

Original articles. Scand J Work Environ Health. 2018;44(1):58–68

Effectiveness of a participatory physical and psychosocial intervention for balancing the demands and resources of industrial workers: A cluster-randomized controlled trial ¹

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1. *Appendices*
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Appendix A. Description of the procedures of retrieving recovery, work ability, work productivity, mental health, well-being, physical work demands and resources, process evaluation measures and descriptive variables of the workers.

Variable	Measurement items	Calculation for the analysis
Primary outcomes		
Recovery	Nine items (eg, "I find it hard to relax at the end of a working day"), five responses categories ranging from "never" to "always" (7, 31).	Need for recovery (NFR) index based on the mean of all items (31), subsequently converted to a scale of 0-100% where 100% indicated highest need for recovery.
Work ability	Single work ability item (ie, "How many points would you give your current work ability if it was worth 10 points when it was best") (55), responses ranging from 0 ("unable to work") to 10 ("work ability at its best").	
Secondary outcomes		
Physical work demands	Seven questions from the Danish Work and Health Survey (56) regarding the proportion of work hours spent sitting; lifting or carrying; pushing or pulling; arm lifted at or above shoulder height; back bending forward;	Reversing the responses to the sitting item and averaging later responses to all seven items; high scores indicated seldom experiencing the listed physical work demands.

	twisting or bending back; and repeating the same hand and finger movements. Six response categories were provided ranging from “almost all the time” to “never”.	
Physical exertion	Using the item "How physically demanding do you normally perceive your working situation?" (57) on a scale between 0 (“not demanding”) and 10 (“maximum demanding”).	
Physical resources	Physical fitness and strength measured using three questions from the Danish Work and Health Survey (56) with response possibilities from 0 (“poor”) to 10 (“excellent”)	Averaging responses to the three items; high scores indicated high physical resources
Well-being index	WHO5 well-being index (5 items, sample item: "During the last 4 weeks, how much of the time did you have a lot of energy?"); 6 response categories ranging from “all the time” to “at no time”	<i>Averaging the responses and later converted to a scale of 0-100 %; 100 % indicated excellent well-being.</i>
Mental health	Mental health index from five items; three items from the SF-36 question-naire (sample item: "During the last 4 weeks, how much of the time have you been very nervous?") with 6 response categories ranging from “all the time” to “at no time”; together with two items from WHO5 (during the last 4 weeks, how much of the time have you been calm and peaceful? and during the last 4 weeks, how much of the time have you been a happy person?) (58)	Reversing the three items from SF-36 (58), as commonly experiencing calmness and nervousness represent different ends of the well-being spectrum. Afterwards, no mean response values were calculated and also converted to a scale of 0-100 % where 100 % indicates excellent mental health.
Productivity	Single item “How would you rate your productivity at work in the last month”, with responses ranging from 0 (“the absolute worst an employee could perform in my job”) to 10 (“the absolute best an employee could perform in my job”) (24)	
Employees’ appraisal of the	Three items (59, 60): item 1: "All in all, what do you think of the activities initiated in connection with project PIPPI, with response categories ranging from 1 (“very good”) to 7 (“very poor”); item 2: "Do you think the project	

interventi on activities has led to sustainable changes in your workplace?"), response categories ranging from 1 ("to a very high degree") to 5 ("to a very low degree"); item 3: "Do you wish your workplace to continue using the project methods?" with "yes", "no" or "don't know" as response categories.

Employee s' appraisal of the interventi on action plans Five items: item 1: "The action plans address the most important problems; "Item 2: "We have discussed the action plans in our team (for instance on meetings);" Item 3: We have had time allocated to work on the action plans"; Item 4: "We continuously revisit the action plans"; Item 5: "We have implemented the planned action plans". Response categories ranging from 1 "highly disagree" to 5 "highly agree".

Descriptive

Worker's age Using the self-reported date of birth and date of completing the questionnaire

Smoking behavior "Do you smoke?" with 4 response categories (a) "yes daily", (b) "yes sometimes", (c) "used to smoke, not anymore", and (d) "I have never smoked" Summarized into smokers (a,b) and non-smokers (c,d)

Marital/cohabiting status Single item "Do you live with a spouse or live-in partner?" with yes/no response options

Job seniority Single item "How many years and months have you been working in your current job?" With responses in years and months Converted to number of years

Shift work Single item "Which time of the day do you usually work in your main occupation?" with five response options (a) "fixed day work", (b) "worked between either 3 o'clock in the afternoon and midnight", (c) "worked between midnight and 5 o'clock in the morning", (d) "varying working hours with Responses categorized into three categories "fixed day work" (a), "fixed evening/night work (b,c)" and "shift work with/without night work" (d,e)"

night shifts" (e) "varying working hours without night shifts"

Leisure-time physical activity	Using three single items about average time consumption for the previous year (1) Walking, biking or other low-intensity exercise, in which you don't get short of breath or sweat (ie, Sunday walks or low-intensity gardening)? (2) Exercise training, heavy gardening, or higher intensity walking/biking, in which you sweat and get short of breath? (3) Strenuous exercise training or competitive sports? Response categories were "more than 4 hours per week", "2-4 hours per week", "less than 2 hours per week" or "does not perform the activity"	Workers were defined as performing high (strenuous physical activity for >4 hours/week), moderate (strenuous physical activity for 2-4 hours/week and moderate physical activity for more than 4 hours/week), sedentary (light intensity activities for less than 2 h/week and no moderate or strenuous physical activities) and light (responses with any other combinations) leisure time physical activity
General health	Single item "How will you describe your health in general?" with five response categories (a) "excellent", (b) "very good", (c) "good", (d) "poor", and (e) "very poor" (61)	Summarized into "very good" (a,b) and "poor-moderate" (c,d,e) (61)

Appendix B. Comparison of the baseline characteristics of the workers who responded to questionnaires at all time points (baseline, 8, 10, and 12-month follow-up) and those who did not in the PIPPI intervention.

Variables	Drop-out		Responded to all time points	
	(N=187)	(N=216)	(N=187)	(N=216)
Age (years), M,SD	42.4	11.4	45.1 ^a	10.0
Males, n %	84.0	70.0%	138.0	70.4%
Height(cm), M,SD	176.4	7.9	177.5	8.9
Weight(kg), M,SD	80.4	14.0	85.2 ^a	17.3
Smokers, n %	41.0	34.2%	59.0	30.1%
Cohabitation, n %	86.0	72.9%	152.0	77.6%
Job seniority, M,SD	8.6	7.9	11.9 ^b	9.3
Shift work, n %				
Fixed day work	54.0	45.8%	88.0	45.4%
Fixed night work	12.0	10.2%	27.0	13.9%
Shift work with/without night work	52.0	44.1%	79.0	40.7%
Work hours (hours), M,SD	38.0	4.1	37.6	3.2
Good health, n %	71.0	60.2%	103.0	52.6%
Need for recovery (0-100%), M,SD	35.9	15.9	36.1	16.6
Work ability (0-10), M,SD	8.4	1.4	8.4	1.4
Productivity (0-10), M,SD	8.0	1.5	8.3	1.2
Physical exertion (0-10), M,SD	5.3	2.4	5.6	2.4
Physical demand scale (1-6), M,SD	4.0	0.8	3.8	0.9

Physical resources scale (0-10), M,SD	5.9	1.7	6.0	1.7
Well-being index(0-100%), M,SD	67.5	16.2	70.1	14.9
Mental health index (1-6), M,SD	78.2	15.2	80.5	13.4

^aP<0.05; ^bP<0.01; M=mean; SD=standard deviation; good health indicates the proportion of the workers who answered 'excellent', or 'very good' to the question on self-rated health; the baseline characteristics of the workers in control and intervention group were compared using independent *t* test for continuous variables and Pearson's chi-square test for categorical variables.

Appendix B. Descriptive of work ability, need for recovery, productivity, physical work demands and resources, physical exertion at work mental health and well-being and their differences between the intervention and control groups at eight, ten and twelve months of follow-up in the per-protocol analysis in the PIPPI

Variable	Control group		Intervention group		Model 1			Model 2				
	Mean	SD	Mean	SD	β	95%CI		β	95%CI		P	
						lower	upper		lower	upper		
Primary outcomes												
Need for recovery												
Baseline	35.84	16.32	36.47	17.05								
8-months	36.89	17.56	35.44	17.79	-2.23	-7.41	-2.96	0.36	2.30	-7.42	-3.02	0.37
10-months	37.08	17.67	40.44	19.60	4.48	0.47	-8.49	0.03	1.94	0.47	-8.49	0.03
12-months	35.94	18.16	37.67	19.92	4.14	0.10	-8.18	0.04	1.96	0.10	-8.18	0.04
Overall effect								0.06				0.06
Work ability												
Baseline	8.37	1.35	8.43	1.50								
8-months	8.58	1.27	8.56	1.24	-0.042	-0.44	-0.35	0.83	-0.04	-0.44	-0.36	0.84
10-months	8.74	1.13	8.38	1.34	-0.43	-0.73	-0.12	0.01	-0.42	-0.72	-0.13	0.00
12-months	8.46	1.21	8.34	1.45	-0.13	-0.44	-0.17	0.40	-0.13	-0.45	-0.19	0.42

Overall effect **0.02** **0.02**

Secondary outcomes

Productivity

Baseline	8.22	1.30	8.33	1.16						
12-months	8.39	1.27	8.49	1.18	-0.05	-0.47-0.36	0.78	-0.06	-0.48-0.35	0.74

Physical exertion at work

Baseline	5.36	2.40	5.81	2.33						
12-months	5.43	2.22	6.05	2.31	0.44	-0.14-1.02	0.14	0.45	-0.14-1.03	0.13

Physical demands

Baseline	3.88	0.80	3.75	0.96						
12-months	3.86	0.86	3.80	0.82	-0.0026	-0.16-0.15	0.97	-0.001	-0.16-0.16	0.99

Physical resources

Baseline	5.91	1.61	6.06	1.89						
12-months	6.17	1.60	6.00	1.75	-0.26	-0.61-0.09	0.14	-0.30	-0.65-0.05	0.09

Well-being index

Baseline	70.41	14.65	69.84	15.25						
12-months	71.21	15.50	70.63	16.34	-1.13	-6.16-3.89	0.61	-0.83	-5.85-4.20	0.71

Mental health

Baseline	80.92	13.08	80.00	13.81						
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12-months	80.64	14.10	81.43	15.50	0.04	-0.17-0.26	0.63	Analysis did not converge
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N= number of workers involved in the analysis; M=mean; SD=standard deviation; β =estimated difference between the intervention and control group from the statistical models; 95%CI= 95% confidence intervals for the estimate; Model 1= indicates the estimated difference between the groups, after adjustment for the baseline outcome score. Model 2= model1+adjustment for smoking. A negative β -value indicates that the estimate is lower in the intervention group than the control group; $P < 0.05$.

Appendix C. Examples of demands or resources mapped in the Visual Mapping Workshops and corresponding

action plans developed in the Action Planning Workshops.

Positively or negatively experienced aspect of the work environment mapped:	Action plan description:
No clear rules for hiring process	Update development plan
Temperature swings in the factory	Look into what is done by employee X when we call for him to adjust the settings
We would like to have a social gathering with the other work teams	Plan a get-together
Problems with work clothes	Document the various problems experienced by the employees
Implement planned maintenance	Talk to a blacksmith
Work task X is strenuous	Call on occupational therapist to observe the task being performed, give advice
Work task Y is strenuous	New bolts might help

Fire alarms should re-engage automatically after we have temporarily disabled them	Contact supporters
Documenting container contents on signs is a waste of time	Look into whether containers can be hung directly on their corresponding tanks
Incorrect lifting technique makes lifting tasks strenuous	Plan training with physical therapist
Changes between shifts are frustrating	Review change procedure, discuss it in joint consultation committee?
Feeling cold and tired on night shifts	Look into: Are we allowed to have soup?
Too many steps and too much walking on stairs pr. shift	Look into: What would it cost to build a bridge between elevated areas within the production?

Note: some of the descriptions have been anonymized.