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A shorter workday as a means of reducing the occurrence of musculoskeletal disorders

by Ebba L Wergeland, PhD,[1] Bo Veiersted, PhD,[2] Michael Ingre, BSc,[3] Birgitta Olsson, PhD,[4] Torbjørn Åkerstedt, PhD,[3] Torkel Bjørnskau, DrPolit,[5] Nils Varg, BA[6]

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Objectives The study examined the relation between daily workhours and the occurrence of neck-shoulder or back pain in physically demanding care work.

Methods Unpublished data were obtained from three intervention projects in care institutions. The projects had been conducted independently in Oslo (46 participants, 175 referents before and 158 referents after the intervention), Helsingborg (60 participants, 89 referents) and Stockholm (41 participants, 22 referents) between 1995 and 1998. The intervention was a reduction of daily workhours from ≥7 to 6 hours (or 30 hours weekly). Full-time salary was retained, and extra personnel were employed to compensate for the reduction in workhours. Data were collected by self-administered questionnaires before and during the intervention periods, lasting from 12 to 22 months.

Results The prevalence of neck-shoulder pain decreased from 40.9% to 25.6% in Oslo and from 57.1% to 39.1% in Helsingborg after 1.5 years with a 6-hour workday; for Stockholm the decrease was from 81.6% to 68.3% after 1 year. No decrease was observed in the reference groups. The prevalence of back pain did not show the same consistent pattern.

Conclusions The shortening of regular workdays from ≥7 hours to 6 hours may considerably reduce the prevalence of neck-shoulder pain among persons with physically demanding care work. The potential health benefits should encourage intervention studies also in other occupations with increased risk of work-related musculoskeletal disorders.

Key terms back, hours of work, neck, pain, shoulder, worktime, women, workload.

Work-related musculoskeletal disorders form a major health problem in industrialized countries. The consequent loss of production and the increase in social expenses is a matter of general concern. The prevalence remains high in spite of considerable ergonomic and other improvements in many workplaces.

History points to shorter workdays as an alternative for reducing the occurrence of work-related musculoskeletal disorders. About a century ago, many employers introduced shorter workdays to prevent a state of chronic exhaustion, known as "industrial fatigue," among workers (1–3). There are interesting similarities between this condition and work-related musculoskeletal disorders, although one is generalized and the other localized. Industrial fatigue was ascribed to excessive workload and inadequate rest, just as work-related musculoskeletal disorders are commonly seen as end results of an imbalance between strain and restitution (4).

1 Institute of General Practice and Community Health, Oslo University, Oslo, Norway.
2 National Institute of Occupational Health, Oslo, Norway.
3 National Institute for Psychosocial factors and Health, Stockholm, Sweden.
4 Department of Business Administration, Stockholm University, Stockholm, Sweden.
5 Institute of Transport Economics, Oslo, Norway.
6 National Board of Health and Welfare, Stockholm, Sweden.

Reprint requests to: Dr Ebba Wergeland, Institute of General Practice and Community Health, POB 1130 Blindern, N-0318 Oslo, Norway. [E-mail: ebba.wergeland@samfunnsmed.uio.no]

Other shared characteristics include high prevalence, considerably reduced work capacity, female vulnerability, and predominance among manual workers.

Intervention projects that reduced the length of workdays but preserved full-time salary have recently been carried out in Sweden and Norway (5–11). The main aim of these projects was to examine the economic consequences and the sickness absence and general effects on health and welfare. The occurrence of musculoskeletal pain in defined regions was recorded in most of the projects, but the results of the analyses of these data have not yet been published.

The aim of our present study was to examine the relation between workhour reduction and the occurrence of musculoskeletal pain in defined regions from unpublished data from previously performed intervention projects.

Subjects and methods

Data sources

Four intervention projects in which daily workhours had been reduced to 6 hours without any reduction in salary were known from personal files (5, 6, 8, 9). A search for further projects was conducted with the following key words: working time, hours-of-work, reduction-of-working-hours (Swedish: arbetstid, arbetstidsforkortning; Norwegian: arbeidstid, arbeidstidsforkortning; Danish: arbejdstid, nedsat arbejdstid). Searches in six electronic databases (arbline, artikelbasen, bibsys, norart, osh-rom, sambok) did not reveal additional projects.

Data were available for the analyses from three projects conducted between 1995 and 1998 in Oslo, Helsingborg, and Stockholm (6, 8, 9). The three projects had been carried out independently, but with the following points in common: (i) the regular workday was temporarily reduced from between 7 and 8 hours to 6 hours, (ii) the reduction in workhours was compensated for by the employment of extra personnel, to avoid a concurrent increase in work intensity, (iii) full-time salary was maintained, reducing the economic incentive for second jobs and overtime work, (iv) information was collected by a self-administered questionnaire on pain in the neck-shoulder and (low) back regions prior to and during the workhour reduction, (v) comparable information was collected for reference groups with similar work tasks but no reduction in workhours.

The extent of compensation for hours lost varied between the projects. In Oslo a complete replacement was achieved by employing new staff (7). To have registered nurses on every shift, some of the hours previously covered by home helpers and nurses' aides were replaced by employing registered nurses; thus staff qualifications were upgraded. In Helsingborg a complete replacement of hours lost was obtained by employing additional nurses' aides and assistant nurses (8). In Stockholm about half the hours lost were replaced by extra personnel (9, 10). Replacement was nearly complete in the kindergartens, but elsewhere the hours lost were only partly replaced by the employment of new staff, and the work was reorganized to save time.

Subjects

In Oslo, 46 workers in nursing homes and home care services had their daily workhours reduced from 7.5 to 6 hours (or 30 hours a week) for 22 months (12 June 1995–31 March 1997). Reference groups were drawn twice, before the intervention and after 1 year, each time from the same nursing homes and home care services in neighboring city regions. They included all the workers actually employed in corresponding, full-time jobs, amounting to 175 before and 158 after 1 year. Most of the 158 persons in the second group had also served as referents in the group drawn before the intervention.

In Helsingborg, 60 workers in an institution covering home care services and work in a nursing home had their daily workhours reduced from 8 to 6 hours (or 30 hours a week) for 22 months (1 March 1997–31 December 1998). The reference group consisted of 89 workers in a similar institution in corresponding full-time jobs.

In Stockholm, 41 workers in home care services, nursing homes, and kindergartens had their daily workhours reduced from ≥7 hours to 6 hours (or 30 hours a week) for 32 months (1 May 1996–30 December 1998). The reference group consisted of 22 workers with corresponding jobs and at least 35 weekly hours. Only data from the first 12 months of the intervention period were employed in this study.

Further details are given in table 1.

Outcomes

Neck-shoulder and back pain was registered in all three projects. The respondents were asked to recall their pain experience for time periods varying from 3 months (Helsingborg) to 12 months (Stockholm). The exact wording of the questions differed between the three projects. In Helsingborg, the question on back pain specified localization to the lower back.

Exhaustion after work was recorded with comparable questions in Oslo and Helsingborg. It was included as an additional outcome of interest because it is a

Table 1. Three intervention projects (Oslo, Helsingborg, Stockholm) with reduced daily workhours — demographic and work-related characteristics and self-rated health before the intervention. (M= mean)

	Oslo												Helsingborg								Stockholm							
	Intervention (N=46)				Reference 1 (N=175)				Reference 2 [a] (N=158)				Intervention (N=60)				Reference (N=89)				Intervention (N=41)				Reference (N=22)			
	N	%	M	Range	N	%	M	Range	N	%	M	Range	N	%	M	Range	N	%	M	Range	N	%	M	Range	N	%	M	Range
Male participants	4	9	·	·	25	14	·	·	21	13	·	·	–	·	·	·	–	·	·	·	6	15	·	·	4	18	·	·
Age (years)	·	·	38	21–61	·	·	36	20–63	·	·	37	21–63	·	·	47	26–63	·	·	44	24–61	·	·	39	26–56	·	·	39	22–60
Workplace																												
Kindergarten	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17	41	·	·	6	27	·	·
Home care [b]	27	59	·	·	102	58	·	·	96	61	·	·	60	100	·	·	89	100	·	·	8	20	·	·	4	18	·	
Nursing home	18	39	·	·	56	32	·	·	52	33	·	·	–	–	–	–	–	–	–	–	10	24	·	·	8	36	·	·
Other care centers	1	2	·	·	17	10	·	·	10	6	·	·	–	–	–	–	–	–	–	–	6	15	·	·	4	18	·	·
Profession																												
Registered nurse	9	20	·	·	25	14	·	·	29	18	·	·	–	·	·	·	–	·	·	·	3	7	·	·	1	5	·	·
Nurses' aide	20	43	·	·	79	45	·	·	71	45	·	·	45	75	·	·	48	54	·	·	4	10	·	·	4	18	·	·
Practical nurse	2	4	·	·	3	2	·	·	2	1	·	·	7	12	·	·	22	25	·	·	13	32	·	·	7	32	·	·
Preschool teacher	–	·	·	·	–	·	·	·	–	·	·	·	–	·	·	·	–	·	·	·	6	15	·	·	1	5	·	·
Children's nurse	–	·	·	·	–	·	·	·	–	·	·	·	–	·	·	·	–	·	·	·	8	20	·	·	4	18	·	·
Home helper	15	33	·	·	68	39	·	·	56	35	·	·	–	·	·	·	–	·	·	·	–	·	·	·	–	·	·	·
Other and unknown	–	·	·	·	–	·	·	·	–	·	·	·	8	13	·	·	19	21	·	·	7	17	·	·	5	23	·	·
Work experience in this profession (years)	·	·	7.8	<1–27	·	·	7.5	<1–35	·	·	7.7	<1–40	·	·	··	··	·	·	··	··	·	·	11.4	<1–36	·	·	11.6	4–30
Commuting time (minutes one way)	·	·	30	··	·	·	37	··	·	·	35	··	·	·	··	··	·	·	··	··	·	·	24	··	·	·	27	··
Overtime (hours/month)	·	·	··	··	·	·	··	··	·	·	··	··	·	·	1.1	··	·	·	1	··	·	·	1.7	··	·	·	1.5	··
More than one job	6	13	·	·	14	8	·	·	14	9	·	·	1	2	·	·	3	3	·	·	1	2	·	·	–	–	·	·
Children <16 years of age at home [c]	10	22	·	·	53	30	·	·	51	32	·	·	12	20	·	·	39	44	·	·	22	54	·	·	10	45	·	·
Self-rated health [d]																												
Poor	1	2	·	·	7	4	·	·	8	5	·	·	··	··	··	··	··	··	··	··	4	10	·	·	2	9	·	·
Intermediate	16	35	·	·	43	25	·	·	32	20	·	·	··	··	··	··	··	··	··	··	7	17	·	·	6	27	·	·
Good	23	50	·	·	92	53	·	·	86	54	·	·	··	··	··	··	··	··	··	··	19	46	·	·	13	59	·	·
Very good	6	13	·	·	30	17	·	·	29	18	·	·	··	··	··	··	··	··	··	··	10	24	·	·	1	5	·	·

[a] Reference group 2 (Oslo) was drawn after 1 year from the same institutions as reference group 1, including mainly the same subjects.
[b] In Helsingborg the institution provided care in both private and nursing homes.
[c] In Oslo <18 years was used.
[d] The categories were collapsed and renamed for comparison between the projects.

Table 2. Questions defining outcome variables in the three intervention projects (Oslo, Helsingborg, Stockholm) with reduced daily workhours in italics (affirmative categories in italics).

Topic of question	Question	Response alternatives
Neck or shoulder pain and back pain		
Oslo	How often have you had one or more of the following problems over the last 6 months: Muscular pain in neck-shoulder Back pain	Never; rarely; sometimes; *quite often; very often*
Helsingborg	Have you suffered from any of the following during the last 3 months: Pain in neck and shoulder Pain in the lower back	Never; rarely; sometimes; *quite often; very often*
Stockholm	Have you had any of the following diseases (pain, ache, discomfort) during the last year (12 months): Problems from neck, shoulders	No; *yes, mild; yes, severe*
	Have you experienced any of the following problems during the last 12 months: Backache	Never; rarely (some times a year); *sometimes (some times a month); usually (several times a week); always (every day)*
Physical exhaustion		
Oslo	Does your work make you feel physically exhausted after the workday?	*Yes, every day; yes, several times a week, but not daily;* yes, about once a week; several times a month, but not every week; less frequently; never
Helsingborg	Do you usually … feel physically exhausted after work? …	Never; sometimes; *often; always*

recognized risk factor for musculoskeletal injury (12, 13). The questions are presented in table 2 (on page 29), and the administration of the questionnaires and recall periods are given in table 3.

Potential confounders

Comparable information about the intervention and reference groups before the intervention was available for some or all the projects for age, gender, workplace, job titles, work experience, second jobs, children in household, commuting time, overtime, and self-rated health (table 1). Information about second jobs and overtime during the period of workhour reduction was recorded for the intervention group in Oslo, and for both groups in Stockholm. The time (month) of the measurements was known for all the projects.

Data analysis

To increase the statistical power, we combined the data from all the studies into one dataset. Each case was coded as having or not having complaints, belonging to the intervention or the reference group, and occurring before or during the intervention (after 1 year). To test the hypothesis that the intervention reduced complaints, a three-way interaction (intervention or reference × before or after 1 year × complaints or no complaints) was evaluated with a multiway frequency analysis using a hierarchical log-linear model (14). A likelihood ratio chi-square was calculated and tested for statistical significance. The directed hypothesis, that the intervention reduced complaints, was evaluated with a one-tailed test for the three-way interaction. A P-value of less than 0.05 was considered statistically significant. All the calculations were performed with SPSS (Macintosh version 10.0, SPSS Inc, Chicago, IL, USA, 2000).

Table 3. Timing of the questionnaires and the duration of the recall periods used in the three intervention projects (Oslo, Helsingborg, Stockholm) with reduced daily workhours.

Project	Questionnaire administered	Recall period
Oslo		
Intervention	Before intervention and after 6, 12 and 18 months	6 months
Reference	Before intervention and after 12 months	6 months
Helsingborg		
Intervention	Before intervention and after 12 and 18 months	3 months
Reference	Before intervention and after 12 and 18 months	3 months
Stockholm		
Intervention	Before intervention and after 12 months	12 months
Reference	Before intervention and after 12 months	12 months

Results

Main outcomes

The prevalence of neck-shoulder pain in the intervention groups had decreased by about one-third in Oslo (40.9% to 25.6%) and Helsingborg (57.1% to 39.1%) after 1.5 years with 6-hour days. The prevalence was also reduced in Stockholm after 1 year with 6 hours a day (81.6% to 68.3%). No similar reductions were observed in the reference groups.

The prevalence of back pain in the intervention groups in Oslo and Helsingborg was also lower after 1.5 years, but there was an increase during the first year of intervention. In Stockholm the reference group experienced a reduction similar to that of the intervention group.

The prevalence of physical exhaustion after work was markedly reduced after 1 year, as well as after 1.5 years, with 6 hours a day, both in Oslo (65.2% to 40.9%) and in Helsingborg (53.3% to 31.4%). There was no consistent reduction among the referents. In Helsingborg, the prevalence decreased among the referents after an initial increase.

By using a multiway frequency analysis on data from all the studies combined, we were able to test for interactions over time (1 year) between the groups (intervention or reference) with respect to the prevalence of complaints. A significant interaction was found for neck-shoulder pain (P=0.034) and for exhaustion after work (P=0.009). The interaction indicated that the reduced prevalences of neck-shoulder pain (58.7% to 44.4%) and exhaustion after work (58.5% to 40.4%) 1 year after the workhour reduction were nonrandom effects. No significant interaction was found for back pain. Detailed results are presented in tables 4 and 5.

Other changes during the intervention period

The response rates in Oslo and Stockholm were above 90% both before and during the intervention period. They fell in both groups (intervention and reference) in Helsingborg from around 90% to around 70% (table 4).

In Stockholm the mean overtime per month increased to 2.5 hours in the intervention group and to 2.0 hours in the reference group, whereas no one reported second jobs during the intervention period. In the intervention group in Oslo three persons worked >5 hours overtime weekly versus eighteen persons before the intervention, and three persons reported employment in a second job versus six before the intervention. Equivalent information was not available from Helsingborg.

All the intervention groups showed increased job satisfaction after the reduction in workhours (6, 8, 10). The intervention group in Oslo also reported more influence on work pace (6). Regarding conditions outside work, the group in Oslo spent more time with their children during the intervention period (6). The intervention group in Stockholm spent more time with friends, family and social activities, and it reported improved sleep quality, reduced mental fatigue, and reduced heart and respiratory complaints (10, 11).

Discussion

Reducing the workday to 6 hours from ≥7 hours was associated with a reduced prevalence of neck-shoulder pain, but not consistently with a reduced prevalence of back pain. The common pattern of the decrease in neck-shoulder pain in all the intervention groups, as opposed to all the reference groups, suggests a nonrandom effect. This suggestion is further supported by the statistically significant interaction over 1 year with group (intervention or reference) for neck-shoulder pain when the data from the three studies were combined. Tests for dependent measurements were not applicable because the data were not available in pairs.

The prevalence of exhaustion after work was also consistently lower during the workhour reduction, and there was a statistically significant interaction over 1 year with the intervention or reference group when data from the three studies were combined. However, large fluctuations in one of the reference groups points to alternative or, more likely, additional determinants of exhaustion.

Misclassification of pain according to group membership, for instance, because the intervention groups benefited more from the project, could explain the reduced pain prevalence in these groups. The lack of a similar group difference for back pain speaks against this explanation.

The decrease in the prevalence of neck-shoulder pain, together with the decrease in the response rate, as seen in Helsingborg, could indicate that workers with

Table 4. Number of respondents (R) and the prevalence of self-reported pain and physical exhaustion before and during the intervention in the three intervention projects (Oslo, Helsingborg, Stockholm) with reduced daily workhours.

Project	Pain in neck or shoulder		Back pain		Exhausted after work	
	R	%	R	%	R	%
Oslo						
Intervention (N=46)						
Before	44	40.9	44	15.9	46	65.2
After 0.5 years	45	40.0	44	22.7	46	47.8
After 1.0 years	43	30.2	42	19.0	45	46.7
After 1.5 years	43	25.6	43	11.6	44	40.9
Reference (N=175 before, 158 after)						
Before	161	35.4	162	27.8	174	71.3
After 1.0 years	144	33.3	143	25.9	155	71.0
Helsingborg						
Intervention (N=60)						
Before	56	57.1	52	26.9	60	53.3
After 1.0 years	49	36.7	47	29.8	49	34.7
After 1.5 years	46	39.1	42	21.4	51	31.4
Reference (N=89)						
Before	82	48.8	79	38.0	86	45.3
After 1.0 years	81	46.9	76	39.5	82	52.4
After 1.5 years	62	50.0	62	38.7	68	35.3
Stockholm						
Intervention (N=41)						
Before	38	81.6	39	51.3	..	..
After 1.0 years	41	68.3	41	26.8	..	..
Reference (N=22)						
Before	22	63.6	22	50.0	..	..
After 1.0 years	22	72.7	22	31.8	..	..

Table 5. Number of respondents and the prevalence of self-reported pain and physical exhaustion before and during the intervention (after 1 year) in the three intervention projects (Oslo, Helsingborg, Stockholm) with reduced daily workhours—data compiled from all three projects.

	Pain in neck or shoulder		Back pain		Exhausted after work	
	N	%	N	%	N	%
Intervention						
Before	138	58.7	135	30.4	106	58.5
After 1 year	133	44.4	130	25.4	94	40.4
Reference						
Before	265	41.9	263	32.7	260	62.7
After 1 year	247	41.3	241	30.7	237	64.6
Multiway frequency analysis (df=1)	Chi-square	P-value (one-tailed)	Chi-square	P-value (one-tailed)	Chi-square	P-value (one-tailed)
Complaints × Group × Time	3.325	0.034	0.218	0.320	5.639	0.009

neck or shoulder pain were particularly prone to quit. A reduced pain prevalence in the intervention group, as opposed to the reference group, was, however, also observed in Oslo and Stockholm, where the response rates in the intervention groups remained high throughout the intervention period.

Seasonal variations for neck-shoulder symptoms have been reported, with prevalences decreasing from autumn and winter towards spring (15). Seasonal variations cannot explain the reduction in the neck-shoulder symptom prevalences observed in our study, however, as the data collection was parallel in time for the intervention and reference groups within each project. The impact of seasonal variations without a concurrent reduction of workhours could only be examined in the reference group in Helsingborg. The initial measurements were made in December-January and the final ones (after 1.5 years) in August. The difference in the symptom prevalence between the two points in time was negligible.

The use of overtime and employment in second jobs decreased in Oslo with workhour reduction. The results in Oslo may therefore reflect a larger workload reduction than just a shorter regular workday.

From the different recall periods employed, one would expect a lower prevalence of neck-shoulder pain in Helsingborg than in Oslo. The prevalence observed in Helsingborg was, however, higher. The higher mean age in Helsingborg may explain this finding, together with the larger proportion of physically demanding jobs, as indicated by the job titles (table 1). The different wording of the questions and the inclusion of male participants in Oslo may have also contributed.

Self-reported pain was used as a proxy measure for musculoskeletal disorders. Pain is the cardinal symptom of musculoskeletal disorders, but it is also a normal transient reaction to muscular strain. There is no clear cut-off point on the continuum of frequency, intensity, or duration to distinguish pain as a normal reaction from pain as a symptom (16). Although not well documented, an acute reaction is generally considered to indicate a risk for later development of musculoskeletal disorders (4).

Beneficial health effects through the reduction of the regular workday in industry from 12 or 10 to 8 hours were suggested already in the beginning of the last century (1). Industrial work has become less demanding physically, but there are indications that a further reduction of workhours may be beneficial for workers in repetitive work (17). Positive associations with workhours have been observed for back or neck pain and fatigue, but no consensus exists regarding health effects from a reduction of weekly worktime below 48 hours (18–20). One reason for the inconsistent results may be a lack of attention to potential confounders like work intensity, overtime, second jobs, and domestic workload. A study of sewing machine operators in Norway observed no lasting difference between full-time (8-h day) and part-time (5-h day) workers with respect to sick leave due to neck-shoulder complaints (21). Less sick leave due to low-back complaints among part-time workers was indicated. Nearly half the female workforce in Norway works part-time, which is associated with children in the household and a larger domestic workload (22). This workload-based selection to part-time jobs makes it difficult to predict the potential effects of reduced regular workhours in comparisons of full-time and part-time operators. Musculoskeletal complaints in the employed female population of Norway are in fact more common among part-time workers (20–34 hours weekly) than among those working full-time (≥35 hours) (23).

The relative reduction in symptom prevalence for neck-shoulder pain after 1 year of intervention was much larger in Oslo and Helsingborg than in Stockholm. This finding may reflect the fact that employees in Oslo and Helsingborg obtained complete compensation for hours lost by employment of new personnel, while, in the Stockholm project, compensation was partly obtained by a reorganization of the work. A shorter workday means more time off and a shorter duration of eventual harmful exposure at work. However, if a shorter day is obtained through an increase in work intensity, exposure at work may become more harmful. Negative effects may attenuate or even outweigh the beneficial health effects of the shorter workday.

Reduced workhours may have reduced the prevalence of neck-shoulder pain through several pathways. On a theoretical basis, a reduced duration of muscular strain can be expected to reduce the risk of musculoskeletal pain (4, 24). Shorter workdays reduce the total energy expenditure required in physically demanding jobs, reducing fatigue and the risk of musculoskeletal injury. Exhaustion after work was prevalent even with 6 hours a day (table 4). Further measures are therefore apparently needed to obtain an optimal balance between individual capacity and job demands for all workers.

Reduced workhours may also protect against muscular pain by reducing mental strain both at and outside work (25). The observed increase in job satisfaction and the influence on workpace, the improved sleep quality, and the additional time spent with friends and children may be protective side effects of intervention through this mechanism. Reduced workhours may also protect against muscular pain by providing better opportunities for recovery and exercise (26).

Several of these pathways may protect against back pain, as well as neck-shoulder pain. The apparent lack of effect on back pain probably reflects a different pathomechanism. Neck pain is mainly associated with long-term neck-muscle activation, while back pain is as-

sociated with short-term overexertion (27). Shorter workdays can reduce the amount of sustained musclular activity at work, but only to a less extent the risk of overexertion injuries. Other factors may be of greater relative importance for the occurrence of back pain, such as the need for the manual handling of heavy loads and the possibilities for safe lifting in both paid work and domestic work.

Potential health benefits may be considerable if the observed effect on neck-shoulder pain reflects causal relationships. Effects on musculoskeletal pain in this and other regions should therefore be a research priority in future intervention projects with shortened workdays. All contributions to the total workload, such as overtime, employment in second jobs, domestic workload, and domestic work sharing should be recorded as potential confounders (28).

Full-time salary should be retained to reduce the incentive for overtime or second jobs. Shorter workdays with a constant work intensity can sometimes be the result of successful mechanization or reorganization. However, in most types of work, it will be necessary to replace hours lost through the employment of extra personnel to avoid any deterioration of work conditions.

Reducing workhours while retaining full-time salary, and replacing hours lost with new personnel, will increase wage costs. Benefits to the employer may include healthy workers, improved quality of service or production, less turnover, and easier recruitment of qualified personnel. According to a comprehensive analysis of the project in Stockholm, economic gains are primarily to be expected at the national level (8). Such gains may result from a reduced incidence of long-term sickness absence, early retirement or disability pensioning, less un- or underemployment, and increased tax income. Government grants to encourage further experiments may therefore be a sound investment.

Future studies should include other types of work, such as light but repetitive work, mentally demanding work, or extremely sedentary work. Both genders should be included and the gender differences examined. The intervention period should preferably be longer, and measurements should be made repeatedly—not only before and during the intervention, but also after the intervention period.

In conclusion, the results from three intervention projects indicate that shortening the regular workday from ≥7 hours to 6 hours may considerably reduce the prevalence of pain in the neck-shoulder region in physically demanding care work. The possibility to reduce the occurrence of work-related musculoskeletal disorders and prevent or postpone work disability should encourage intervention studies with reduced daily workhours also in other occupations with increased risk of work-related musculoskeletal disorders.

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