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EFFECTS OF DIFFERENT PSYCHOLOGICAL INTERVENTIONS ON NECK, SHOULDER AND LOW BACK PAIN IN FEMALE HOSPITAL STAFF

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One hundred and eleven females volunteered to take part in this intervention study of musculoskeletal pain. They all completed a survey of pain among five hundred and eighty-six female hospital staff and presented mild to severe pain in the neck, shoulder and/or low back. They were randomly assigned to one of the following groups; Focus on job-stress and psychosocial coping (Cognitive), relaxation training (Relaxation), the combination of the two (Combined) or to a control group (Control). Musculoskeletal pain (intensity and duration) was assessed by self-report prior to interventions, immediately after interventions, and at a four months follow-up. Results from multivariate analyses of variance as well as covariance (pre-intervention levels of pain as covariate) showed that magnitude of pain reduction was dependent upon the interaction between area of the back and type of intervention. These trends were more significant for intensity than for duration scores. They were due to reductions of pain in (1) neck and shoulders for the Cognitive and Combined groups and (2) in the low back and shoulders for the Relaxation group. The four month follow-up assessment revealed a significant risk of relapse only for duration of low back pain among subjects in the Combined group. Results from the Cognitive approach to intervention may reflect a causal role for ability to cope with psychosocial job stress in the development of neck and shoulder pain in female hospital staff.

KEY WORDS: Back pain, cognitive intervention, coping, musculoskeletal, psychosocial, relaxation training, stress.

INTRODUCTION

The high incidence of skeletal muscle pain has attracted increasing concern in industrialised societies and has provoked a search for improved intervention procedures (see, e.g., Bergenudd and Nilsson, 1988; Lee *et al.*, 1985; Tellnes, 1989; Tellnes *et al.*, 1989). The present research is part of a Norwegian programme that has addressed this challenge. A preliminary review of findings from this programme is reported by Ursin *et al.* (in press).

Psychological factors are believed to play a significant part in the development

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of musculoskeletal pain. Winkel and Westgaard (1992) concluded that psychososial factors, individual characteristics and physical workload were related to neck, shoulder and low back pain, with only a few exceptions. Reviewing a broader range of risk factors Riihimäki (1991) identified six studies reporting associations between psychosocial work factors and low back pain. Ursin, Endresen and Ursin (1988) found associations between psychological factors and both neck, shoulder/arms and low back pain. However, Westgaard and Jansen (1992a) found significant relationships only between psychological problems and pain in the head and neck region, whereas no such associations were found for pain in other body areas. Svebak *et al.* (1991) reported stronger associations between (a) psychological factors, such as exposure to stressors, coping efforts and negative moods, and (b) neck and shoulder pain, as compared with low back pain.

It is commonly found that muscle tonus can be elevated as well as reduced by psychological events (see e.g. Apter and Svebak, 1986; Jacobson, 1932; 1938; Malmo, 1965; Svebak, 1988; Wærsted, Bjørklund and Westgaard, 1991). It is possible that long lasting elevation in muscle tonus, caused by psychological events, might lead to musculoskeletal pain (Sejersted and Vollestad, 1993).

Several psychological treatment approaches have been developed to address the problem of chronic back pain (see Turk and Flor, 1984, for a review). Relaxation training is a commonly used psychological technique for the reduction of this kind of pain. The cognitive-behavioural approach to treatment of pain is a more recent development. According to Turk and Flor (1984) several studies show promising results for this latter approach. However, findings are not conclusive (see also Sailis *et al.*, 1987). Cognitive-behavioural treatments often include different components; e.g. the teaching of skills for more effective handling of psychosocial job demands, stress management via identification and modification of maladaptive cognitions and the teaching of relaxation. According to Turk and Flor (1984), more research is needed to examine the contributions of the various components of the cognitive-behavioural approach to treatment.

In this study we compared the effect of a (A) cognitive-behavioural approach (focus on improving skills for handling psychosocial job demands: Cognitive) with (B) relaxation training (Relaxation) where the procedure had a specific focus on the reduction of tension in skeletal muscles of the neck, shoulder and low back pain. We also included (C) a combination of the two approaches (Combined) to examine possible synergy effects of the combined approach.

METHOD AND MATERIAL

Subjects

Five hundred and eighty-six female hospital staff participated in the initial screening that recruited participants with varying degrees of skeletal muscle pain from neck, shoulders and/or low back into the intervention study. These subjects were recruited to meet several criteria including gender (only females), different professions (medical doctors, registered nurses, auxiliary nurses, laboratory staff, kitchen staff), and availability (excluding e.g. staff working in sterile environments). Thirty-nine subjects were excluded from the intervention study due to diagnoses based upon medical screening (e.g. rheumatoid arthritis, Bechterew's disease, epilepsy, previous surgery to the spine, osteoporosis, breast cancer, fibromyalgia, pregnancy).

One hundred and sixty-eight subjects with relatively severe pains were offered an oppurtunity to participate in one of the three different procedures for treatment of musculoskeletal back pain. This sub-sample of subjects met a criterion that included (a) reported pain in the neck, shoulder and/or low back over the last seven days and that had caused leave of absence for some period over the last twelve months (see section on assessment of musculoskeletal complaints, below). In addition (b), back pain had to be reported for at least two periods over the last six months.

Subjects were randomly assigned to the three intervention procedures with a fourth sub-group defined as a 'waiting-list' Control group. One hundred and nineteen subjects (71%) volunteered to take part and were pre-tested for neck, shoulder and low back pain. One hundred and eleven subjects (66%) completed the procedures: Cognitive: $N = 19$, mean age = 37.7, SD = 9.55, range = 24–53; Relaxation: $N = 15$, mean age = 40.4, SD = 9.73, range = 22–55; Combined: $N = 24$, mean age = 36.7, SD = 10.33, range = 24–53; Control: $N = 53$, mean age = 36.5, SD = 8.36 range = 23–57.

Assessment of musculoskeletal pain

The initial screening of musculoskeletal pain was made by use of self-report using a section of the extensive Nordic Questionnaire for the analysis of musculoskeletal symptoms (NQ: see Kourinka *et al.*, 1987, upper section of page 235). The validity and reliability of the NQ has been reported to be adequate (Kourinka *et al.*, 1987). From this form, scores on neck, shoulder and low back pain over the last twelve months were combined with information on sick leave, level of pain over the last seven days as well as number of complaint periods within the last six months (see subject section, above, on recruitment criteria).

Pre-treatment baseline assessment of musculoskeletal pain made use of a more focused scale than the NQ, developed by Westgaard and Jansen (1992b) who also reported data on validity and reliability. Five levels of *intensity* are assessed in this scale as related to the last thirty days:

0 = No complaint;
1 = Almost no complaints, only slight feeling of discomfort at breaks, when not concentrating on the work task;
2 = Slight, but noticeable complaints when performing the work tasks.
However, these are of sufficiently low intensity not to interfere with performance at work;
3 = Relatively strong complaints during work, making it necessary to maintain

a conscious effort in order to carry out the work tasks. It is necessary at times to have breaks due to the discomfort experienced. The feelings of discomfort are relieved following such breaks;
4 = It is difficult to carry out work because of the complaints. The feelings of discomfort are not fully relieved following such breaks.

This scale was combined with assessment of *duration* of pain over the last thirty days, using a four-step format like in the Ursin Health Inventory (see Ursin, *et al.*, 1988):

0 = No period with pain over the last 30 days;
1 = Pain over 1 to 10 days;
2 = Pain over 11 to 20 days;
3 = Pain over 21 to 30 days.

The scale was applied to the neck, shoulder and low back areas, respectively. The scales for assessment of intensity and duration of musculoskeletal pain were administered three times: (1) Before interventions started (Pre), (2) immediately after interventions ended (Post-1) and (3) at a follow-up assessment session four months after the interventions ended (Post-2).

The Intervention Procedures

Cognitive

This intervention procedure provided education on relationships between personality, work environment, and musculoskeletal pain. One important aspect of the training was to help the participant to cope better with occupational demands (e.g. by way of a more conscious distinction between demands with different priorities). Another was the teaching of effective strategies for interpersonal communication. The Cognitive intervention focused also upon helping participants to appraise potentially threatening situations in a positive way. The procedure relied heavily upon the participants' ability to identify their own coping resources and to actively seek out ways of using these resources through group discussions. Data from a previous local study on relationships between personality, job environment and musculoskeletal pain were used as input to these sessions. Main issues of the program were (1) job-stressors, appraisal, and coping, (2) effects of stress on cognitive functioning and behaviour, (3) personality and musculoskeletal pain, (4) motivational state and musculoskeletal pain, (5) psychological defence and musculoskeletal pain, (6) the use of self instructions to moderate emotional arousal, and (7) strategies for better communication and self-assertion. All these issues were primarily related to the job-situations. The procedure included ten sessions of two hours each.

Relaxation

This procedure included progressive relaxation (Jacobson, 1938) and autogenic training (Schultz and Luthe, 1969) that was practised by playback of a 30-minute audio-taped instruction including both relaxation techniques. In addition, the participants met in groups for ten one and a half hours sessions where 30 minutes were spent on practice of relaxation, with the rest of the session spent on discussion of experiences with the relaxation procedures. Three additional sessions were interspersed across these ten sessions to provide simple biofeedback-assisted relaxation training by use of integrated EMG power out-put transduced from the frontalis muscle.

Combined

One intervention procedure combined the cognitive intervention and relaxation training in shortened versions. This program included ten sessions of two hours each. The first one and a half hours were used for the Cognitive approach, and it was followed by half an hour spent on relaxation training. In this way the allocation of time to the two components was asymmetrical to reflect a typical time period for the administration of relaxation, and to allow for elements of cognitive treatment to be adequately implemented as a discussion-oriented type of group intervention.

Control

The Control group was kept on a 'waiting-list' arrangement that meant these subjects were promised participation in some intervention procedure at a later time.

Procedure

All sessions were given during working hours. For part-time workers it was not always possible to give sessions during working hours and, therefore, they were paid to compensate for extra time spent on participation in some sessions. The procedures and assessment sessions were administered in cooperation with staff from the Occupational Health Unit. The procedures were implemented by the first and third authors. Participants in the active intervention procedures were given 'homework' with practice in abilities acquired during sessions. They were all instructed not to discuss the content of sessions with individuals outside their group and, for subjects on relaxation training, not to hand out copies of audio-tapes to others. For ethical reasons the subjects in the Control group were given a physical training intervention immediately after the first post-test. Follow-up testing of the Control group is therefore not reported in this paper.

Data Scoring and Statistical Analyses

Assessment of intensity of pain made use of a five-step interval scale ranging from no pain to severe pain, and values zero through four were assigned respectively to these levels of pain. Duration of pain was assessed by a four-level scale ranging from no duration to thirty days of duration. Values zero through three were assigned to the increasing levels of duration (see above for details).

Effects of treatments on neck, shoulder and low back pain were tested by use of the MANOVA-program of the SPSSPC-package (Norusis, 1986), treating data as doubly multivariate, and with repeated measures and pain sites as within-subject factors. In addition, MANCOVAs with pre-test scores as the covariate were performed to control for possible confounding effects caused by differences between treatment groups already existing in the preintervention period. Dependent variables in the MANCOVAs were difference-scores between Pre- and Post1-tests: Pre-test scores were used as covariates. Finally, within-group changes from Pre to Post-1 and from Post-1 to Post-2 were tested with pair-wise t-tests.

RESULTS

Pre-test assessment showed a concentration of subjects with 'moderate' intensity of pain from neck and shoulders (Figure 1). Subjects with low back pain showed pre-test scores that were evenly distributed from 'no pain' to 'strong' level of pain in all subject groups. However, the Combined group showed a positive skewness with higher percentage of subjects in the 'moderate' and 'strong' levels of low back pain. Compared to the Pre-test, Post-1 showed a general change towards bimodality of pain levels with concentrations of scores on 'no pain' and moderate pain levels for neck and shoulders. Post-2 scores showed the same pattern as that of Post-1.

Differences in Pre to Post-1 changes for intensity and duration of pain scores

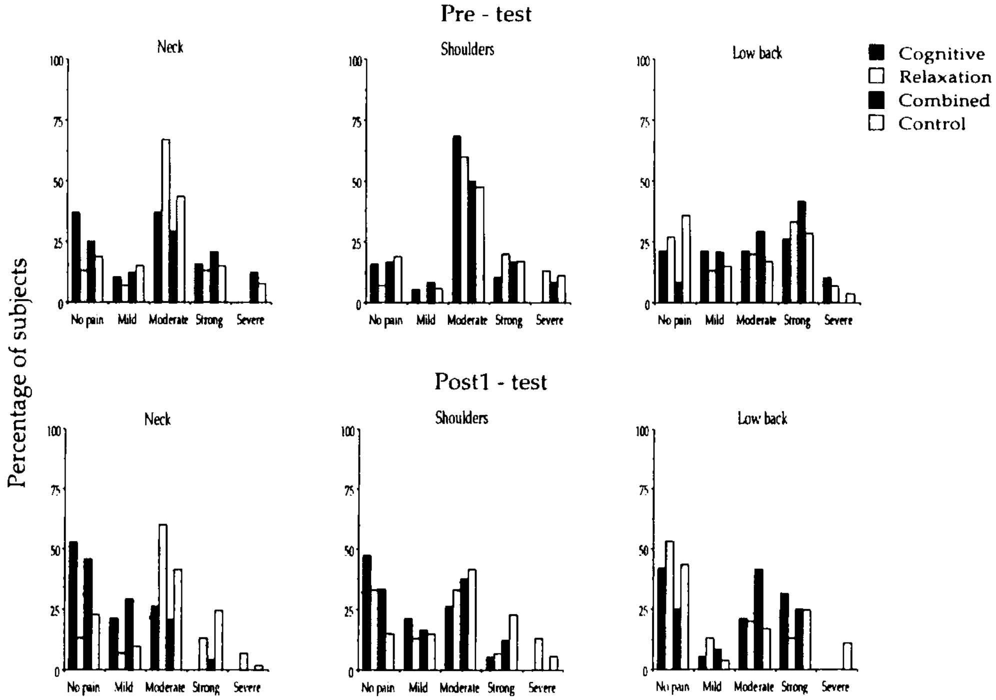

Figure 1 Percentage of subjects with different intensity levels of, neck, shoulder and low back pain at the pre-intervention assessment (Pre), end of intervention (Post1) and four months after end of intervention (Post2) in four different subject groups.

between treatments and the three back areas were tested by multivariate analyses of variance (MANOVA), treating data as repeated measures in time (T) with back areas (A) as an additional within subject factor. Changes in intensity of pain were significantly different for the neck, shoulder and low back areas from Pre to Post-1 (T × A: see Table 1). Moreover, for intensity of pain a significant three-way interaction emerged between type of intervention (I), time and pain area (I × T × A). This effect was due to a reduction in intensity of neck pain for the Cognitive and Combined groups, whereas intensity of low back pain was reduced for the Relaxation group (see Figure 2). For duration of pain there was a similiar but only marginally significant tendency. Differences in pain between interventions (I) were significant for duration but only marginally significant for intensity. There was a significant change in pain levels for duration scores from Pre to Post-1 (T) independent of interventions or areas.

Confounding effects may have been due to somewhat different pain mean scores between groups before interventions. A MANCOVA was therefore performed with difference-scores between Pre and Post-1 as dependent variables and prescores as covariates (see Table 2). The results from the MANCOVAs yielded significant F-score for differences between interventions (I) in changes for intensity as well as duration scores from Pre to Post-1. This approach to the interaction of areas and interventions yielded more significant results for intensity scores than did the MANOVAs (Table 1). The interaction between intervention and area (I × A) was only marginally significant for scores reflecting *duration* of pain. In this way, the MANCOVA results supported the main trends of the MANOVAs presented in Table 1.

Differential effects of interventions were also tested without the inclusion of the

Table 1 Multivariate analyses of variance for intensity and duration of musculoskeletal pain in three areas of the back (neck, shoulder, low back) assessed at two times (Pre, Post-1) in four intervention groups of subjects (Cognitive, Relaxation, Combined, Control; see text for details).

Source	*Df*	*F-score*	*p-value*
Intensity:			
Intervention (I)	3/107	2.17	.099
Time (T)	1/107	1.17	n.s.
I × T	3/107	1.68	n.s.
Area (A)	2/214	1.18	n.s.
I × A	6/214	1.24	n.s.
T × A	2/214	12.95	.00004
I × T × A	6/214	4.90	.0004
Duration:			
I	3/107	4.02	.009
T	1/107	7.20	.008
I × T	3/107	0.56	n.s.
A	2/214	1.21	n.s.
I × A	6/214	1.22	n.s.
T × A	2/214	5.01	.007
I × T × A	6/214	1.98	.069

Total N = 111 (Cognitive N = 19, Relaxation N = 15, Combined N = 24, Control N = 53) control group of subjects (see Table 3). Results from these MANCOVAs confirmed significant interactions between type of interventions and areas (I × A) for intensity of pain scores. The interaction between type of intervention and area (I × A) was also significant for *duration* of pain scores. Changes in mean pain scores are illustrated in Figure 2 and showed that these effects were due to reductions in intensity as well as, duration of neck pain for the Cognitive and Combined groups, whereas, intensity and duration of low back pain were reduced in the Relaxation group.

Pair-wise comparisons of changes given in Figure 2 showed a significant reduction in *intensity of neck pain* for the Cognitive and Combined groups from Pre to Post-1 ($t = 2.63$, $p = .017$; $t = 3.81$, $p = .001$, respectively), while scores for intensity of neck pain for the Relaxation group remained fairly unchanged. In contrast, the Relaxation group showed the most apparent reduction in *intensity of low back pain* from Pre to Post-1 ($t = 2.98$, $p = .010$). For *intensity of shoulder pain* the Cognitive, Combined and Relaxation groups all showed significant reduction from Pre to Post-1 ($t = 3.28$, $p = .004$; $t = 2.61$, $p = .016$; $t = 3.29$, $p = .005$, respectively).

Table 2 Multivariate analyses of covariance for pre-to-post intervention change in intensity and duration of musculoskeletal pain as a function of type of intervention (Cognitive, Relaxation, Combined, Control) and body area (neck, shoulders, low back) with the pre-intervention level as the covariate.

Source	*Df*	*F-score*	*p-value*
Intensity:			
Intervention (I)	3/106	7.60	.0004
Area (A)	2/213	0.12	n.s.
I × A	6/213	2.93	.009
Duration:			
I	3/106	5.72	.002
A	2/213	0.05	n.s.
I × A	6/213	1.90	.083

Total N = 111 (see Table 1 for details).

Table 3 Multivariate analyses of covariance for pre-to-post intervention change in intensity and duration of musculoskeletal pain as a function of type of intervention (Cognitive, Relaxation, Combined) and body area (neck, shoulders, low back) with the pre-intervention level as the covariate. (Note that the Control condition is ommitted from this version of the MANCOVA.)

Source	*Df*	*F-score*	*p-value*
Intensity:			
Intervention (I)	2/54	0.73	n.s.
Area (A)	2/109	0.29	n.s.
I × A	4/109	4.17	.003
Duration:			
I	2/54	3.07	.055
A	2/109	0.12	n.s.
I × A	4/109	2.76	.032

N = 58 (Cognitive N = 19, Relaxation N = 15, Combined N = 24).

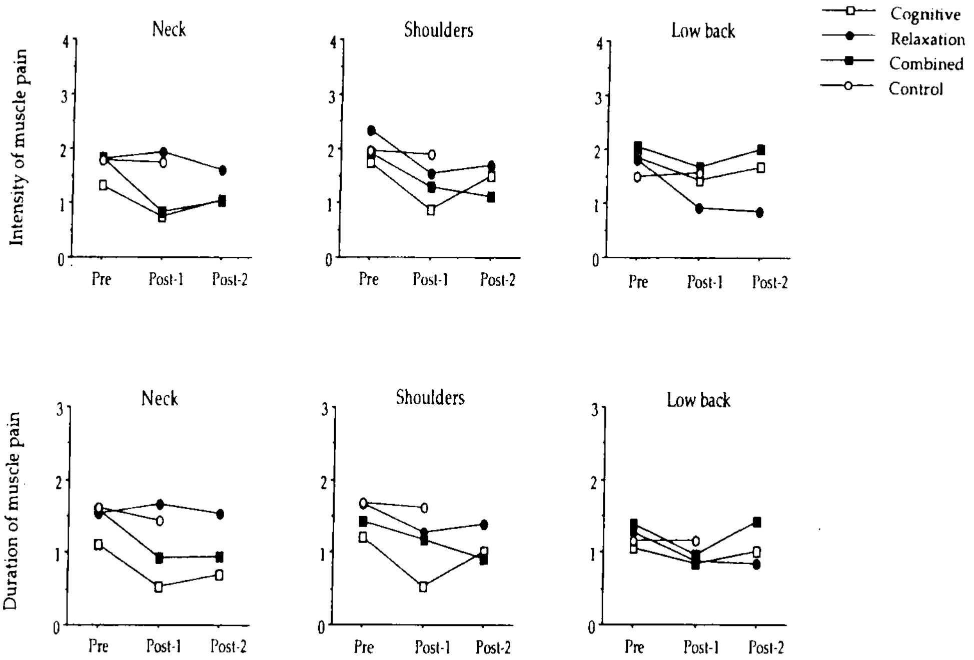

Figure 2 Mean scores for muscle pain at pre-intervention (Pre), end of intervention (Post1) and four months after end of intervention (Post2) in four different subject groups. (Note that the Control group is excluded from Post2.)

Reductions in *duration of neck pain* from Pre to Post-1 were significant for the Cognitive and Combined groups ($t = 2.63$, $p = .017$; $t = 2.33$, $p = .029$), whereas duration of neck pain appeared to be unchanged for the Relaxation group. The *duration of low back pain* was significantly reduced for the Relaxation group ($t = 3.06$, $p = .009$). In contrast, scores for duration of low back pain remained unchanged for the Cognitive and Combined groups. For *duration of shoulder pain* the reduction in duration was only significant for the Cognitive group ($t = 3.64$, $p = .002$). No changes in intensity and duration of pain were significant for the Control group.

Table 4 shows results of MANOVAs for changes in intensity and duration of pain from Post-1 to Post-2. It will be seen from this Table that changes in both intensity and duration of pain were different depending upon type of intervention (I × T), indicating that the intervention strategies showed different capabilities in the maintenance of treatment effects upon musculoskeletal pain. Relapses were most evident for intensity and duration of pain in the shoulders among subjects in the Cognitive group and in duration of low back pain among subjects in the Combined group (see Figure 2).However, relapse was significant only for the duration of low back pain in the Combined group ($t = 2.54$, $p = .018$).

Table 4 Multivariate analyses of variance for changes in intensity and duration of musculoskeletal pain from Post1 to a four-month follow-up (Post2), and for the neck, shoulders and low back areas. Intervention groups were distinguished as Cognitive, Relaxation and Combined (see text for details).

Source	*Df*	*F-score*	*p-value*
Intensity:			
Intervention (I)	2/50	0.36	n.s.
Time (T)	1/50	1.67	n.s.
I × T	2/50	5.63	.006
Area (A)	2/100	0.27	n.s.
I × A	4/100	5.12	.001
T × A	2/100	0.12	n.s.
I × T × A	4/100	0.52	n.s.
Duration			
I	2/50	2.36	n.s
T	1/50	0.04	n.s.
I × T	2/50	3.86	.027
A	2/100	0.61	n.s
I × A	4/100	3.35	.013
T × A	2/100	0.54	n.s.
I × T × A	4/100	0.12	n.s.

N = 53 (Cognitive N = 16, Relaxation N = 13, Combined N = 24).

DISCUSSION

The efficacy of the interventions proved to be different for the upper and lower sections of the back. This applied to both intensity and duration of pain, although results for intensity showed the most significant and consistent patterns of change from Pre to Post-1. The Cognitive and Combined intervention procedures were the more effective in reducing neck pain, whereas Relaxation was relatively successful in reducing low back pain. For shoulder pain, however, all three interventions were effective in reducing intensity of pain, whereas only the Cognitive approach to intervention was significantly effective in reducing *duration* of shoulder pain.

The lack of efficacy of Relaxation in the treatment of neck pain may be due to a difference in causal factors of neck and low back pain and, therefore, a lack of sensitivity of intervention to causal factors in neck pain. Of course, the skills in the Relaxation procedure involve cognitive activity. However, they seem to focus upon the efforts to reduce *muscle tension* (Turk and Flor, 1984). The Cognitive procedure in our study, in contrast, aimed at the improvement of coping with *psychosocial job-demands* by means of a wide range of cognitive strategies; (e.g. the ability to distinguish between demands of different priorities, effective interpersonal communication and preventive appraisals of potentially threatening situations). Our findings are consistent with previous findings showing a closer relationship between psychosocial factors and neck and shoulder pain than with low back pain (Svebak, 1991; Winkel and Westgaard, 1992). However, such area-specific relationships are not consistently reported in recent studies (Ursin *et al.*, 1988).

Our suggestions about causal relationships between psychosocial factors and musculoskeletal pain gain some support from the present findings. The efficacy of the Cognitive procedure in reducing neck, and possibly also shoulder pain, indicates a significant role for ability to cope with psychosocial job-demands in the development of such pain in female hospital staff. On the other hand, relaxation skills emerged as efficient in the reduction of low back pain in particular. It is therefore possible that psychosocial factors are less causally related to low back pain in this subject sample.

Finally, tests on the four months maintenance of treatment effects from Post-1 revealed that the most stable scores were for low back pain reduction in the group exposed to Relaxation. It will be seen from the mean scores in Figure 2 that relapses appeared in shoulder pain among subjects in the Cognitive intervention and in low back pain among subject in the Combined intervention. However, there is no basis in these results for any explanation why the distributions around the means made only the latter relapse magnitude come out as statistically significant.

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