Scand J Rehab Med 23: 135–142, 1991

NECK AND SHOULDER DISORDERS IN MEDICAL SECRETARIES

Part II. Ergonomical Work Environment and Symptom Profile

Kitty Kamwendo,[1] Steven James Linton[2] and Ulrich Moritz[3]

From the [1]Occupational Health Care Center, Örebro Medical Center, S-701 85 Örebro, [2]Department of Occupational Medicine, Örebro Medical Center, S-701 85 Örebro, and the [3]Department of Physical Therapy, Lund University, S-220 05 Lund, Sweden

ABSTRACT. Seventy-nine medical secretaries with neck and shoulder pain were included in a study aimed at an in-depth description of the ergonomical work environment and the participant's symptom profile, as well as analysing relationships between ergonomical factors and symptoms. Data were collected by daily ratings, questionnaires, and direct observation. The symptom profile showed low mean daily ratings of perceived fatigue and pain, a low medicine consumption, and few stress symptoms. A mean number of 2.1 undesirable work postures was observed. The correlations between perceived fatigue, pain, and well-being with number of shifts from sitting to standing and time spent typing, were generally small. This study suggests that risk factors for neck and shoulder pain are individual and multifactorial.

Key words: neck and shoulder pain, stress symptoms, ergonomical work environment, risk factors.

Workplace design, posture, and monotonous work have been pointed out as important factors in the development of occupational neck and shoulder disorders (3, 11). In order to reduce the static muscular load caused by monotonous work, the introduction of spontaneous as well as scheduled pauses is advocated (3, 5).

In a previous study on medical secretaries ($n=420$) we reported a significantly increased risk of neck and shoulder pain when five or more hours were spent working with office machines (6). However, there was no significant relation between pain and the number of hours spent sitting down, suggesting that sedentary work in general includes tasks that give greater physical variation than does work with office machines. The study used a cross-sectional design with one-time retrospective ratings. Although offering a simple and easily administered way of obtaining valuable data, this method nevertheless, has some limitations. One might question whether the subjects have been able to correctly remember their pain for a period of one year, and whether pain has interacted with the subject's perception of workload resulting in an overestimation of average time spent sitting or typing. Consequently, it would be of interest to study the number of postural changes from sitting to standing in relation to symptoms experienced within a given time period.

Pain can be expressed in many ways, e.g. verbally (pain ratings) or reflected in individual behaviour (use of pain relieving medication or restriction of every day activities). Pain may also result in the development of stress symptoms such as sleep problems, anxiety, or feeling depressed (10). Accordingly, in order to get a comprehensive picture of pain, a multidimensional approach is recommended.

The aim of this study was to describe the ergonomical work environment and symptom profile for a group of secretaries with neck and shoulder pain, as well as to analyse the relationship between work environmental factors and symptoms. Special reference was paid to the relationship between discomfort and number of shifts from sitting to standing and hours spent typing. The questions addressed were whether (*a*) individuals who make more frequent postural changes and type fewer hours also experience less daily discomfort, and whether (*b*) number of shifts and typing hours are related to the development of discomfort during the course of the day. The symptom profile included stress symptoms, daily ratings of perceived muscular fatigue, pain, and general well-being, use of pain medication, and ability to perform household chores.

MATERIAL AND METHODS

Subjects

From a study of 420 medical secretaries currently working (6) a group was selected. The inclusion criteria were (*a*) having experienced some pain in either the neck or shoulder region during the previous year, (*b*) estimated their average time spent sitting during working hours to be a minimum of five hours daily and (*c*) worked at least 30 hours per week.

The 119 subjects who fulfilled the initial criteria were fur-

Table I. *Equipment used by the secretaries* ($n=79$)

Type of equipment	Number	% of secretaries
Chairs		
Height adjustable	79	100
Height adjustable while seated	25	32
Seat can tilt forward	20	25
Typewriter or VDU		
Low profile keyboard[a]	37	47
High profile keyboard	13	17
Typewriter well	33	42
High profile/no well	0	0
Foot rest	37	47
Wedged cushion	0	0
Tilted table	0	0
Wrist support	3	4
Manuscript holder	8	10
Adjustable side-lamps	61	77

[a] Height from desk surface to middle of keyboard does not exceed 3 cm.

ther screened for possible inclusion in the present study. An interview was carried out by a physiotherapist. The purpose was to select secretaries who could be studied in their work environment and for whom it would be reasonable to assume that the presence of neck and shoulder pain was primarily work-related. Consequently the exclusion criteria were (*a*) present or planned sick- or maternity-leave, (*b*) suffering from a disease with musculoskeletal symptoms not related to work or (*c*) under medical care likely to effect the individuals neck and shoulder disorders.

Subsequently 40 individuals were not selected to the study for the following reasons:

- Eight individuals were on sick-leave (3 epicondylitis, 2 back pain, 3 non-muscular skeletal disease).
- Two individuals were pregnant and due for their maternity-leave before the start of the study.
- Six individuals were under medical care for non-work-related diseases (M. Bechterew, multiple sclerosis, diabetes, RA etc).
- Four individuals were referred for further medical examination (3 epicondylitis, 1 swollen joints).
- Fourteen individuals did not actually fulfill the initial inclusion criteria (3 had changed jobs and were sitting less than 5 hours daily and 11 worked less than 30 hours/week).
- Three individuals wanted immediate intervention.
- Three individuals did not report for the screening examination.

In order to test whether the exclusions had altered the studied group, pain frequency of individuals excluded for medical reasons ($n=18$) were compared with those selected for the study ($n=79$). However, the difference was not significant (neck pain $\chi^2(1)=0.50$, $p=0.48$, shoulder pain $\chi^2(1)=2.02$, $p=0.15$).

Consequently 79 secretaries were invited to take part in the present investigation. Their mean age was 39.4 years (SD 10.7). Sixty-three percent of the secretaries had worked 10 years or less with secretarial work (mean 9.6, SD 7.3). Seventy-three percent worked full-time, i.e. 40 hours per week, while 27% worked at least 30 hours per week.

Secretaries were provided with information about the study and participation was voluntary. The study was approved by the hospital's Health and Safety Committee as well as its Board of Ethics.

Worksite visit

Worksite visits were made, and equipment (Table I) and main duties were examined. A secretary often had two work stations, e.g. the visual display unit as well as her own desk. Eighty-five percent ($n=67$) of the secretaries spent at least 70% of their working time at one work station which was then the station included in the analysis. When work was divided equally between two stations ($n=12$) the station which the secretary considered the most strenuous was analysed.

A 10 min observation of the individual's working posture was made. The observed work was chosen so as to be representative of the respective secretary's main tasks. Ten different work postures (Table II) generally believed to be associated with neck and shoulder pain were checked (1, 5, 8, 9). Postures adopted for at least one minute or three times during the observation period were recorded. However, exact frequency or duration recordings were not made. A score of one was given if the posture was satisfactory, and a score of

Table II. *Number of secretaries observed with work postures generally believed to be associated with neck and shoulder pain* ($n=79$)

Position	*n*	%
1. Feet not supported	2	3
2. Lumbar support inadequate	4	5
3. Trunk bent forward		
$\geq 20°$[a]	6	8
$\geq 60°$	3	4
4. Trunk twisted		
$\geq 15°$	12	15
$\geq 45°$	8	10
5. Shoulders held high	12	15
6. Upper arms flexed forward or abducted		
$\geq 60°$	11	14
$\geq 60°$	25	32
7. Neck bent forward		
$\geq 20°$	40	51
8. Neck bent backwards (chin forward)	9	11
9. Head turned		
$\geq 15°$	28	35
10. Hands above elbow height	9	11

[a] All degrees are estimates.

two if it was not. For three of the observed postures (trunk bent forward, trunk twisted, and upper arms flexed forward or abducted) a score of three could be given depending on the severity of the adverse posture. Thus, an index could be formed ranging from 10–23 points.

The observations were carried out by a physical therapist or an assistant especially trained for the task. The inter-observer reliability at the start of the observation period was 96.7% and at the end was maintained at 97.3%.

Stress symptoms

The secretaries were individually called to their occupational health care center where they were asked to answer a questionnaire on stress symptoms, i.e. tired for no reason, headache, restless sleep, heart palpitations, indigestion, concentration difficulties, feeling restless or tense, worried or nervous, and depressed or sad (2). The four category scale used ranged from "almost never" to "almost always", and was summed to an index ranging from 9–36 points representing a minimum respectively a maximum of stress symptoms.

In order to compare the magnitude of stress symptoms found in the current investigation, data from the occupational category "female typists" collected by the Foundation for Occupational and Environmental Research (13) were employed. These typists had taken part in occupational health screenings during 1986, worked typically from manuscripts and tapes on typewriters and word processors, as well as with calculators. For the sake of comparison, the four category scale for the stress symptoms used in the present study was dichotomized by collapsing the categories "almost never" and "sometimes" respectively "often" and "almost always" thus creating a "no" versus "yes often" scale comparable to the one used by the foundation.

Daily ratings

Daily ratings were carried out at work and the secretaries were asked to complete five days of ratings. Days off, occasional sick days, or poorly completed ratings, were compensated for by extending the rating period accordingly. An assistant collected the rating sheets once per day.

Ratings of perceived neck and shoulder *fatigue* and *pain*, as well as *general well-being*, were carried out three or four times daily depending on whether the secretary worked part-time or full-time. For these variables 100 mm visual analogue scales, anchored by extremes, e.g. "no pain" and "considerable pain", were used. The scale for well-being was anchored by "excellent" and "very poor".

Participants also rated their number of *shifts from sitting to standing* and number of *hours spent typing*. These ratings were carried out two or three times daily, again, depending on the total working hours.

Finally, *experienced workload* (using a 100 mm visual analogue scale, anchored by "unusually little to do" and "unusually much to do"), consumption of *medicine* due to neck and shoulder problems, and ability to perform *household chores* (using a three category scale) were rated once daily. The latter rating was performed in the morning and referred to the ability the previous afternoon and evening. Consequently the ratings included week-days (Monday to Thursday) and Sundays.

Validity of rated number of shifts and time spent typing

The validity of the daily rating of number of shifts from sitting to standing and time spent typing was tested by direct observation. Ten secretaries who had completed the study were observed for two 4-hour periods on two separate days. The participants had been informed that the observation concerned occupational factors in general, but were unaware of the details involved. During the observation period daily ratings were carried out according to previously described routines. The secretaries were observed continuously, but the observer did not take part in any conversation with either the secretary or any other person at the workplace. The results showed good validity as indicated by a strong correlation (Pearson $r=0.92$) between the observed and rated number of shifts. There was also a strong correlation (Pearson $r=0.84$) between observed and rated time spent typing.

Statistical analysis

Data were summarized to provide frequency distributions and prevalence rates. When examining group differences, using nominal and ordinal data, the appropriate χ^2-test was used. When correlations between variables were analysed Spearman rank correlation coefficients (designated r_s) were calculated.

RESULTS

Worksite visit

Forty-eight percent ($n=38$) of the secretaries said that their main task was typing, while 28% ($n=22$) said that it was general desk work done by hand. Telephone and cashier work primarily occupied 13% ($n=10$) of the secretaries, while 11% ($n=9$) worked with visual display units (VDU). Of those 59% working with typing or VDU-work, 83% ($n=39$) worked from a dictaphone rather than a manuscript.

An inventory of the equipment used by the secretaries is shown in Table I. All chairs were height adjustable. However, only 32% could be adjusted while the chair was being used. Twenty-eight individuals (35%) reported that they lacked proper equipment while only eight had actually formally applied for the equipment in question. The items most commonly desired were more easily adjusted chairs, modern desks with lighter drawers and larger surfaces, and finally, additional lighting.

The three most frequently observed work postures believed to be associated with neck and shoulder pain were neck bent forward, upper arms flexed forward or abducted, and head turned (Table II). The mean number of adverse postures was 2.1. For 19% of the secretaries no undesirable work postures were observed at all, while the 22% representing the poorest outcome (highest score) had a median index score of 17 points on the 10–23 point scale.

Table III. *A comparison of stress symptoms (occurring "often") between participants in the present study and a group of typists*

Data from the Foundation for Occupational and Environmental Research.

Symptom	Secretaries in study ($n=79$)		Typists reference ($n=333$)			
	n	%	n	%	$\chi^2(1)$	p
1. Tired no reason	21	27	113	34	1.57	NS
2. Headache	24	30	100	30	0.00	NS
3. Restless sleep	13	17	80	24	2.09	NS
4. Heart palpitation	4	5	23	7	0.35	NS
5. Unconcentrated	8	10	47	14	0.88	NS
6. Restless	10	13	70	21	2.85	NS
7. Worried, nervous	5	6	60	18	6.57	<0.05
8. Depressed, sad	4	5	57	17	7.35	<0.01
9. Indigestion	11	14	53	16	0.19	NS

Stress symptoms

With regard to the nine stress symptoms a mean of 1.3 symptoms were experienced "often" by the secretaries. "Headache" and "tired for no reason" occurred most frequently and were "often" experienced by 30 respectively 27% of the participants (Table III).

When secretaries in this study were compared to a group of typists ($n=333$) there was no overall difference, the mean number of symptoms "often" experienced by the typists amounting to 1.8. The two symptoms "worried or nervous" and "depressed or sad", however, were experienced significantly less often by the secretaries in the present study ($\chi^2(1)=6.57$, $p<0.05$ and $\chi^2(1)=7.35$, $p<0.01$ respectively) than by the typists (Table III).

Relationship of stress symptoms with age, work posture, and psychosocial work environment

In order to examine a possible relationship between stress symptoms and age, work posture, and psychosocial work environment, the stress symptoms index was used.

There was no significant correlation between stress symptoms and age ($r_s=0.17$, $p=0.07$), nor between stress symptoms and the work posture index ($r_s=0.02$, $p=0.90$).

Data collected on the psychosocial work environment from the previous study (an index, range: 10–40 points) (6) were used to examine the relationship between stress symptoms and the psychosocial work environment. No significant correlation was found between frequency of symptoms and the psychosocial environment, using the overall index ($r_s=0.22$, $p=0.06$). When however, the 10 psychosocial questions were broken down into three subindexes of work content, social support, and work demand, it was found that frequently occurring stress symptoms correlated significantly with poor social support ($r_s=0.32$, $p=0.004$).

Daily ratings

Fig. 1 shows mean intensity ratings for perceived neck and shoulder fatigue and pain, as well as general well-being.

There was an increase in fatigue as well as pain and a decrease in general well-being during the course of the day. At no time did maximum mean ratings exceed 30 mm on the 100 mm VAS. The maximum mean rating for general well-being was 28 mm (0="excellent") indicating general well-being to be fairly good.

The mean rated number of daily shifts from sitting to standing was 26.5 (SD 18.3). The mean rated number of daily hours spent typing was 3.0 (SD 2.8). Although the individual differences were large, there was little group variation during the course of a day or over the week.

Correlation of fatigue, pain, and well-being with number of shifts from sitting to standing and hours spent typing

The relationships between perceived fatigue, pain, and general well-being with the number of shifts from

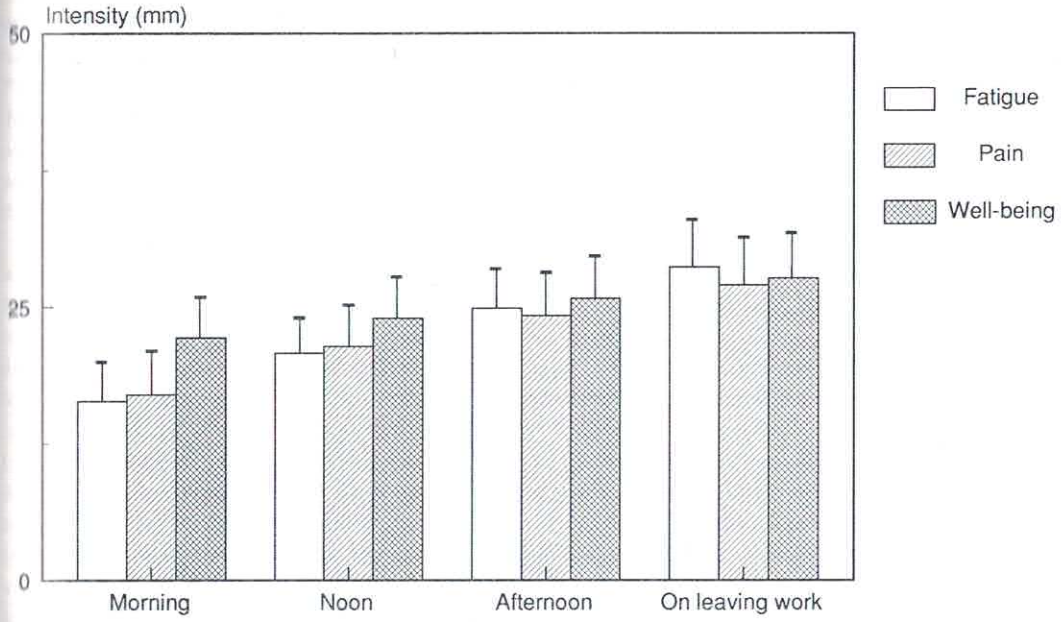

Fig. 1. Mean intensity ratings with confidence intervals for perceived neck and shoulder muscular fatigue, pain, and general well-being measured on a visual analogue scale ($n=79$). (The scale for well-being is depicted so that higher scores on the scale denote a poorer level of well-being.)

sitting to standing and number of hours spent typing, were examined on a group level as well as on an individual basis. Mean daily ratings incorporated measures from the noon, afternoon, and leaving work assessment periods. Correlation coefficients calculated on an individual basis used a maximum of 15 observation pairs per individual. Since correlations could not be made for those individuals who either had not rated any fatigue or pain or had not typed during the 5-day rating period, 42 (9%) of the possible 6×79 correlations could not be calculated.

Overall correlations of discomfort with number of shifts were small, and contrary to expectations, positive (fatigue $r_s=0.14$, pain $r_s=0.13$, well-being $r_s=0.23$). Furthermore the only significant correlation found was for the variable well-being ($p=0.05$). For overall correlations with number of hours spent typing coefficients were even smaller (fatigue $r_s=0.01$, pain $r_s=-0.01$, well-being $r_s=0.13$).

When correlations were calculated on an individual basis, expected negative correlations between number of shifts and fatigue were found for 72% ($n=75$) of the individuals. The percentage of expected negative correlations for number of shifts and pain was 61% ($n=76$), and similarly for shifts and well-being 60% ($n=77$). The correlations were generally small and only 31% (fatigue), 21% (pain), and 19% (well-being) of the individuals had negative coefficients greater than 0.40. Furthermore, significant negative correlations were found for only nine (fatigue), two (pain), and six (well-being) individuals.

Expected positive correlations between number of hours spent typing and fatigue were found for 28% ($n=67$) of the individuals. The percentage of expected positive correlations between typing and pain was 38% ($n=68$) and similarly for typing and well-being 42% ($n=69$). The correlations were again small and only 6% (fatigue), 7% (pain), and 6% (well-being) of the individuals had positive coefficients greater than 0.40. Significant positive correlations were found for only two (fatigue), zero (pain), and two (well-being) individuals.

Correlation of fatigue, pain and well-being with workload

Experienced workload, rated on a 100 mm VAS, was fairly evenly distributed over the five rating days ranging from a daily mean of 51.2 mm to 57.3 mm. The large standard deviations (27.4 and 24.0 respectively) reflect the large individual differences.

Correlation coefficients were calculated for each of the five days for workload and the three dependent

Table IV. *Overall correlations between afternoon ratings of perceived fatigue, pain, and general well-being and experienced workload*

		Afternoon			On leaving work		
		n	r_s	*p*	*n*	r_s	*p*
Fatigue	Day 1	76	0.34	0.00	66	0.34	0.01
	Day 2	75	0.19	0.10	64	0.22	0.09
	Day 3	75	0.20	0.08	64	0.29	0.02
	Day 4	74	0.32	0.01	63	0.35	0.00
	Day 5	66	0.27	0.03	56	0.39	0.00
Pain	Day 1	76	0.18	0.12	67	0.20	0.11
	Day 2	75	0.17	0.14	64	0.22	0.08
	Day 3	75	0.21	0.07	67	0.23	0.05
	Day 4	74	0.16	0.18	64	0.23	0.07
	Day 5	66	0.29	0.02	56	0.43	0.00
Well-being	Day 1	77	0.21	0.07	68	0.26	0.03
	Day 2	77	0.09	0.44	67	0.07	0.55
	Day 3	76	−0.01	0.95	69	0.07	0.59
	Day 4	75	−0.01	0.96	66	0.00	0.99
	Day 5	67	0.10	0.38	58	0.26	0.05

variables perceived fatigue, pain, and well-being respectively. Since all participants did not work full-time, coefficients for both afternoon ratings are given (Table IV). There were more significant correlations found for fatigue (7 out of 10) than for pain (3 out of 10) and well-being (2 out of 10). Also, there were more significant correlations found "on leaving work" (8 out of 15) compared to the "mid afternoon" (4 out of 15) ratings. All significant correlation coefficients were positive, showing that greater workloads were associated with more fatigue and pain as well as a sense of poorer well-being.

Correlation of fatigue, pain, and well-being with age

Age did not correlate significantly with mean daily ratings of perceived fatigue ($r_s=0.19$, $p=0.09$), pain ($r_s=0.10$, $p=0.36$), or well-being ($r_s=0.18$, $p=0.11$).

Medication

Nine of the 79 secretaries had taken pain relieving medication for their neck and shoulder discomfort during the 5-day rating week. One of them having medicated for four days, two for two days, and the remaining six for one day.

Household chores

Household chores were managed with ease (49% of the total number of ratings) or with some difficulty (38% of the total number of ratings). Thirteen percent of the total number of ratings indicated great difficulty. Household chores were managed with less difficulty on Sundays compared to weekdays. The difference was significant ($\chi^2(2)=9.37$, $p<0.01$).

DISCUSSION

In this descriptive study of a group of medical secretaries, workplace factors, and pain as well as stress symptoms have been studied. A mean number of 2.1 undesirable work postures was observed while the mean number of reported stress symptoms was 1.3. Daily ratings of perceived fatigue and pain increased during the course of the day. However, rated number of daily shifts from sitting to standing and number of hours spent typing did not correlate strongly with fatigue, pain, or well-being. The data indicates that individual and broad-based analyses are needed if potent preventive measures are to be taken.

Overall the ergonomical work environment was better than expected and the mean number of adverse postures was 2.1. This result must, however, be interpreted with some caution. Although state-of-the-art technique was used and representative work routines were selected, the observations were, nevertheless, made during a limited time period (10 min) with no analysis of frequency and duration. Consequently, the full impact of the individual adverse postures

could be underestimated while the number of postures actually undesirable might be overestimated. For instance, a secretary working with arms abducted during the major part of the 10-min observation period would receive the same score as an individual who only lifted her arms occasionally, despite the fact that the first situation clearly is more strenuous.

Some studies have tried to correlate work postures with experienced discomfort and failed (7, 12). Kemmlert & Kilbom found not only a lack of correlation between symptoms and unsatisfactory workplace ergonomics, but observed that individuals with problems had an ergonomically better workplace. This could indicate that the individual suffering from muscular discomfort initiates improvements on his or her own in order to relieve pain. In the present study the modest number of adverse postures that was found (mean 2.1) could be a result of the fact that secretaries suffering from neck and shoulder pain already had taken steps to improve their workplace and postures.

Twenty-eight secretaries said that they lacked necessary equipment, but only eight of these had actually tried to obtain the desired items. This might imply that they did not consider the lack of equipment to be of any great importance, but could also be a sign of resignation; they did not believe they would be granted the equipment.

There was no evidence of overrepresentation of stress symptoms among the secretaries in this study compared to a group of typists. In fact, both groups experienced few symptoms. One might have expected more symptoms among the secretaries in the present study since they had been selected on a "problem criteria", i.e. pain, in contrast to the typists who had taken part in a general health screening. However, the subjects in the present study were actually less worried or nervous, as well as less depressed or sad, than the typists.

The increase during the course of the day of perceived muscular fatigue and pain is in accordance with findings by Hagberg & Sundelin (4). In the present study the mean daily ratings of fatigue and pain in the neck and shoulders were generally low, i.e. only the lower third of the total scale was put to use. Furthermore, only nine secretaries reported having used any medication at all for their neck and shoulder pain during the assessment week. However, although the symptoms that the secretaries present with may be described as modest the long-term effect is unknown. It may well be that working at a low pain level may result in an increase of disorders in the future.

It was thought that the total effect of the daily workload would influence the ability to perform household chores. In the present study, household chores were performed more easily on Sundays compared to week-days. This may indicate that the individual has had time to recuperate during the weekend and as a result is less restricted by muscular fatigue or pain. On the other hand the results may primarily reflect a situation where home duties were less frequent and less demanding on Sundays compared to week-days.

Hagberg & Sundelin, when studying the effect of short pauses on word processor operators, found a significant negative correlation between number of spontaneous pauses and muscular load (4). In the present study, however, the overall correlations failed to demonstrate an expected negative relationship between number of shifts and daily discomfort ratings, as well as an expected positive relationship between hours spent typing and daily discomfort. Nor were we able to show that the number of shifts or typing hours were associated with the development of muscular discomfort during the course of the day, since individual correlations were not only generally small but many were in an unexpected direction. This was especially true for the variable "hours spent typing" with more than 50% of the coefficients being in an unexpected direction.

The results of the study suggest that although monotonous work appeared as an important factor associated with neck and shoulder pain for some individuals, for the majority of the participants there were probably other factors of greater importance related to muscular discomfort. Finally it must be pointed out that the unexpected directions of the overall as well as some of the individual correlations, may reflect a situation where secretaries who suffered pain had applied for jobs that offered less typing and greater physical variation (7).

One variable that might be associated with work posture as well as psychosocial work factors was stress. For example in a stressfull situation the secretary may adopt a tense body posture or she may not take time to adjust her equipment correctly, resulting in undesirable work postures. However, no association between work postures and stress symptoms was found, whereas there was a small correlation between poor social support and higher frequency of stress symptoms.

The ultimate aim of the identification of possible risk factors is to include the knowledge in preventive

work so that the risk may be reduced or eliminated. The isolation of potent risk factors may however, as was the case in this study, prove to be difficult. The preventive work strategy, it then appears, should be individually tailored both in regard to identifying the problem as well as to the choice of intervention. Although the study presented was not designed to establish a cause–effect relationship between variables, the results suggest that a preventive programme aimed at reducing neck and shoulder pain in medical secretaries would benefit from the consideration not only of ergonomical aspects but also of other relevant factors such as the psychosocial work environment.

ACKNOWLEDGEMENTS

We sincerely thank Lennart Bodin, Ing-Liss Bryngelsson and Kerstin Åkerstedt for their help in analysing the data and preparing the manuscript. This research was made possible through financial support from the Swedish Work Environment fund and the Örebro Medical Center Research Committee.

REFERENCES

1. Andersson, G. et al.: Modell för bedömning av skador på halsrygg och axelled i enlighet med arbetsskadeförsäkringen. (A model for assessing neck and shoulder injuries in accordance with the occupational injuries insurance.) Läkartidningen 80: 3186–3189, 1983. (In Swedish.)
2. Andersson, K.: Utveckling och prövning av ett frågeformulärsystem rörande arbetsmiljö och hälsotillstånd. (The development of questionnaires regarding work environment and health.) Stiftelsen för Yrkesmedicinsk och Miljömedicinsk Forskning och Utveckling. (The Foundation for Occupational and Environmental Research.) Örebro 1986. (In Swedish.)
3. Arndt, R.: Working posture and musculoskeletal problems of video display terminal operators—review and reappraisal. Am Ind Hyg Assoc J *44:* 437–446, 1983.
4. Hagberg, M. & Sundelin, G.: Discomfort and load on the upper trapezius muscle when operating a wordprocessor. Ergonomics *29:* 1637–1645, 1986.
5. Hünting, W., Läubli, T. H. & Grandjean, E.: Postural and visual loads at VDT workplaces. I. Constrained postures. Ergonomics *24:* 917–931, 1981.
6. Kamwendo, K., Linton, S. J. & Moritz, U.: Neck and shoulder disorders in medical secretaries. Part I. Pain prevalence and risk factors. Scand J Rehabil Med (in press).
7. Kemmlert, K. & Kilbom, Å.: Besvär i nacke/skuldra och samband med arbetssituation. En utvärdering med hjälp av frågeformulär och arbetsplatsbesök. (Musculoskeletal trouble in the neck and shoulder—relationship between questionnaire findings and workplace design in offices.) Arbete och Hälsa, Arbetsmiljöinstitutet. (Work and Health, National Institute of Occupational Health.) Stockholm, 1988. (In Swedish.)
8. Kilbom, Å. & Persson, J.: Work technique and its consequences for musculoskeletal disorders. Ergonomics *30:* 273–279, 1987.
9. National Swedish Board of Occupational Safety and Health: Work postures and working movements. Ordinance 1983: 6. Arbetarskyddsstyrelsen, Stockholm, 1984.
10. Pinkerton, S., Hughes, H. & Wenrich, W. W.: Behavioral Medicine, clinical application. John Wiley and Sons, New York, 1982.
11. Rossignol, A. M., Morse, E. P., Summers, V. M. & Pagnotto, L. D.: Video display terminal use and reported health symptoms among Massachusetts clerical workers. J Occup Med *29:* 112–118, 1987.
12. Starr, S. J., Shute, S. J. & Thompson, C. R.: Relating posture to discomfort in VDT use. J Occup Med *27:* 269–271, 1985.
13. Ydreborg, B. & Kraftling, A.: Referensdata till formulären FHV 001D, FHV 002D, FHV 003D, FHV 004D och FHV 007D. (Reference data for the Occupational Health Care questionnaires 001D, 002D etc.) Stiftelsen för Yrkesmedicinsk och Miljömedicinsk Forskning och Utveckling. (The Foundation for Occupational and Environmental Research.) Örebro, 1987. (In Swedish.)

Address for offprints:

Kitty Kamwendo
Landstingshälsan
Fredsgatan 27 A
S-703 62 Örebro
Sweden