

Development of a Work Improvement Checklist for Occupational Mental Health Focused on Requests from Workers

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Abstract: Development of a Work Improvement Checklist for Occupational Mental Health Focused on Requests from Workers: Hiroyuki TAHARA, *et al.* Department of Mental Health, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan—**Objectives:** To develop tools offering definite orientation for managers and employees to support their work improvement through occupational mental health. This research was a part of the Mental Health Improvement & Reinforcement Study (MIR study), conducted from October 2004 to March 2006. **Methods:** We developed a trial version named the Kaizen Check List (KCL) by referring to problem solving methods for quality management. Then we improved it for a formal version named MIR Research of Recognition (MIRROR). A feedback form named MIR Action Guidance (MIRAGe) was also developed. We analyzed data from 1,953 respondents at five manufacturing enterprises in Japan using MIRROR and the Brief Job Stress Questionnaire (BJSQ) to determine whether or not the workers requesting work improvement had more stress than other workers. **Results:** The KCL had 47 items, which indicated desirable working conditions for mental health at work, and four answer categories. MIRROR has 45 selected items and improved answer categories. MIRAGe displays the results of MIRROR and step-by-step guidance for work improvement. Respondents with request had significantly higher

scores in stressor and lower scores in buffer factors compared with respondents without request in many items of MIRROR. **Conclusions:** A combinational use of MIRROR and stress scales is useful for finding worksites with high risk factors for mental health and for directing focus on work improvement at these worksites according to workers' requests.

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Key words: Management quality circles, Occupational health, Office management, Problem solving, Psychological, Questionnaires, Stress

Interventional approaches for stress management at work are being tried worldwide. Although some successful cases have been reported^{1–4}, interventional approaches have not always been effective with regard to work improvement and a generally accepted methodology has not yet been developed. There is a clear need for methodological improvement¹, because the number of workers with health problems caused by job stress continues to increase.

In interventions, researchers try to assess the stressor in the worksite or workers' stress response for work improvement. A variety of self-administered psychological questionnaires are used in the occupational health field. The NIOSH Generic Job Stress Questionnaire by the National Institute for Occupational Safety and Health (NIOSH)⁵ and the Job Content Questionnaire (JCQ) by Karasek⁶ are commonly used internationally, and the Brief Job Stress Questionnaire (BJSQ) by the Ministry of Labour⁷ and the Job Stress Scale Revised Version (JSS-R) by Kosugi *et al.*⁸ are also commonly used in Japan.

These questionnaires are standardized by factor analysis and apply their factor scores for assessment, but

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the results tend to be abstract for managers and employees. As a result, they may not promote or follow up on work improvement after the questionnaire survey, especially in cases where there is no support by an expert on stress management.

The purpose of this study was to develop new tools offering definite orientation for managers and employees to support their work improvement. This was in effect a development of tools to activate the Plan-Do-Check-Act (PDCA) cycle of work improvement. The Mental Health Action Check List (MHACL) by Yoshikawa *et al.*⁹⁾ also serves the same purpose. MHACL is an example of the application of the good-practice approach, which is utilized in the ergonomics field, for stress management. We developed tools in another approach, which focused on workers' requests and followed the problem solving method in quality management of products or services.

Methods

Development of the trial version

The original idea of this study was conceived from our interventional approaches for work improvement at several manufacturing enterprises. Both full-time occupational health staff and ourselves heard about work improvement from managers and employees after measuring stressors or stress reactions, and the points were summarized in a checklist. As the checklist was a conventional "Yes or No" format, and its items were specific to each enterprise, we needed a new checklist with a broader general application that would allow useful interventions to be extended to other worksites with high risk factors for mental health.

We devised a process for work improvement with a participatory approach and laid out the following four steps for implementation: assessment of pre-intervention status as step 1; deciding priority of problems as step 2; planning and executing the actions for work improvement as step 3; and assessment of post-intervention status as step 4. Various scales of stressor or stress reaction are relevant to step 1. Sessions of group discussion by managers and employees are held at steps 2 and 3. MHACL, which offers action plans firsthand, is relevant to step 3. We decided to develop a tool that makes it easier to proceed from step 1 to 2, for enterprises using conventional stress scales. The first trial version was named the Kaizen Check List (KCL).

We also referred to problem solving methods in quality management of products or services¹⁰⁻¹¹⁾, i.e. Quality Control (QC) and Total Quality Management (TQM), to devise the form of the KCL. The purpose of devising new tools is that employees can define the gap between the current status at work and an ideal status¹⁰⁾. Also managers can prioritize working condition improvements by importance, difficulty, cost, or other relevant factors, because it is impractical to solve all the problems at one

time.

We then held a brainstorming session with eleven other occupational health specialists in the University of Occupational and Environmental Health, Japan (UOEH), collected desirable working conditions for mental health referring to case reports¹²⁾ and questionnaires, and categorized them as demand, control, and support-related items. These items included not only physical and chemical agents but also work organization, work arrangements, working hours, work methods, and human relations. Three occupational health specialists and two human resource managers at an enterprise in Japan reviewed the items.

Development of the formal version

In November 2004, we explained the aims of this research and invited to the research at an annual meeting of about 200 occupational health specialists who graduated from UOEH. Twenty-four enterprises in Japan participated, and a master copy of the KCL was delivered to the occupational health staff at each enterprise. This checklist was anonymous in principle, but required the responder's gender, section, occupational position, and job category for summation. Occupational health staff at each enterprise obtained written or oral informed consent from each respondent before replying. We made sums of the answers in four job categories with increasing occurrence of mental health problems: research & development (R&D); system engineer (SE); manufacturing (Mfg); and sales & trades (S&T). The following two indexes were calculated for each item to select items for the formal version of the checklist. One was the "index of concern" (Ic), the ratio of the number of answers *concerned* with the item to the number of answers *not concerned*, for each occupation. We added the number one to both the denominator and numerator, so as not to divide by zero. The other index was the "index of request" (Ir). We subtracted the percentage of respondents requesting work improvement in each occupation of each enterprise from that of all the respondents in the enterprise to control differences between enterprises, and took the average of each occupation of all the enterprises. Then, we investigated the cut-off points of both Ic and Ir.

We also improved the items and the answer categories to reflect the meaning of each category more exactly, referring to users' objections. The formal version was named the Mental Health Improvement & Reinforcement (MIR) Research of Recognition (MIRROR).

Development of the feedback form

We considered the following three points in planning the method of summation and feedback of the checklist: (1) managers and employees who receive the result can easily imagine the situation in their own worksite; (2)

Table 1. The enterprises surveyed by BJSQ & MIRROR

Enterprise	Category	Employees	Respondents	Delivery
A	Metal	780	706	Paper
B	Metal	497	453	Paper
C	Electronics	895	117	Paper
D	Heavy Industry	about 1,100	1,042	Paper/Online
E	Chemical	about 1,200	318	Online
Total			2,636	

BJSQ: Brief Job Stress Questionnaire; MIRROR: Mental Health Improvement & Reinforcement, Research of Recognition.

the checklist indicates not only existence but also the priority of problems; and (3) the checklist displays both the strengths and weaknesses of the worksite. We then set about developing an input sheet, automatic summation program, and visual feedback sheets using Microsoft Excel 2000 for Windows.

Assessment of the relationship between the checklist and conventional stress scales

Since the checklist was developed as a complementary tool for conventional stress scales, the results of the checklist needed to be matched to measured stressors. As a primary step to analyze the linkage between the results of MIRROR and conventional stress scales, we tried to determine whether or not the workers requesting work improvements had more stress than other workers by the following method.

We surveyed five enterprises with full-time occupational health specialists in Japan using BJSQ and MIRROR (Table 1). The ethics committee of UOEH reviewed this part of the study, and occupational health specialists at each enterprise linked the anonymous MIRROR to the registered BJSQ. Then, the data of each item was analyzed by one-way analysis of variance (ANOVA) with the existence of a request for work improvement as an independent variable and four subscales, quantitative workload, control, support from superiors, and support from colleagues of BJSQ, as dependent variables. These statistical analyses were carried out with SAS version 8.

Results

Development of the trial version

We decided to make a checklist that contains desirable conditions of worksite stress management, and to have each worker answer the necessity of improvement of each item.

The answer categories of the KCL were: (1) it must be improved; (2) it needs improvement, if possible; (3) it has already been improved; and (4) no improvement

needed. Each responder circled the answer which most closely applied to him/her. We divided the "improvement needed" answer into two categories for a weighted count to decide the priority. The answers are summed by category, and they are used as indicators of priority.

We collected 55 desirable conditions for mental health in the brainstorming session. Then, we corrected and integrated them into 47 items, which were published as the KCL. The items of the KCL are shown in Table 2.

Development of the formal version

One thousand five hundred ninety workers at 18 enterprises in Japan replied to the KCL, and we made sums for the answers in four job categories: 690 at 6 enterprises with R&D; 175 at 8 enterprises with SE; 309 at 6 enterprises with Mfg; and 149 at 6 enterprises with S&T. We defined the answers (1)(2)(3) as "concerned" and the answer (4) as "not concerned" and calculated the I_c and I_r for each occupation (Table 3). Several patterns of cut-off points were examined, and we decided to remove two items, "Office get-together is seldom held (KCL-21)." and "No emergency contact. No consecutive emergency contacts (KCL-44).", with $I_c < 1.5$ and $I_r < -5$, respectively, in all the four occupations. There were two reasons: one was that we preferred to retain those items best suited for universal use as much as possible; the other was that each item is independently summed in the current version of KCL/MIRROR. " $I_c < 1.5$ " means that about one-third or more of the respondents circled the answer (4), and " $I_r < -5$ " means that the percentage of requests by the occupation was fewer by 5% or more than that by all respondents from the same enterprise. The items of MIRROR are shown in Table 4.

We also improved the wording, since KCL users' opinions were that "(4) no improvement needed" was indistinguishable from "(3) it has already been improved", and changed the order of the answer categories for MIRROR to primarily place positive issues along with the good-practice approach. The improved answer categories were restated as: (1) we have this situation

Table 2. The items of the KCL

No.	Descriptions
KCL-01	Since personnel distribution and workload assignment have been adequate, the burden is not being placed on a specific person disproportionately.
KCL-02	Since the person who gives instructions about who does what is explicit, it is always clear who to follow.
KCL-03	Work which is appropriate to each level of skill is assigned.
KCL-04	The content of work allotted is specified.
KCL-05	Coordination and cooperation with other groups are going well.
KCL-06	Personnel relocation or relocation to a different group is carried out adequately.
KCL-07	Policy of work is determined in a way acceptable to all.
KCL-08	Everyone is free to express his/her opinion and thoughts in the workplace.
KCL-09	Customer feedback is reflected in the development of systems and products.
KCL-10	Information about objectives, perspective and orientation of the work is explicitly given.
KCL-11	A forum for discussion about the progress and degree of attainment of the work with the boss/superiors/supervisors is in place.
KCL-12	The number and content of the meetings are appropriate enough to share information and matters.
KCL-13	Training according to ability and experience and that for ability development are given.
KCL-14	Supervisors actively give their subordinates opportunities for training.
KCL-15	I do not have significant workload problems which affect my core responsibilities.
KCL-16	My current workload of inputting data on manufacturing and ordering is not excessive.
KCL-17	Consideration has been made to keep the preparation of materials and reports to the minimum necessary.
KCL-18	Systems for communication and support have been arranged when you are away on business.
KCL-19	There is sufficient staffing to cover large and longer tasks (Manpower arrangement and support is promptly made when a task involving a heavy workload becomes prolonged).
KCL-20	Systems for consultation and support when troubles occur with customers or related traders have been established.
KCL-21	Office get-together is modestly held.
KCL-22	There is no one who behaves without regard for others in the workplace.
KCL-23	There is no one who is left behind or isolated.
KCL-24	Distinction between where people can and cannot smoke has been made adequately.
KCL-25	Workers' wishes have been incorporated in the working environment (ventilation, lighting, etc.).
KCL-26	I have enough space for my work.
KCL-27	Persons in charge in the field have sufficient power to facilitate the work.
KCL-28	Freedom is given to adjust workload of the day at one's own discretion.
KCL-29	Everyone can utilize their own skills and ideas at work.
KCL-30	Supervisors are not too busy so that they have time to listen to their subordinates.
KCL-31	Supervisors have been able to adequately arrange workload based on reports and proposals from their subordinates.
KCL-32	An assistant to act for his/her direct supervisor who is very busy has been appointed.
KCL-33	Supervisors coordinate closely with their subordinates to help their subordinates accomplish their core responsibilities smoothly.
KCL-34	Supervisors confirm the mental and physical health condition of their subordinates at regular interviews with their subordinates.
KCL-35	Supervisors give their subordinates a clear explanation on everything.
KCL-36	Cooperative with each other.
KCL-37	Arrangements have been made to avoid working on too many regular days off or excessive overtime.
KCL-38	I can rest for sure on my break.
KCL-39	Answering telephone calls and dealing with visitors have not been concentrated on a specific person.
KCL-40	I can go home without feeling any constraints as soon as I have done my job.
KCL-41	A "No overwork day" has been set and is utilized.
KCL-42	I can take a paid holiday fairly easily.
KCL-43	Work schedules of irregular work shifts have been arranged in consideration of workers' health.
KCL-44	No emergency contact. No consecutive emergency contacts.
KCL-45	No working on the weekend. No consecutive weekend working.
KCL-46	It's rather easy to take time off in exchange for working on the weekend.
KCL-47	I can commute to work outside rush hour or by other routes which are not crowded with commuters.

Table 3. The indexes on the KCL items

Item	R&D		SE		Mfg		S&T		Formal Version
	Ic	Ir	Ic	Ir	Ic	Ir	Ic	Ir	
KCL-01	5.33	34.30	7.43	41.39	4.48	28.96	6.89	29.01	○
KCL-02	1.48	-4.45	1.41	-5.87	1.66	-9.51	2.08	-7.25	○
KCL-03	1.91	-3.86	2.22	10.14	2.46	1.31	4.35	15.70	○
KCL-04	2.10	1.88	2.22	-3.47	2.23	-2.81	2.97	-4.75	○
KCL-05	3.13	16.83	4.36	23.36	3.37	19.21	5.04	14.42	○
KCL-06	3.40	0.99	3.61	19.45	2.90	18.36	4.59	13.46	○
KCL-07	3.39	8.00	2.93	13.61	3.14	7.95	4.21	9.30	○
KCL-08	1.22	-13.96	1.61	-3.96	1.95	-5.56	2.02	-12.76	○
KCL-09	8.04	20.23	2.37	6.80	3.21	3.12	6.84	26.00	○
KCL-10	3.38	15.70	3.29	7.07	2.43	-2.00	4.17	3.30	○
KCL-11	2.77	5.68	2.09	-7.08	2.84	-0.72	2.60	-12.10	○
KCL-12	2.94	8.74	3.12	7.11	3.28	4.37	3.58	-2.06	○
KCL-13	2.79	10.59	5.52	21.51	3.98	24.82	4.21	12.25	○
KCL-14	1.68	-0.49	3.09	9.36	2.90	-3.28	2.51	-7.24	○
KCL-15	2.52	21.31	3.12	10.30	3.51	21.12	7.39	16.65	○
KCL-16	0.80	-8.23	1.92	2.09	2.49	0.40	3.17	6.98	○
KCL-17	2.20	4.76	4.65	11.21	3.07	4.39	5.00	11.09	○
KCL-18	2.18	-2.74	2.37	-2.62	1.50	-15.00	2.36	-5.95	○
KCL-19	3.34	15.12	5.10	12.80	3.94	16.77	4.21	18.43	○
KCL-20	1.85	4.17	2.38	-4.98	1.75	-8.43	2.43	-2.00	○
KCL-21	0.90	-12.11	1.24	-10.90	1.41	-11.97	1.40	-27.59	×
KCL-22	0.87	-12.52	1.15	-13.90	1.54	-16.76	2.08	-9.90	○
KCL-23	0.94	-17.74	1.30	-9.67	1.68	-5.68	1.85	-13.87	○
KCL-24	0.94	-27.88	0.81	-26.51	2.33	-10.28	1.59	-38.11	○
KCL-25	1.72	-8.86	1.68	-5.03	3.83	10.04	1.90	-18.07	○
KCL-26	1.31	-9.35	1.36	-5.38	2.13	-8.06	1.36	-20.20	○
KCL-27	1.41	-7.95	2.15	-7.55	1.96	-5.04	1.88	-6.43	○
KCL-28	1.06	-12.21	2.11	0.30	2.50	3.77	2.31	-3.58	○
KCL-29	1.47	-5.68	1.90	-5.11	2.39	-1.30	2.02	-7.56	○
KCL-30	2.10	15.98	3.12	19.32	2.96	20.04	3.05	8.17	○
KCL-31	1.95	-1.75	2.74	-3.37	2.21	2.40	3.26	-1.51	○
KCL-32	1.83	-2.87	3.68	10.22	2.45	0.99	2.92	-1.83	○
KCL-33	1.77	-1.43	2.37	-8.72	2.16	-4.57	2.19	-8.67	○
KCL-34	1.74	3.49	2.25	2.57	1.99	-6.04	2.57	-8.79	○
KCL-35	2.31	9.49	3.33	13.40	2.47	2.06	3.17	-1.62	○
KCL-36	1.10	-15.24	1.60	-9.39	1.79	-4.12	3.46	0.42	○
KCL-37	1.24	2.09	4.58	16.61	2.56	7.01	3.20	7.95	○
KCL-38	0.68	-21.47	1.49	-2.14	1.53	-9.76	1.92	0.09	○
KCL-39	0.69	-13.53	2.80	8.19	1.21	-8.81	1.98	-0.30	○
KCL-40	0.87	-7.18	1.70	-2.30	1.50	2.85	1.33	-22.32	○
KCL-41	1.31	12.61	4.58	23.13	2.60	12.71	3.84	19.42	○
KCL-42	0.92	-4.02	2.41	-0.52	3.30	15.66	1.88	-2.10	○
KCL-43	0.69	-19.17	1.75	-6.85	1.98	-0.23	1.94	-4.30	○
KCL-44	0.37	-25.75	1.00	-19.93	1.01	-19.84	0.81	-23.17	×
KCL-45	0.47	-27.78	2.35	-1.68	1.23	-20.71	1.14	-15.97	○
KCL-46	0.66	-17.30	2.35	-3.81	1.71	-7.70	1.83	-6.22	○
KCL-47	0.77	-22.50	1.78	4.13	1.05	-12.36	1.57	-7.02	○
Numbers of Items with Ic≥2.0, Ir≥0 (each)	15	19	31	23	28	21	30	16	
Numbers of Items with Ic≥2.0 and/or Ir≥0	12 / 17		21 / 33		20 / 29		15 / 31		
Numbers of Items with Ic≥1.5, Ir≥-5 (each)	24	27	39	33	42	30	42	27	
Numbers of Items with Ic≥1.5 and/or Ir≥-5	17 / 26		23 / 39		22 / 42		17 / 42		

■ Ic<1.5 or Ir<-5 ■ 1.5≤Ic<2.0 or -5≤Ir<0

Ic: Index of Concern; Ir: Index of Request; KCL: Kaizen Checklist; R&D: Research & Development; SE: System Engineer.

Table 4. The items of MIRROR

KCL No.	MIRROR No.	Descriptions
(1)	1	Since personnel distribution and workload assignment have been adequate, the burden is not being placed on a specific person disproportionately.
(2)	2	Since the person who gives instructions about who does what is explicit, it is always clear who to follow.
(3)	3	Work which is appropriate to each level of skill is assigned.
(4)	4	The content of work allotted is specified.
(5)	5	Coordination and cooperation with other groups are going well.
(6)	6	Personnel relocation or relocation to a different group is carried out adequately.
(7)	7	Policy of work is determined in a way acceptable to all.
(8)	8	Everyone is free to express his/her opinion and thoughts in the workplace.
(9)	9	Customer feedback is reflected in the development of systems and products.
(10)	10	Information about objectives, perspective and orientation of the work is explicitly given.
(11)	11	A forum for discussion about the progress and degree of attainment of the work with the boss/superiors/supervisors is in place.
(12)	12	The number and content of the meetings are appropriate enough to share information and matters.
(13)	13	Training according to ability and experience and that for ability development are given.
(14)	14	Supervisors actively give their subordinates opportunities for training.
(15)	15	I do not have significant workload problems which affect my core responsibilities.
(16)	16	My current workload of inputting data on manufacturing and ordering is not excessive.
(17)	17	Consideration has been made to keep the preparation of materials and reports to the minimum necessary.
(18)	18	Systems for communication and support have been arranged when you are away on business.
(19)	19	There is sufficient staffing to cover large and longer tasks (Manpower arrangement and support is promptly made when a task involving a heavy workload becomes prolonged).
(20)	20	Systems for consultation and support when troubles occur with customers or related traders have been established.
(22)	21	There is no one who behaves without regard for others in the workplace.
(23)	22	There is no one who is left behind or isolated.
(24)	23	Distinction between where people can and cannot smoke has been made adequately.
(25)	24	Workers' wishes have been incorporated in the working environment (ventilation, lighting, etc.).
(26)	25	I have enough space for my work.
(37)	26	Arrangements have been made to avoid working on too many regular days off or excessive overtime.
(38)	27	I can rest for sure on my break.
(39)	28	Answering telephone calls and dealing with visitors have not been concentrated on a specific person.
(40)	29	I can go home without feeling any constraints as soon as I have done my job.
(41)	30	A "No overwork day" has been set and is utilized.
(42)	31	I can take a paid holiday fairly easily.
(43)	32	Work schedules of irregular work shifts have been arranged in consideration of workers' health.
(45)	33	No working on the weekend. No consecutive weekend working.
(46)	34	It's rather easy to take time off in exchange for working on the weekend.
(47)	35	I can commute to work outside rush hour or by other routes which are not crowded with commuters.
(27)	36	Persons in charge in the field have sufficient power to facilitate the work.
(28)	37	Freedom is given to adjust workload of the day at one's own discretion.
(29)	38	Everyone can utilize their own skills and ideas at work.
(30)	39	Supervisors are not too busy so that they have time to listen to their subordinates.
(31)	40	Supervisors have been able to adequately arrange workload based on reports and proposals from their subordinates.
(32)	41	An assistant to act for his/her direct supervisor who is very busy has been appointed.
(33)	42	Supervisors coordinate closely with their subordinates to help their subordinates accomplish their core responsibilities smoothly.
(34)	43	Supervisors confirm the mental and physical health condition of their subordinates at regular interviews with their subordinates.
(35)	44	Supervisors give their subordinates a clear explanation on everything.
(36)	45	Cooperative with each other.

KCL: the Kaizen Check List; MIRROR: Mental Health Improvement & Reinforcement, Research of Recognition.

Table 5. The numbers of MIRROR items in which the request group showed significantly higher scores in the BJSQ

Subscales of BJSQ	<i>p</i> value	N of items	Examples (Effect Size)
Quantitative Workload (BJSQ A1-3)	$p < 0.001$	43	No.15 (0.89), No.1 (0.72), No.26 (0.66)
	$0.001 \leq p < 0.01$	1	No.24 (0.15)
	$0.01 \leq p < 0.05$	0	
	n.s.	1	No.23 (0.01)
Control (BJSQ A8-10, reversed)	$p < 0.001$	41	No.37 (0.62), No.27 (0.57), No.38 (0.52)
	$0.001 \leq p < 0.01$	2	No.28 (0.16), No.20 (0.12)
	$0.01 \leq p < 0.05$	0	
	n.s.	2	No.18 (0.04), No.9 (0.06)
Support from Superior (BJSQ C1,4,7)	$p < 0.001$	40	No.42 (0.75), No.8 (0.69), No.44 (0.68)
	$0.001 \leq p < 0.01$	3	No.34 (0.15), No.33 (0.14), No.16 (0.13)
	$0.01 \leq p < 0.05$	0	
	n.s.	2	No.30 (0.07), No.35 (0.09)
Support from Colleagues (BJSQ C2,5,8)	$p < 0.001$	30	No.45 (0.58), No.8 (0.41), No.42 (0.40)
	$0.001 \leq p < 0.01$	4	No.27 (0.14), No.31 (0.14), No.9 (0.13)
	$0.01 \leq p < 0.05$	3	No.17 (0.11), No.32 (0.11), No.24 (0.09)
	n.s.	8	No.30 (0.00), No.23 (0.02), No.33 (0.06)

n.s.: Not significant; BJSQ: Brief Job Stress Questionnaire; MIRROR: Mental Health Improvement & Reinforcement, Research of Recognition; RG: The Request Group.

right now, therefore, no further improvements needed; (2) it needs improvement, if possible; (3) it must be improved; and (4) the question has no relevance to my worksite.

Development of the feedback form

The feedback form of MIRROR, named MIR Action Guidance (MIRAGe), consists of a summation table of all the items, extracted two rankings, and a step-by-step guidance for work improvement.

The two rankings are highlighted in green "improved ranking", and red "request ranking". They were developed in the following way. We referred to the 1970 edition of the Subjective Symptoms of Fatigue Test by the Working Group for Occupational Fatigue, Japan Society for Occupational Health (JSOH)¹³⁻¹⁵, and adopted the "complaint ratio" (CR) in the section or the position. The ratio of each category is calculated by section or position in this method. Then, the ten highest items of the ratios of answer (1) and answer (2) or (3) are extracted and expressed on the feedback sheet. The former is the "improved ranking". It indicates positive evaluation and may increase the motivation of managers and employees to promote their work improvement, and is also an indicator of the progress of work improvement. The latter is the "request ranking". It is used as a reference to decide the priority of problem solving.

We also devised some visual effects on the summation table and the two rankings. When a cell exceeds 50% in

the CR, its background becomes light-colored. If it exceeds 80%, the background becomes deep-colored.

MIRAGe is delivered to the manager or group leader of the worksite, and he/she can understand the current status of the worksite. He/She is then expected to promote prioritization of the problems and work improvement.

Assessment of the relationship between the checklist and conventional stress scales

A total of 2,636 workers returned the questionnaires and data from 1,953 respondents (74.1%, 39.7 ± 11.4 yr), which had no missing responses was analyzed. There were 1,853 male (39.8 ± 11.6 yr) and 100 female (37.3 ± 8.4 yr) subjects.

We defined respondents who circled (2) or (3) as the "request group" (RG) and (1) or (4) as the "no-request group" (NRG) in each item of MIRROR. RG showed significantly higher quantitative workload calculated by BJSQ scores in 44 of 45 items, lower control in 43 items, lower support from superiors in 43 items and lower support from colleagues in 37 items than NRG (Table 5). These results suggest that RG may be in more stressful situations.

Discussion

In a Medline search, only MHACL provided a checklist complementing conventional stress scales. In the current study, we developed a checklist named MIRROR reflecting the workers' requests for work improvement

and a feedback form named MIRAGe.

The current version of MIRROR adopts a unique style of categorical scales to offer definite orientation for MIRAGe. We discussed whether the checklist should adopt the standard interval scale or not, when we devised the form. A checklist with an interval scale will be universal, but it may dilute other scales or answer categories. Some items of MIRROR have multiple meanings. It is unsuitable to apply the methods for interval scales, such as factor analysis or Cronbach's coefficient alpha, to MIRROR because of these characteristics. We assessed the relationship between the existence of "requests for improvement" in MIRROR and the subscales of job stressor in BJSQ to check the validity as an alternative approach. Respondents *with* requests had significantly higher scores in stressor and lower scores in buffer factors, compared with respondents *without* requests in many items of MIRROR. The four subscales have critical roles in the demand-control-support model⁶⁾ and may be controllable by managers or employees. The results indicate that MIRROR is in conformity with BJSQ. In practical use, a combinational use of MIRROR and stress scales would be useful for finding worksites with high risk factors for mental health and to direct focus of work improvement at these worksites according to workers' requests. The time courses of the improved ratio and the request ratio may be used as indicators for the progress of work improvement. We intend to confirm if the improved ratio elevates and/or the request ratio declines after intervention approaches in further research. This method of assessment is expected to be suitable as a part of an Occupational Safety and Health Management System (OHSMS) at various enterprises.

Users can use MIRROR *instead of* MHACL, if they have some sessions of group discussion using MIRAGe directly. They can also use MIRROR *with* MHACL, if they utilize the rankings on MIRAGe as the "three good examples", which are already going well, and the "three improvement points", which are the conditions to be improved, in MHACL-based group discussion. If they want, users can add or subtract items, because every item of MIRROR is independent. Several users actually requested us to add their original items, i.e. "the workload after the introduction of computer system is reasonable", in this study.

On the other hand, MIRROR has the following limitations or weaknesses. It is difficult to cover all of the various requests for work improvement at various worksites by a checklist. There are concrete items: i.e. "Answering telephone calls and dealing with visitors have not been delegated to a specific person"; and abstract items; i.e. "Cooperative with each other" on the same checklist. An extreme personal opinion may be reflected in the result in a small workgroup because MIRAGe sums

workers' requests as percentage scores. In future research, we are going to improve the items of MIRROR through standardization of job stressors based on current items of MIRROR, and further develop the methodology by analysis of data of recent interventional approaches at many enterprises and the collection of good examples of work improvement.

It is hoped that the methods and tools included in MIRROR will be continuously developed and help to promote work improvement everywhere.

Conclusions

We developed a work improvement checklist named MIRROR and a feedback tool named MIRAGe for occupational stress management. The workers with requests for work improvement had significantly higher scores in stressor and lower scores in buffer factors than other workers in many items of MIRROR. A combinational use of MIRROR and stress scales will be useful for finding worksites with high risk factors for mental health and to direct the focus of work improvements at these worksites.

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