Improving subjective health at the worksite: a randomized controlled trial of stress management training, physical exercise and an integrated health programme

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Our objective was to evaluate the effect of 12 weeks of stress management training (SMT), physical exercise (PE) and an integrated health programme (IHP) in a worksite setting on subjective health complaints. To do this, we randomly split 860 employees into the following groups: control (n = 344), PE (n = 189), IHP (comprising physical exercise and health information) (n = 165) and SMT (n = 162). There were no significant effects on subjective health complaints, sick leave or job stress. However, strong and specific positive effects were experienced for the particular goal areas defined for each intervention. The PE group showed improved general health, physical fitness and muscle pain, while the SMT group showed improved stress management. The IHP group showed the strongest effects, affecting most goals set for treatment.

Key words: Coping; physical exercise; RCT; stress.

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Introduction

The majority of traditional health promotion and physical exercise interventions aim at reducing possible risk factors for diseases like cancer, diabetes and coronary heart disease. In this paper, we present a controlled trial study of interventions to improve subjective health problems, one of the main causes of sick leave. Subjective health complaints are conditions with few or no objective findings [1,2]. In Norway, more than half of total sick leave is due to causes based on subjective statements from patients [3]. More than 45% of long-term sick leave (>8 weeks), nearly 33% of permanent disability benefit and 45% of rehabilitation compensation is due to musculoskeletal complaints [4]. Major savings in health care costs can be achieved simply by elimination of these non-fatal conditions [5].

These complaints are very frequent in the normal Nordic population, with 75% reporting at least some subjective health complaint, the most common being tiredness, headache, worry, low back pain, and pain in the arms and shoulders [6]. For most people, such complaints are regarded as minor problems that do not require medical assistance or financial support in any form. However, there seem to be no clear threshold or specific characteristics for when these conditions require

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treatment and support, even if they constitute major areas of expenditure for the health delivery systems [7]. In this paper, we have assumed that reducing subjective health complaints might reduce sick leave due to these conditions, and improve the general feeling of well-being that is an essential part of the definition of health [8]. We chose four strategies to reduce these complaints: physical exercise (PE), stress management training (SMT), a combined integrated health programme (IHP) and organizational intervention. We report the results from a randomized controlled study of three interventions applied at the worksite: an aerobic PE programme, an SMT programme and an IHP combining exercise with information. An organizational intervention was also offered, but not as a randomized experiment, and these results have been reported separately [9–11].

Materials and methods

Materials

In 1996 and 1997, a total of 1558 employees (in at least 40% employment) from 29 post offices and two postal terminals in the Norwegian postal service were invited to participate in the study. Cleaning personnel, long-distance drivers, pregnant women and individuals on leave were not included. All the employees were given an informed consent and a screening questionnaire. The response rate was 68% (n = 1059, 401 males and 658 females). The interventions were run during spring 1996 in Oslo (post offices), autumn 1996 in Bergen (post offices), spring 1997 in Bergen (postal terminal) and autumn 1997 in Oslo (postal terminal) (see Figure 1).

After inclusion and the first screening, participants were randomly assigned, using random permuted blocks within strata, to a control group (n = 344) or one of the three intervention groups: PE (n = 189), IHP (n = 165) or SMT (n = 162). A table of random numbers was used and the randomization was concealed. A fourth intervention, organizational intervention, included all employees (n = 199) from four different organizational units (two post offices and two terminal/sorting units), selected based on size and feasibility of this type of intervention.

Interventions took place during working hours, and only a limited number of individuals from each department or post office participated in the interventions. The randomization was therefore done within strata of department/post office, including leaders. In addition to the preset group size, an additional 104 individuals were randomly selected as reserves for the intervention groups.

Drop-out

Sixty-eight individuals dropped out within the first 3 weeks of the intervention (see Figure 1) (no reason, 22; 'changed their mind', 15; leaving the job, 7; sick leave, 10; pregnancy, 1; no time, 3; too hard, 2; made them worse, 1; lacked trust in the organization, 2; granted leave, 3; education/courses, 1; holiday, 1) and were substituted by reserves. By the post-test, 124 had dropped out of the study (no reason, 80; leaving the job, 16; sick leave, 7; pregnancy, 1; granted leave, 2; holiday, 1; military enrolment, 3; did not want to participate, 14). Reasons for leaving the project before the follow-up test were obtained from only 4 of the 196 participants leaving. Finally, 127 participants dropped out from the intervention, but still wanted to answer the follow-up test (education/courses, 3; sick leave, 10; did not have the time or opportunity to participate, 26; did not want to participate, 19; lacked trust in the organization, 3; no reason, 67).

Interventions

All interventions were standardized and based on detailed protocols, manuals and prepared teaching material (slides, transparencies). Professional instructors were trained in the respective methods used. For the physical training programmes, only authorized instructors were used. The PE intervention was administered for 1 h twice a week for 12 weeks, giving a total of 24 h. The IHP and SMT interventions were administered for 2 h once a week for 12 weeks, giving a total of 24 h.

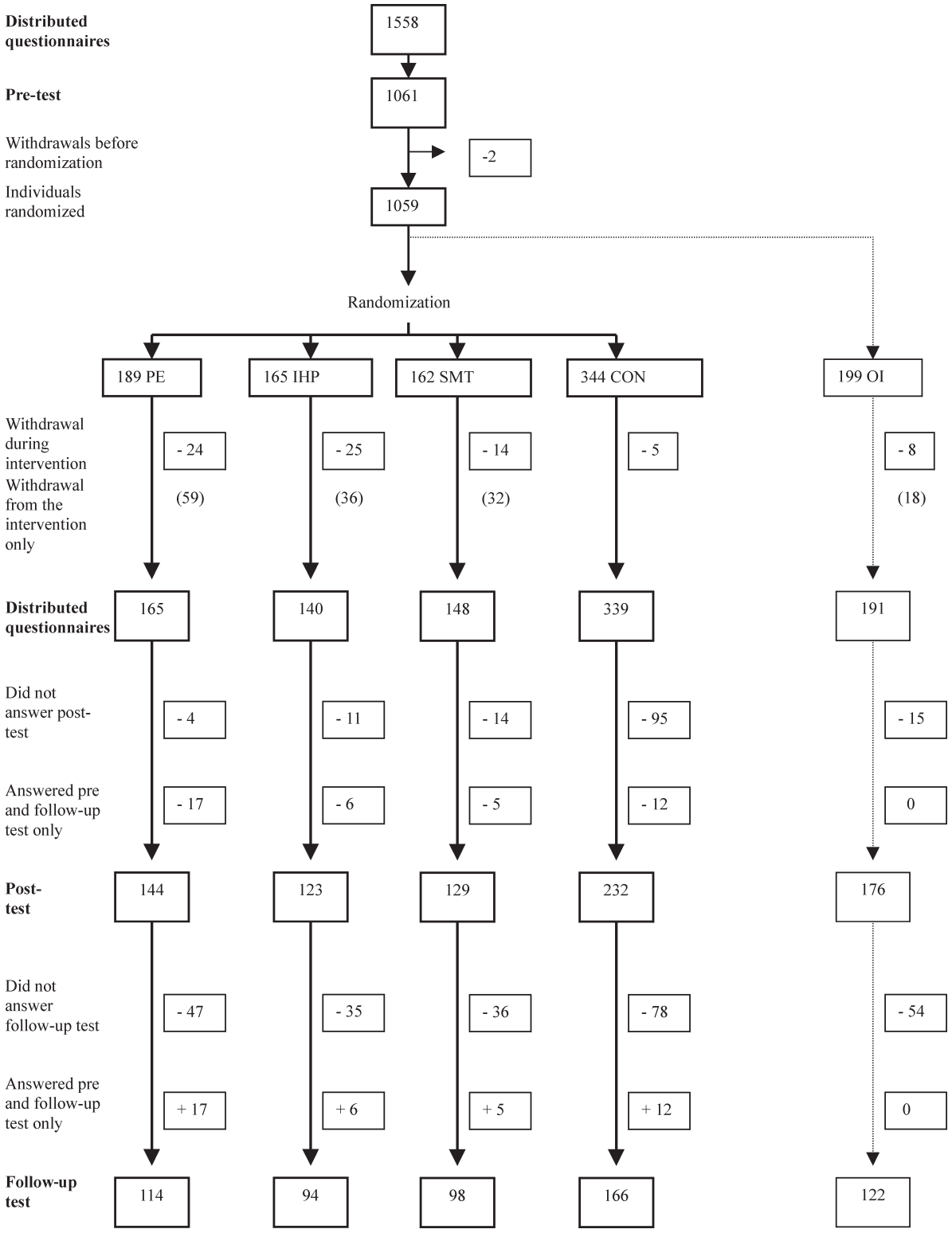
The PE

The Norwegian aerobic fitness model, Gymnastikk i tiden [12,13], is a standardized aerobic dancing programme. The general aim was to improve physical capacity, muscle strength and flexibility. In addition, the programme had a special focus on reducing pain in the neck, back and arm/shoulder by relaxation and circulation exercises. The level and intensity were modified to meet the capability of each individual and the particular group. The exercise was dynamic and rhythmical at moderate intensity (70–80% of maximum heart rate). Overloads, anaerobic- or static work (arm exercises at or above shoulder height) were actively avoided. Special care was taken to avoid injury in general and to make the workout a positive event for the participants.

The IHP

The IHP was developed particularly for this study. It consisted of three main components: physical exercise; information about stress, coping, health, nutrition, etc.; and practical examination at the worksite. During each session, the first hour was theoretical and the second comprised physical exercise. The worksite was visited twice, during the second and eighth weeks, when the degree of static work, heavy lifts, repetitive motions, etc. were analysed. During the second practical examination,

Figure 1. Flow chart. CON = control group; OI = organizational intervention.



the focus was on possible new ways of doing the job. In the theoretical part (10 h), the relationships between demands and exercise, anatomy, information about low back pain [14], activation and stress theory [15,16], ergonomics, exercise physiology, pain and behaviour, musculoskeletal pain, nutrition related to performance and health, and the relationship between physical exercise and musculoskeletal pain were discussed. These topics

were also referred to during the following physical exercise session. The physical exercise part was similar to the PE, but with greater emphasis on exercise and training relevant to the work situation. Each session consisted of ergonomics (5 min), warm-up/aerobic (14 min), alternative working positions and strength training (15 min), stretching (15 min), and relaxation (10 min). The level and intensity of the exercise programme were individually adapted to meet the capability of each individual. Two instructors were present at each session.

The SMT

The SMT was developed to improve the coping ability of the participants through a cognitive–behavioural approach. Coping was conceptualized as the individual's expectancies of control [16]. It was assumed that the coping ability of the individual could be modified by (i) emotion-focused strategies that act to reinterpret or redefine a stressful situation; or (ii) problem-focused strategies tackling the situation directly. Maladaptive cognitions and lifestyle factors (sleeping and eating habits, physical fitness) were identified and attempts made to modify these. Effective strategies for interpersonal communication and social skills were emphasized, and tested with the other participants in a protected setting, with role play and video recordings. In addition, the relationships between stress, appraisal, coping and health, dealing with job stress, defence mechanisms, the use of self-instructions to moderate emotional arousal, communication and self-assertion, performance anxiety, time management, and sleep hygiene were discussed. The themes were covered by lectures, group discussions and practical exercises, such as progressive relaxation [17], autogenic training [18] and visualization. The subjects were given 'homework' to practice abilities acquired during sessions through playback of a 30 min audiotaped instruction. Once learned, the groups discussed when and where such procedures should be used.

Procedure

All participants were screened before the intervention (the pre-test), immediately after the intervention (the post-test) and 1 year after the first screening (the follow-up test). All interventions were administered during working hours for most participants. When this was impossible, the employees in Bergen were compensated with a corresponding number of reduced working hours. The participants in 1996 had to travel from their worksite to a different location to participate in the intervention, while in 1997 participants had the facilities at their worksite. For the follow-up test, questionnaires were also distributed to individuals who had not answered the post-test if they had not specifically withdrawn from the project.

Ethics

All participants were assigned an identification number and were treated anonymously in all analyses. The list containing the name and number of all participants was kept in a secure safe where only one of the investigators had access. Before the first screening started, the employees were informed about the project by their leaders, through information meetings with the scientific project team and by an information pamphlet. Before volunteering to enter the study, all participants signed an informed consent form and were informed about their rights according to the Helsinki declaration.

Instruments

All data were measured by Norwegian versions of questionnaires covering a broad range of factors, including age, gender, number of regular and extra hours of work, shift-work and education, in addition to the specific questionnaires described below.

Job stress was measured by 19 questions from the Cooper job stress questionnaire [19,20], scored on a six-point scale, yielding four subscales on amount of perceived job stress. High scores indicate high levels of perceived stress. Communication (eight items, $\alpha = 0.87$) covers lack of communication and influence, and conflicts with management, co-workers and different groups of employees. Leadership (four items, $\alpha = 0.65$) is related to the employee's relationship to management and subordinates, feeling of being undervalued, and amount of pay. Workload (three items, $\alpha = 0.58$) covers workload perceived as a source of stress, time pressure and deadlines, and workload influencing private life. Relocation (four items, $\alpha = 0.73$) is a mixed factor covering promotion prospects, relocation, managing people and taking work home as perceived sources of stress.

Subjective health complaints were measured by the Subjective Health Complaint Inventory (SHC) [2], previously known as Ursin's Health Inventory [21]. The inventory lists 29 items on subjective somatic and psychological complaints experienced during the last 30 days. Severity was scored on a four-point scale. The SHC inventory yields five subscales: musculoskeletal pain (headache, neck pain, upper back pain, low back pain, arm pain, shoulder pain, migraine and leg pain) ($\alpha = 0.76$); 'pseudoneurology' (palpitation, heat flushes, sleep problems, tiredness, dizziness, anxiety and depression) ($\alpha = 0.71$); gastrointestinal problems (heartburn, epigastric discomfort, ulcer/non-ulcer dyspepsia, stomach pain, gas discomfort, diarrhoea and constipation) ($\alpha = 0.63$); allergy (asthma, breathing difficulties, eczema,

allergy and chest pain) ($\alpha = 0.47$); and flu (cold/influenza and coughing) ($\alpha = 0.67$).

Sick leave was self-reported. The participants were asked to report the frequency and duration of sick leave during the last 30 days.

Subjective evaluation of improvement after intervention was measured by asking participants if the interventions had had any influence on health, work environment, work situation, physical fitness, muscle pain, ability to deal with stress and knowledge of how to maintain good health. Each question was scored on a five-point scale, which was transformed to a three-point scale in the analyses (better, unchanged, worse).

Statistics

Based on 90% power at a 5% significance level, 85 employees were needed in each group to detect differences on mean score on subjective health complaints between the groups. To compensate for possible drop-outs and the inclusion of job stress as an additional outcome, the number of individuals in each group was increased. SPSS 9.0 for Windows was used for the statistical analyses. Means and 95% confidence intervals (CI) were calculated for the baseline characteristics in order to investigate potential differences between the participants lost to follow-up and those who participated. Differences between groups were evaluated by one-way ANOVA and χ^2 tests. Reliability analyses (Cronbach's α) were conducted for the SHC and job stress scores. If <50% of scores were missing, the mean values of the other items of the scale for that individual were computed, otherwise the scale was regarded as missing.

In order to investigate the effect of the interventions, a full factorial model, type III sum of squares general linear model (GLM) for repeated measurements was used (Wilks' λ), and gender and time of intervention (location) were included in the model as covariates. Three separate analyses of the pre-, post- and follow-up values (time) on the SHC scores (musculoskeletal, pseudoneurological, gastrointestinal, allergy and flu), the job stress scores (communication, leadership, relocation and workload) and the self-reported sick leave (number of days in the last 30 days) by the three intervention groups and control group (between subject factor) were conducted. Two series of analyses were conducted. First, intention-to-treat analyses were used and missing values due to participants lost to follow-up were replaced, assuming a zero event rate over the follow-up period, in accordance with the last value principle. Secondly, the GLM for repeated measures was used to analyse any treatment effect of those who had attended at least 50% of the sessions in the intervention. This could be done for the PE and IHP groups only, due to missing attendance lists on the SMT intervention. Differences in degrees of freedom are due to missing data. Odds ratios (OR) and 95% CI of the subjective effects of interventions were calculated.

Results

Baseline characteristics

The participants in the control group had been working for a significantly shorter period in their current occupation, and worked significantly fewer days per week, than participants in the PE group and the SMT group. Otherwise there were no differences between the groups at baseline (see Tables 1 and 2 for descriptive statistics).

Participants lost to follow-up

More women than men were lost to follow-up ($\chi^2 = 7.76$, df = 1, $P = 0.005$). There were no significant differences between the two groups on SHC scores, job stress or self-reported sick leave at baseline. There was, however, a significant age difference between the groups: the participants who completed the study [mean = 39.8 (CI = 38.9–40.6)] were older than those lost to follow-up [mean = 35.4 (CI = 34.4–36.3); $F = 43.5$, df = 1, $P < 0.0001$], and the continuing participants [mean = 14.8 (CI = 14.0–15.5)] had also been working longer in their current occupation than the group lost to follow-up [mean = 11.0 (CI = 10.2–11.9); $F = 39.8$, df = 1, $P < 0.0001$].

Table 1. Baseline statistics for the three different intervention groups and the control group

	CON	*PE*	*IHP*	*SMT*	*P-value*
No.	344	189	165	162	
Gender [No. (%) of men]	125 (36.3)	78 (41.3)	67 (40.6)	66 (40.7)	0.611[a]
Age [mean (95% CI)]	37.0 (35.8–38.1)	38.2 (36.7–39.7)	38.2 (36.5–39.8)	38.9 (37.2–40.6)	0.237
Education [mean (95% CI)]	11.9 (11.7–12.2)	11.7 (11.4–12.1)	11.8 (11.5–12.2)	12.0 (11.6–12.3)	0.770
Number of working hours per week [mean (95% CI)]	32.7 (31.8–33.5)	34.7 (33.8–35.7)	35.2 (34.3–36.1)	34.3 (33.3–35.4)	0.000
Years in current occupation [mean (95% CI)]	11.9 (10.7–12.9)	14.2 (12.7–15.6)	13.2 (11.8–14.7)	14.3 (12.7–15.9)	0.019

CON = control group.

[a]Differences tested with the χ^2 test, otherwise differences were tested with a one-way ANOVA.

Table 2. Mean and 95% CIs of the control and intervention groups, for the effect variables at the pre-, post- and follow-up tests

	CON (n = 344)	*PE (n =189)*	*IHP (n =165)*	*SMT (n =162)*
SHC				
Musculoskeletal				
Pre-	4.66 (4.03–5.29)	4.16 (3.40–4.91)	4.03 (3.23–4.84)	4.07 (3.38–4.76)
Post-	4.41 (3.86–4.96)	3.59 (3.00–4.18)	3.86 (3.12–4.60)	4.25 (3.51–4.99)
Follow-up	4.68 (4.22–5.15)	4.30 (3.68–4.91)	4.63 (3.92–5.34)	4.76 (4.01–5.52)
Pseudoneurological				
Pre-	2.38 (1.93–2.84)	2.17 (1.70–2.64)	2.02 (1.53–2.52)	2.05 (1.55–2.55)
Post-	2.45 (2.09–2.81)	1.81 (1.44–2.19)	2.05 (1.63–2.48)	2.12 (1.70–2.55)
Follow-up	2.60 (2.29–2.92)	2.33 (1.96–2.70)	2.64 (2.19–3.09)	2.69 (2.22–3.16)
Gastrointestinal				
Pre-	1.34 (1.05–1.62)	1.40 (1.07–1.73)	1.45 (1.01–1.89)	1.42 (1.03–1.81)
Post-	1.44 (1.18–1.69)	1.42 (1.07–1.77)	1.53 (1.16–1.91)	1.57 (1.18–1.97)
Follow-up	1.38 (1.17–1.60)	1.52 (1.19–1.86)	1.61 (1.25–1.97)	1.65 (1.28–2.01)
Allergy				
Pre-	0.66 (0.48–0.84)	0.69 (0.47–0.91)	0.35 (0.21–0.49)	0.70 (0.46–0.95)
Post-	0.74 (0.55–0.93)	0.53 (0.36–0.70)	0.46 (0.23–0.69)	0.59 (0.39–0.79)
Follow-up	0.99 (0.81–1.17)	0.93 (0.67–1.18)	0.88 (0.65–1.10)	0.96 (0.66–1.26)
Flu				
Pre-	0.99 (0.78–1.21)	0.84 (0.60–1.10)	0.91 (0.64–1.19)	0.74 (0.49–0.98)
Post-	1.00 (0.82–1.17)	0.94 (0.71–1.16)	0.80 (0.59–1.01)	0.84 (0.62–1.07)
Follow-up	1.06 (0.91–1.20)	1.22 (0.97–1.46)	1.26 (1.02–1.50)	1.18 (0.94–1.41)
Job stress				
Communication				
Pre-	11.54 (10.16–12.92)	11.25 (9.71–12.78)	10.78 (9.03–12.53)	12.73 (10.95–14.51)
Post-	11.78 (10.69–12.88)	9.77 (8.55–11.00)	9.77 (8.37–11.17)	12.51 (11.08–13.95)
Follow-up	10.30 (9.42–11.17)	10.46 (9.29–11.63)	10.16 (8.86–11.46)	11.17 (9.74–12.59)
Leadership				
Pre-	4.66 (4.07–5.25)	4.51 (3.89–5.13)	4.47 (3.71–5.23)	5.31 (4.56–6.07)
Post-	4.66 (4.13–5.18)	4.55 (3.96–5.15)	4.16 (3.45–4.87)	4.87 (4.23–5.51)
Follow-up	4.10 (3.69–4.50)	4.00 (3.49–4.50)	3.79 (3.18–4.40)	4.30 (3.67–4.93)
Relocation				
Pre-	4.03 (3.44–4.63)	4.13 (3.44–4.82)	3.66 (2.90–4.42)	3.81 (3.09–4.53)
Post-	3.77 (3.27–4.28)	3.98 (3.56–4.61)	3.32 (2.73–3.92)	3.97 (3.39–4.56)
Follow-up	3.59 (3.17–4.02)	3.73 (3.18–4.28)	3.65 (3.08–4.22)	3.75 (3.18–4.32)
Work load				
Pre-	6.24 (5.63–6.85)	6.79 (6.14–7.44)	6.35 (5.55–7.15)	6.03 (5.31–7.75)
Post-	6.35 (5.86–6.85)	6.39 (5.79–6.99)	6.66 (6.00–7.32)	6.13 (5.58–6.68)
Follow-up	6.31 (5.91–6.70)	6.20 (5.68–6.71)	6.45 (5.89–7.02)	6.21 (5.63–6.79)
Sick leave				
Pre-	1.51 (0.99–2.03)	1.38 (0.80–1.96)	2.27 (0.95–3.59)	1.41 (0.72–2.10)
Post-	1.60 (0.97–2.22)	0.65 (0.21–1.10)	1.43 (0.72–2.15)	1.27 (0.55–2.00)
Follow-up	2.04 (1.01–3.07)	2.31 (0.89–3.74)	1.23 (0.24–2.23)	2.56 (1.11–4.00)

CON = control group.

Effects of interventions

Subjective health complaints

There was no significant effect of interventions on subjective health complaints [time × intervention/control group; Wilks' $\lambda(30, 1057.3) = 0.968$, $P = 0.517$]. Neither was there any effect of interventions on subjective health complaints when only those who had attended >50% of the interventions IHP and PE together with controls were included in the analysis [$F(20, 444) = 0.855$, $P = 0.646$].

Job stress

There was no significant effect of interventions on job stress [time × intervention/control group; $F(24, 1154.9) = 1.326$, $P = 0.135$]. Neither was there any effect of interventions on job stress when only those who had attended >50% of the interventions IHP and PE together with controls were included in the analysis [$F(16, 486) = 1.549$, $P = 0.079$].

Sick leave

There was no significant effect of interventions on self-

reported sick leave [time × intervention/control group; $F(6, 1110) = 1.301$, $P = 0.254$]. Neither was there any effect of interventions on sick leave when only those who had attended >50% of the interventions IHP and PE together with controls were included in the analysis [$F(4, 492) = 1.254$, $P = 0.287$].

Subjective effects

Subjective effects were reported on health, physical fitness, work situation, muscle pain, ability to deal with stress and knowledge on how to maintain good health (see Table 3 for details). These were specific effects for the different interventions. IHP was the intervention with the best overall effect, work environment being the only listed condition that was not improved. Participants in PE and IHP were more likely to report an improvement in health and physical fitness than the control group. Participants in SMT and IHP were more likely to report an improvement in their work situation and capability of dealing with stress than the control group. Participants in PE, SMT and IHP were more likely to report a positive effect on muscle pain and knowledge on how to maintain good health than the control group. Most of the effects were maintained at follow-up (see Table 3). Participants in IHP were most likely to report an improvement in health, physical fitness, muscle pain, ability to handle stress and capability of maintaining good health. The PE group showed the same effects at post-test, and in the SMT group the effects on muscle pain, stress management and health maintenance were all maintained. There were no significant subjective negative effects of the interventions.

Discussion

The interventions had no effects on subjective health complaints, job stress or self-reported sick leave. However, the participants did report that the interventions had other positive effects. These positive effects were specific for the particular goal areas defined for the intervention they had participated in, and the effects were robust and still present at the 1 year follow-up.

If health is what is measured by our subjective health complaints questionnaire [2], then the interventions had no effect. However, if it is the subjective feeling of being in good health that is measured, then the results are positive. The participants were satisfied with the programme, and they found that the specific goals set for each programme were obtained even if subjective health complaints

Table 3. ORs (95% CIs) of the subjective effects of the three different interventions, calculated by logistic regression with the unchanged group as reference category

Parameter	*Effect*	*PE*	*IHP*	*SMT*
Health	Unchanged[a]	1	1	1
	Better at post-test	20.0 (9.1–43.8)	15.5 (7.0–34.3)	2.2 (0.8–5.8)
	Better at follow-up test	8.5 (3.4–21.5)	10.2 (4.0–26.0)	3.0 (1.1–8.6)
Work environment	Unchanged[a]	1	1	1
	Better at post-test	1.8 (1.0–3.2)	1.4 (0.7–2.6)	1.2 (0.6–2.3)
	Better at follow-up test	0.9 (0.4–1.8)	1.3 (0.6–2.6)	1.2 (0.6–2.4)
Physical fitness	Unchanged[a]	1	1	1
	Better at post-test	25.5 (13.4–48.6)	18.4 (9.6–35.3)	0.5 (0.2–1.6)
	Better at follow-up test	9.4 (4.6–19.5)	8.0 (3.8–16.8)	1.9 (0.8–4.5)
Work situation	Unchanged[a]	1	1	1
	Better at post-test	2.1 (1.0–4.2)	3.2 (1.6–6.3)	2.4 (1.2–4.9)
	Better at follow-up test	1.4 (0.7–3.0)	1.6 (0.8–3.4)	1.8 (0.8–3.8)
Muscle pain	Unchanged[a]	1	1	1
	Better at post-test	11.3 (3.8–33.4)	15.1 (5.1–44.4)	5.0 (1.6–16.0)
	Better at follow-up test	3.2 (1.1–9.5)	7.2 (2.6–20.2)	2.0 (0.6–6.7)
Stress	Unchanged[a]	1	1	1
	Better at post-test	1.1 (0.6–2.1)	2.3 (1.3–4.1)	7.7 (4.5–13.2)
	Better at follow-up test	1.0 (0.5–2.0)	4.1 (2.2–7.7)	6.3 (3.4–11.7)
Health maintenance	Unchanged[a]	1	1	1
	Better at post-test	4.5 (2.8–7.3)	7.5 (4.5–12.4)	2.4 (1.4–4.0)
	Better at follow-up test	2.4 (1.4–4.2)	4.1 (2.4–7.3)	2.3 (1.3–4.1)

[a]Reference group.

remained as before. This agrees with other findings that at least a moderate level of subjective health complaints does not seem to impair a general feeling of being in good health or a feeling of improved health. In spite of the very high prevalence of subjective health complaints, the majority of the Norwegian population reports that their health is good. This is true even if they have a verified organic disease [22].

A major concern is the high number of individuals who dropped out of the interventions and/or tests, even though 75–80% of the employees in the different intervention groups did respond at post-test. Drop-out may be selective. The lack of effect on subjective health complaints and self-reported sick leave might be related to problems with compliance. It is likely that those in the greatest need are least likely to participate. Blue-collar workers tend to participate less in worksite health promotion programmes [23], and our sample is a mix of blue-collar (postal terminal) and white-collar (post office) workers. Most of the participants were healthy, and regarded themselves as healthy, even if they reported high degrees of subjective health complaints. It is probably easier to recruit healthy individuals to health interventions, and this adds to the difficulty in targeting interventions to the population that probably would benefit most. More important may be that the interventions were offered from outside, from a university research team backed by the administration. The necessity for a randomized design may also have been a negative factor. Interventions may be more effective if participants can choose specific ones for their needs. Also, we entered the postal organization at a time of turmoil and instability. The postal service went from a monopoly to a profit-oriented organization with fierce competition. During the project period, employees were told that the present 2300 post offices would be reduced to 1400 before the year 2000. Other process factors that may be obstacles for this and similar interventions have been identified in a recent paper [24].

In previous randomized Norwegian investigations [25,26], the results were also mixed, but with stronger effects on subjective health complaints and job stress. A main difference is that these interventions were directed at office workers and nurses, where motivation, acceptance and compliance were likely to be higher.

The interventions we tested are some of the most commonly used interventions in working life [1]. The lack of documented effects on subjective health complaints, job stress and sick leave in general [1], and in this study specifically, may raise difficulties for occupational health professionals. What are they to offer when asked to undertake workplace health promotion initiatives? Do our data prove that such interventions are useless, with inconclusive or no demonstrable effects? We believe that the most important conclusion is that the participants themselves found positive effects on a number of specific variables. This may have positive long-term effects for keeping people in working life. The interventions may add to the positive aspects of participating in working life, even if there are no demonstrable short-term effects.

No interventions have effects that will last forever. If the interventions do lead to changes in lifestyle, we expect long-term effects on individual health, e.g. if there is a long-term effect on physical exercise [27].

These interventions may also be acknowledged by the employees as positive 'contributions' to the work environment or considered as fringe benefits. The employers must make a decision on why they want to introduce these interventions. If they want to make the employees feel better, they will probably gain from introducing these interventions. If the goal is to reduce sick leave or improve subjective health complaints, there is no demonstrable effect from these interventions.

The strongest effects were obtained with the new IHP, combining exercise, cognitive factors and information. This appears to be the most efficient approach to motivate lifestyle changes, and for the robustness of any changes that take place.

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