter 4, a simulation game was provided to encourage participants to improve their belief that they could successfully perform the learned skills in an analogous situation and smoothly transfer the skills to real life.

*Chapter 5: Application.* This phase was designed to encourage participants to put the acquired skills into practice in the workplace. Relapse prevention strategies and application skills were provided in the form of Frequent Questions and Answers (FAQ).

At the end of each chapter, participants were asked to answer questions regarding the contents of the individual chapter. Only those who gave the right answer to all questions could go on to the next chapter. To increase motivation and decrease drop out rates, three types of e-mail were sent as reminders or prompts: an "inquiry mail" was sent to those who did not commence learning during the first two weeks after the learning period started, an "encouragement mail" to those who finished half the course of the program, and a "congratulations mail" to those who finished the whole course.

### Measures

All data were measured by Japanese versions of the questionnaire and all measurements were conducted on the web. Rating scales, as well as the learning program, were only accessible with an ID and password, which was mailed to the participants. Responses to the rating scales were administered by the third author and concealed from others such as supervisors or occupational health staff. Details of the scales or questions used in the study are described below.

#### 1) Primary outcome measures

*Self-efficacy* was measured using 17 items from the questionnaire, which was originally developed by Sherer and Maddux<sup>30</sup> and then translated into Japanese<sup>31</sup>. This

questionnaire has the following two subscales: general self-efficacy (17 items) and social self-efficacy (6 items); this study used the former one. Items were scored on a five-point Likert scale ranging from "1=strongly disagree" to "5=strongly agree". The total score of the 17 items was used as an indicator of self-efficacy (Cronbach's alpha coefficient=.89).

*Problem solving behavior* was measured by an instrument developed for this study (6 items). Each item corresponds to each stage of problem solving described above<sup>27</sup>. Respondents were asked to indicate how frequently he or she used the strategy described by a particular item ranging from "1=not at all" to "5=often". Principal components analysis of the 6 items indicated one large component that accounted for 70.4% of the variance. The total score of the 6 items was used as an indicator of problem solving behavior (Cronbach's alpha=.91). This score had positive correlations with self-efficacy ( $r = .48, p < .001$ ) and job satisfaction ( $r = .24, p < .001$ ), and negative correlations with psychological ( $r = -.33, p < .001$ ) and physical stress responses ( $r = -.19, p < .01$ ).

#### 2) Secondary outcome measures

*Psychological and physical stress responses* were assessed using 29 items from the Brief Job Stress Questionnaire (BJSQ)<sup>32</sup>, scored on a four-point Likert scale ranging from "1=strongly disagree" to "4=strongly agree". The BJSQ assessed four aspects regarding job stress: job stressor, stress response, job and life satisfaction, and social support. With regards to the stress response, the following 6 subscales were used to measure psychological and physical stress responses: vigor (3 items), anger (3 items), fatigue (3 items), anxiety (3 items), depression (6 items), and somatic stress responses (11 items). In calculating the psychological stress response score, each item of the vigor scale was reverse scored so that a high score indicated a high extent of stress response, then the scores of vigor, anger, fatigue, anxiety, and depression were summed (Cronbach's alpha coefficient=.92). For the physical stress response, the total score of the 11 items from the somatic stress responses scale was used (Cronbach's alpha coefficient=.85).

*Job satisfaction* was assessed using a single item, that is, whether or not the participant was satisfied with his/her job. It has been argued that a global index of overall job satisfaction (single item measure) is an inclusive and valid measure of general job satisfaction<sup>33-35</sup>. This item was scored on a four-point Likert scale ranging from "1=satisfied" to "4=dissatisfied". It was reverse scored so that high scores indicated a high extent of job satisfaction.

#### 3) Other measures

Job stressor was assessed using the following 2 subscales from the BJSQ: job demands and job control.

These subscales had 3 items, respectively, which were scored on a four-point Likert scale ranging from “1=agree” to “4=disagree”. Each item was reverse scored so that high scores indicated a high extent of job demands or job control. Cronbach’s alpha coefficients for each scale were .76 and .59 for job demands and job control, respectively. The demands-control ratio, which was constructed by dividing the score of job demands by that of job control, was used as an indicator of job stressor. High scores indicated a high extent of job stressor.

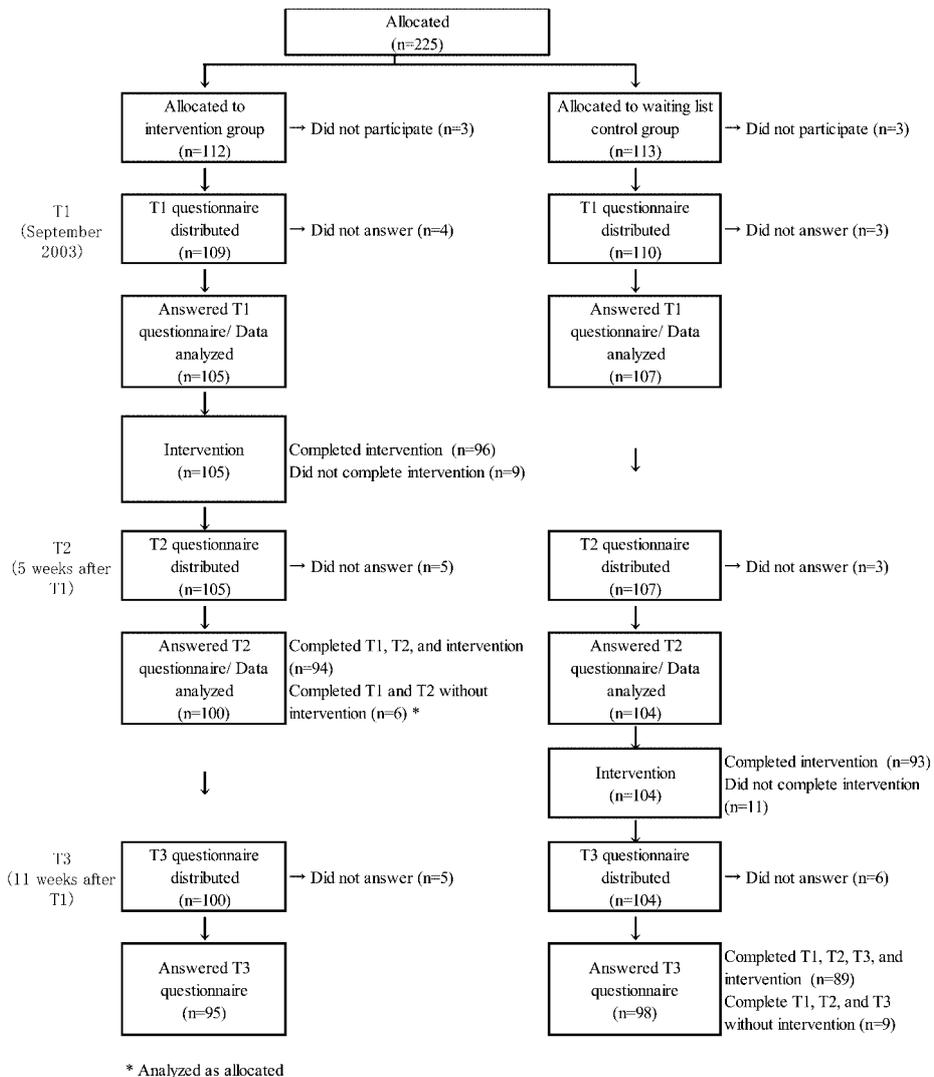
Demographic data (sex and age) and information on interests in managing stress were also collected.

*Statistical procedure*

To investigate the intervention effect, the change score in primary and secondary outcome variable was calculated by subtracting the score at T1 from that at T2. Then, the difference in the scores between groups was examined using analyses of covariance (ANCOVA) with

the T1 score as the covariate. We applied the same analyses to the respective items of self-efficacy and problem solving behavior (primary outcome measures) to evaluate intervention effect in detail. Furthermore, those analyses were conducted for subgroups classified by sex, age, interests in managing stress, and job strain at T1 to determine which participants profited from the intervention. Each subgroup was defined according to the respective median at the T1 except for sex.

This study did not deal with data from the follow-up survey (T3), because the follow-up was uncontrolled. All statistical analyses were performed on an intention-to-treat basis; data from all assigned participants were included in the analyses independent of completion of the learning if they had both T1 and T2 observation. The statistical analyses were performed with SPSS 11.0J for Windows.



**Fig. 1.** The flow of participants through the trial.

## Results

### Participants

Figure 1 summarizes the flow of participants through the trial. Three employees from each group dropped out just before commencing the study because of resignation, suspension, or a change of workplace. At the baseline survey (*T1*), 219 participants (109 from the intervention group and 110 from the waiting list control group) were sent the welcome e-mail and asked to answer the questionnaire; 212 completed it (105 and 107 from each group, respectively). At the post-intervention survey (*T2*), 204 participants (100 from the intervention group and 104 from the waiting list control group) completed the questionnaire, and data from those who answered both the *T1* and *T2* surveys were analyzed to investigate the short-term intervention effect (N.B. 6 out of 100 participants in the intervention group did not complete

the learning). The retention rate was 90.7 % (89.3 % for the intervention group and 92.0 % for the waiting list control group). At this point (*T2*), the number of participants who completed the intervention (finished the entire e-learning course and answered both the *T1* and *T2* questionnaires) was 94 in the intervention group.

### Baseline characteristics

Table 1 shows the characteristics of the participants who completed the baseline survey (*T1*). We detected no differences between the intervention and waiting list control groups in all baseline variables.

### Drop-outs

Using the baseline data from the intervention group, we compared baseline characteristics for “completers” who finished the entire e-learning course and answered both the *T1* and *T2* questionnaires with those for “drop-

**Table 1.** Means (and SDs) or numbers (and percentages) of demographic and outcome variables at *T1*

Variables	Intervention group (n=105)		Waiting list control group (n=107)		<i>p</i> value
Sex <sup>a, b</sup>	88	(80.73)	94	(85.45)	0.351
Age	41.9	(11.48)	44.0	(11.31)	0.180
Job demands	8.7	(1.92)	8.7	(2.16)	0.852
Job control	8.4	(1.66)	8.3	(1.97)	0.746
Job strain (Job demands/Job control)	1.1	(0.50)	1.2	(0.51)	0.630
Interests in managing stress	2.1	(0.81)	2.1	(0.82)	0.461
Self-efficacy	58.9	(8.37)	57.8	(10.24)	0.412
Problem solving behavior	14.4	(4.86)	15.2	(4.45)	0.189
Psychological stress response	36.8	(9.88)	38.3	(9.39)	0.259
Physical stress response	18.4	(5.19)	18.6	(5.66)	0.890
Job satisfaction	2.7	(0.81)	2.6	(0.83)	0.387

<sup>a</sup>Number of men. (%), <sup>b</sup>Differences tested with  $\chi^2$  test, otherwise differences were tested with t-test.

**Table 2.** Comparison of Means (and SDs) or numbers (and percentages) of demographic and outcome variables between Completers and Drop-outs in intervention group at *T1*

Variables	Completers (n=94)		Drop-outs (n=11)		<i>p</i> value
Sex <sup>a, b</sup>	73	(77.66)	11	(100.00)	0.080
Age	41.09	(11.38)	49.18	(10.14)	0.026
Job demands	8.69	(1.85)	8.73	(2.57)	0.954
Job control	8.31	(1.71)	8.73	(1.19)	0.432
Job strain (Job demand/Job control)	1.13	(0.52)	1.02	(0.32)	0.488
Interests in managing stress	2.12	(0.83)	1.64	(0.50)	0.063
Self-efficacy	58.72	(8.22)	60.27	(9.88)	0.564
Problem solving behavior	14.13	(4.80)	16.45	(5.05)	0.133
Psychological stress response	36.88	(9.81)	36.27	(10.96)	0.847
Physical stress response	18.57	(5.21)	17.36	(5.08)	0.467
Job satisfaction	2.68	(0.81)	3.00	(0.77)	0.215

<sup>a</sup>Number of men. (%), <sup>b</sup>Differences tested with  $\chi^2$  test, otherwise differences were tested with t-test.

**Table 3.** Comparison of the change scores ( $T_2-T_1$ ) between groups by ANCOVA with  $T_1$  score as covariate

Variable	Intervention group (n=100)		Waiting list control group (n=104)		F value	p value
	Mean	(SD)	Mean	(SD)		
Self-efficacy	0.54	(4.726)	-0.32	(5.494)	1.688	0.195
Problem solving behavior	0.32	(3.861)	-0.16	(3.419)	0.062	0.803
Psychological stress response	-1.07	(5.688)	-0.72	(6.760)	0.851	0.357
Physical stress response	-0.77	(2.788)	-0.27	(3.313)	1.547	0.215
Job satisfaction	0.09	(0.605)	-0.02	(0.462)	3.075	0.081

**Table 4.** Comparison of the change scores ( $T_2-T_1$ ) between groups by ANCOVA with  $T_1$  score as covariate: Results of the corresponding items of self-efficacy scale

Variables	Intervention group (n=100)		Waiting list control group (n=104)		F value	p value
	Mean	(SD)	Mean	(SD)		
	1 When I make plans, I am certain I can make them work.	0.12	(0.729)	0.10		
2 One of my problems is that I cannot get down to work when I should. (Reversed)	-0.08	(0.950)	-0.13	(0.900)	0.803	0.371
3 If I can't do a job the first time, I keep trying until I can.	0.07	(0.807)	-0.07	(0.873)	2.765	0.098
4 When I set important goals for myself, I rarely achieve them. (Reversed)	0.08	(0.929)	-0.10	(0.807)	3.966	0.048
5 I give up on things before completing them. (Reversed)	0.16	(0.884)	-0.15	(0.901)	7.584	0.006
6 I avoid facing difficulties. (Reversed)	-0.04	(0.852)	0.04	(0.913)	0.213	0.645
7 If something looks too complicated, I will not even bother to try it. (Reversed)	-0.09	(0.668)	0.03	(0.886)	1.079	0.300
8 When I have something unpleasant to do, I stick to it until I finish it.	-0.03	(0.893)	0.03	(0.830)	0.111	0.739
9 When I decide to do something, I go right to work on it.	-0.04	(0.974)	-0.05	(0.885)	0.011	0.916
10 When trying to learn something new, I soon give up if I am not initially successful. (Reversed)	-0.05	(0.833)	-0.10	(0.795)	0.923	0.338
11 When unexpected problems occur, I don't handle them well. (Reversed)	0.00	(0.725)	0.05	(0.817)	0.579	0.448
12 I avoid trying to learn new things when they look too difficult for me. (Reversed)	0.07	(0.756)	0.02	(0.914)	1.079	0.300
13 Failure just makes me try harder.	0.20	(0.804)	0.13	(0.669)	0.536	0.465
14 I feel insecure about my ability to do things. (Reversed)	0.00	(0.778)	-0.01	(0.842)	0.222	0.638
15 I am a self-reliant person.	0.04	(0.751)	0.03	(0.769)	0.001	0.977
16 I give up easily. (Reversed)	0.01	(0.745)	-0.13	(0.914)	3.081	0.081
17 I do not seem capable of dealing with most problems that come up in life. (Reversed)	0.12	(0.700)	-0.01	(0.744)	1.826	0.178

outs" who only answered the  $T_1$  questionnaire (Table 2). Drop-outs were significantly older ( $p=0.026$ ) and had marginally significant lower interests in managing stress ( $p=0.063$ ) than completers. The rate of drop-outs among men were marginally higher than that among women ( $p=0.080$ ). However, we detected no differences between the groups in any other variable at  $T_1$ .

#### Intervention effects

*Self-efficacy:* We detected no significant differences between groups in changes in the self-efficacy scale (Table 3). With respect to the corresponding items, however, significant or marginally significant differences were found between groups in 4 items from  $T_1$  to  $T_2$  (Table 4). These 4 items were all with regards to the willingness to expend effort in completing the behaviors

and persistence in the face of adversity. Participants in the intervention group showed increases in the respective scores, while those in the waiting list control group showed decreases in them.

*Problem solving behavior:* We detected no significant differences between groups in changes in the problem solving behavior scale and all corresponding items in that scale.

*Stress responses:* We detected no significant differences between groups in changes in both the psychological and physical stress response scales ( $p > .10$ ).

*Job satisfaction:* We detected a marginally significant difference between groups in changes in the job satisfaction scale from  $T1$  to  $T2$  ( $p = 0.081$ ). Participants in the intervention group showed an increase in job satisfaction score, while those in the waiting list control group showed a decrease in it.

#### Subgroup analyses

When we investigated the intervention effects by sex (male/female), male participants showed significant or marginally significant positive effects on physical stress response ( $p = 0.069$ ) and job satisfaction ( $p = 0.009$ ), while females showed no intervention effects on any indicator ( $p > .10$ ). With regards to age (40 yr or younger/ 41 yr or older), younger participants showed significant or marginally significant positive effects on self-efficacy ( $p = 0.033$ ) and psychological distress ( $p = 0.093$ ), while older individuals showed no intervention effects on any indicator ( $p > .10$ ). With regards to the interests in managing stress (no or low/ high or very high), those with initially higher interest scores showed significantly positive effects on psychological distress ( $p = 0.029$ ), while those with initially lower interest scores showed no intervention effects on any indicator ( $p > .10$ ). With regards to job strain (0–1/1+), those with initially higher job strain showed a marginally significant positive effect on problem solving behavior ( $p = 0.086$ ), while those with initially lower job strain showed a marginally negative effect ( $p = 0.067$ ).

## Discussion

The main purpose of this study was to examine the effects of web-based psychoeducation on employees' self-efficacy, problem solving behavior, stress responses and job satisfaction. Although many web-based psychoeducation programs have been developed, most were for psychiatric patients. To our knowledge, this study was the first controlled clinical trial using data from a normal population in the workplace. Our program seemed acceptable to the participants, with a retention rate of 89.3%. The main findings of the intervention effects were 1) increased self-efficacy, especially in willingness to expend effort in completing the behaviors and persistence in the face of adversity, and 2) increased

job satisfaction.

According to Bandura<sup>28</sup>, self-efficacy consists of two types of expectancies, outcome expectancy (convincing oneself that a certain behavior will lead to desirable consequences) and self-efficacy expectancy (belief that one can perform the behavior in the required situation). Bandura<sup>28</sup> pointed out that improved outcome expectancy does not lead to behavioral change unless self-efficacy expectancy is improved. Therefore, this program aimed at improving not only outcome expectancy but also self-efficacy expectancy. Explanation of the problem solving procedures, the simulation game, and FAQ all may lead to improved self-efficacy, although we should interpret our results with caution due to the multiple comparisons.

Job satisfaction is defined as "a pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences"<sup>36</sup>, and low job satisfaction has potential impacts on reductions in performance, product quality and customer responsiveness, as well as increases in turnover<sup>37</sup>. It is noteworthy that increased job satisfaction, although marginally significant, was found among participants in the intervention group, because improvement of job satisfaction seems important in terms of both occupational mental health and organizational management.

Nevertheless, contrary to our expectations, no intervention effect was observed for problem solving behavior and stress responses in any analysis for all participants. A number of factors might explain this lack of effect. First, the participants were limited to white-collar workers, because the blue-collar workers did not have their own personal computers in their workplaces. Therefore, we assigned only white-collar workers to the intervention or waiting list control group. It is possible that some participants in the intervention and control groups worked in the same workplaces and therefore talked to each other about the content of the programs<sup>17</sup>. Some participants in the control group commented that this novel psychoeducation program became something of a topic of conversation in the workplace during the waiting period. The shared information within the control group might have led to less clear intervention effects. These problems might be minimized if participants are recruited from a broader sample in different workplaces<sup>17</sup>.

A second concern is the design of the web page. We explained six stages of problem solving in Chapter 3, and participants had to open the chapter whenever they wanted to review the problem solving process. The top page that summarizes the outline might act as a prompt or reminder that encourages participants to put their acquired skills into practice in the workplace.

A third concern is that the post-intervention survey ( $T2$ ) was conducted 1 week after completion of the learning period, but long-term intervention effects were not evaluated. It might take some time to transfer the acquired

coping skills to real life, thus long-term observations could lead to clearer intervention effects<sup>38</sup>). Van der Klink *et al.*<sup>13</sup>) recommend that a controlled follow-up of at least 12 weeks be part of the design of intervention studies.

A fourth concern is the assessment of problem solving behaviors. The scale used to measure the problem solving behaviors was developed specifically for this study, and the psychometric properties were not fully examined. Furthermore, retrospective self-reports could not distinguish between the opportunity to employ the acquired skills and ability to do them. A procedure that allowed problem solving behaviors to be measured in analogous situations would have provided a better method for detecting changes attributable to intervention effects. In addition to self-reports and analogous situations, it would have been helpful to have outside observers (such as supervisors or co-workers) rate participants' behavioral manifestations during the data collection period to determine how well participants were able to apply skills learned in the program<sup>21</sup>).

Nevertheless, significant or marginally significant intervention effects on problem solving behavior and stress responses as well as self-efficacy and job satisfaction were found in the explanatory analyses of subgroups. These effects were found among males and younger individuals, and those who initially had higher job strain or higher interests in managing stress. We will attempt to explain these findings by first looking at the characteristics of the completers who finished the entire program course. These individuals were younger and had higher interests than the drop-outs. Those who most needed the skills to deal with stress were more likely to complete the program. It is acceptable that clearer intervention effects were found among those with high motivation. It is also acceptable that those with higher job strain were likely to need the skills and thus be highly motivated, which, in turn, could lead to intervention effects. Eriksen *et al.*<sup>39</sup>) claimed that motivation, acceptance and compliance are important factors for intervention effects. Another explanation is familiarity with computer and web-based training; male and younger participants might be more familiar with these programs than females or older participants. Furthermore, the contents of the program could have influenced the intervention effect. The program in this study provided skills to help participants to find by themselves appropriate strategies to deal with a wide range of stressors. The number of female workers in Japan who suffer from interpersonal problems is 1.5 times as many as males<sup>15</sup>). Thus a program that mainly focuses on skills to deal with interpersonal problems might be more helpful for female workers. Further studies are needed to clarify to whom and in what circumstances the program brings about the most benefits.

Before making a conclusion, we have to refer to several

limitations of the study. As noted above, the short follow-up period, self-reported outcome measures, original measure of problem-solving behavior, and participants' characteristics (only white-collar) could have had some effects on the results. In addition, non-blinded trial and quasi-randomization according to employee number could also have had unexpected effects. Furthermore, the clinical/practical significance of the difference in the change scores between groups which we observed is unclear due to lack of previous evidence and lack of quantitative information. Further studies on the effects of web-based psychoeducation are needed with the clinical/practical significance of the change scores in outcome measures defined.

In summary, this empirical study provides evidence that web-based psychoeducation is an acceptable tool for individual-focused stress management in the workplace. This study also suggests the possibility that it may have short-term effects on self-efficacy and job satisfaction, and that programs that focus on particular subgroups might be more effective.

*Acknowledgments:* This study was supported by Fujitsu Infocsoft technology Co. Ltd. and partially by Grants-in-aid for scientific research from the Japan Society for the Promotion of Science (Representative: Professor. Miyatani M, Hiroshima University).

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