

Symptoms and Clinical Findings From the Musculoskeletal System Among Operators at a Call Centre in Sweden—A 10-Month Follow-Up Study

Allan Toomingas

Department for Work and Health, National Institute
for Working Life, Stockholm, Sweden

Tohr Nilsson

Section for Occupational Medicine, Department
of Public Health and Clinical Medicine, Umeå University,
Umeå, Sweden

Mats Hagberg

Occupational and Environmental Medicine, Sahlgrenska
University Hospital, Gothenburg, Sweden

Maud Hagman

Ewa Wigaeus Tornqvist

Department for Work and Health, National Institute
for Working Life, Stockholm, Sweden

The musculoskeletal health among 57 operators at 1 call centre in Sweden was studied with 10 monthly follow-ups, parallel to a reference group of 1,226 professional computer users in other occupations. Operators at this call centre

The Swedish Work and Environment Found is gratefully acknowledged for funding this study. We would like to thank the management and all contributing staff at the call centre and the reference companies and also all doctors, ergonomists, and assistants for practical help during data collection.

Correspondence and requests for offprints should be sent to Allan Toomingas, Department for Work and Health, National Institute for Working Life, SE-113 91 Stockholm, Sweden. E-mail: <allan.toomingas@niwl.se>.

were more symptom-loaded than the other professional computer users in spite of their younger age and shorter exposure to computer work. Symptoms were long-lasting or recurrent. Muscle tenderness and nerve affections in the neck-shoulder region were the most common specific findings and diagnoses at medical examination of incident symptom cases. More extensive studies should be done on the working conditions and health status among call centre workers.

symptoms clinical findings musculoskeletal call centre follow-up study

1. INTRODUCTION

Call centres are relatively new organizational units that use telephones and computers to manage communication with, for example, customers, the public, or government agencies. Independent call centres are proliferating rapidly as many companies are outsourcing their telephone services to specific companies to more efficiently manage uneven demands for services.

Call centres are one of the most rapidly growing labour market sectors today. There are an estimated 5 m people employed in call centres in the USA, and approximately 1.5 m in Europe. There have been call centres in Sweden since the mid-1980s. According to the state-run Invest in Sweden Agency, approximately 55,000 people are employed in Swedish call centres, corresponding to about 1.3% of the total labour force (Invest in Sweden Agency, 2002). Industry growth forecasts some 110,000 employees by 2007. Financial and technical support is growing rapidly. Call centres are expanding primarily in rural areas, where there is a good supply of available labour force.

In a study of call centres in the United Kingdom, it was found that operators and managerial staff were relatively young, usually under 35, and they had worked at the call centre for only a short time (2 years or less among 50% the managerial staff and 75% of the operators; Austin Knight & Calcom Group, 1997). Operators and managerial staff were predominantly women (70 and 60% respectively).

The expansion of call centres can have a positive impact on many rural communities by creating new jobs. However, problems have been noted. Strained working conditions have been reported both concerning organizational and psychosocial aspects, like time pressure, emotional load, electronic monitoring, and voice taping of calls, but also concerning bad physical condi-

tions, and ergonomics (Bagnara, Gabrielli & Marti, 2000; Bain & Taylor, 1999; Smith, Carayon Sanders, Lim, & LeGrande, 1992; Taylor, Baldry, Ellis, & Bain, 2002).

Musculoskeletal disorders, feelings of stress, and physical and mental exhaustion among the operators have been reported (Aronsson, Dallner, & Åborg, 1994; Ferreira & Saldiva, 2002; Norman, Toomingas, Nilsson, Hagberg, & Wigaeus Tornqvist, 2001; Smith et al., 1992). Most studies have been cross-sectional, however. No prospective study has been identified reporting incidence of symptoms, nor any studies about clinical findings or diagnoses among call centre workers with such symptoms.

2. AIM

The aim was to study incident symptoms and findings from the musculoskeletal system at clinical examination among operators at one call centre in Sweden in comparison with other professional computer workers.

3. METHODS

The design was a closed prospective cohort study with a baseline data collection and 10 monthly follow-ups. Participants were operators at one call centre in northern Sweden. Thirty-five female and 35 male operators, who were supposed to remain during the study period, were selected among all 380 operators employed at the call centre. A reference group of 896 female and 636 male professional computer users in 14 other occupations was followed in parallel. The referents were entered into the study by including whole departments of, for example, high-tech engineers, flight-schedulers, librarians, university staff, medical secretaries, insurance administrators, lay-out workers in printing offices, and so forth.

A baseline questionnaire asked about ache or pain during the previous month (31 days) from 13 specific regions of the upper body defined by an illustration (National Institute for Working Life, 1997). A specific question concerned numbness and tingling in the hands. The participants were also asked to note the total number of days of suffering from each separate symptom during this month. A participant who reported ache or pain during minimum 3 days from any of the 13 upper body regions or numbness or tingling in the hands was classified as a symptom case. Other health issues and working conditions were also registered, but are not reported here.

Measurements at follow-up were made by 10 monthly questionnaires with the same symptom recording method as at baseline. Incident symptom cases were defined as (new) symptom cases among noncases during the preceding baseline or follow-up month. A medical examination was performed within a few weeks among incident cases. Only first-time of incidence is reported here.

The medical examination was performed by one of eight physicians following a predefined protocol. Exposure conditions, both at work and in private life, were penetrated. A traditional medical history was taken. The examination of the musculoskeletal system covered inspection, range of movement (active and passive), pain at resisted muscular contraction or stretching of structures, muscular strength (including grip strength using a Martin Vigorimeter, Martin Instruments, BCB Ltd., UK), tenderness at palpation of muscular or tendon insertions, tendon reflexes and test of sensitivity to touch in the dermatomes C5-Th1. A blood sample was tested for CRP (C-reactive protein).

Pathological findings were classified into about 140 different affected organs using predefined criteria, for example, nerve root in C4-C5, trapezius muscle-descending part, lateral humeral epicondyle, or median nerve in wrist region. The left and right side were separated, when possible. Making use of all available information about the case the examining physician made a decision of a diagnosis or syndrome. "Unclear finding" was chosen for cases with no pathology or unclear or contradictory findings.

The examiners were not blinded to the symptoms or the exposure situation. In fact, one of the tasks was to judge the work-relatedness of the symptoms and findings and give the examined participant preventive or rehabilitative advice, if possible. The medical examinations were mostly done at the company health office during the participants' ordinary working hours, and usually lasted 30–45 min.

4. STATISTICAL METHODS

Prevalence odds ratios and incidence rate ratios with 95% confidence intervals (CI) were analyzed adjusting for age and gender according to Mantel-Haenszel (Rothman & Greenland, 1998). Incidence rate ratios were calculated using Cox's regression model (PHREG; SAS/STAT User's Guide, 1999).

5. RESULTS

The response rate to the baseline questionnaire was somewhat above 80%, except 10% less among men in the reference group (Table 1). The call centre operators were on the average about 14–17 years younger, had a lower educational level, 7 years shorter experience of computer work, and about 10 years' less seniority in the present profession than the reference group (Table 2).

Symptom cases were found at baseline among 86% of the female call centre operators compared to 72% among women in the reference group (difference: 14%; 95% CI 1–27). The corresponding figures among men were 68 and 50% (difference: 18%; 95% CI 0–36). The odds ratio for being classified as a symptom case among call centre operators versus the referents was 2.2 (95% CI 1.2–4.3, adjusted for gender and age). The neck and shoulder regions were most frequently affected in both groups.

The response rate on the follow-up questionnaires was substantially lower (15–20%) in the call centre groups than in the reference groups (Table 1). The total time under risk during follow-up was 2,757 days among call centre men, 1,936 days among women; 90,122 days among men in the reference group and 91,792 days among women. Five women and 13 men at the call centre were incident cases (Table 3). The incidence rates were thus 1.7/person-year among call centre men and 0.93 among call centre women versus 0.80 among male referents and 1.2 among female referents. The age adjusted relative risks (incidence rate ratios) for incident symptoms among call centre operators versus the reference groups were thus 2.1 (95% CI 1.2–3.6) among men and 0.71 (95% CI 0.30–1.7) among women. The age and gender adjusted relative risk was 1.3 (95% CI 0.79–2.1).

For each participant a calculation was made of the proportion of follow-ups that fulfilled the criteria for symptom cases. These proportions showed a bimodal distribution (Figure 1). The arithmetic mean of these individual proportions was 72% among female call centre operators versus 53% among referents (difference: 18%; 95% CI 2–33) and 49% among male operators versus 32% among referents (difference: 17%; 95% CI 3–31). If also the baseline questionnaire was included these proportions increased about 3% in all 4 groups.

A substantially lower proportion of male call centre operators than males referents remained symptom-free during baseline and all follow-ups, 11 versus 32% (Table 3). Additionally, a substantially higher proportion of female call centre operators than females referents were symptom cases during baseline and all follow-ups, 52 versus 29%.

TABLE 1. Response Rates in the Call Centre (CC) and Reference Groups (Ref) at Baseline and 10 Monthly Follow-Up Questionnaires and Medical Examination of Incident Cases. Differences in Response Rate Between Call Centre and Referents With 95% Confidence Intervals (95% CI)

Parameter	Women			Men		
	CC	Ref	Difference [95% CI]	CC	Ref	Difference [95% CI]
Invited (number of participants)	35	860	—	35	599	—
Responded (number of participants)	29	756	—	28	470	—
Baseline response rate (%)	83	88	-5 [-18-8]	80	79	2 [-12-15]
Maximal possible number of follow-ups	290	7,560	—	280	4,700	—
Number of received follow-ups	197	6,635	—	199	4,047	—
Follow-up response rate (%)	68	88	-20 [-25-(-14)]	71	86	-15 [-20-(-10)]
Number of incident cases	5	315	—	13	199	—
Number of medically examined	5	239	—	9	150	—
Examination rate (%)	100	76	24 [19-29]	69	75	-6 [-32-20]

TABLE 2. Characteristics of the Call Centre (CC) and Reference Groups (Ref). Differences Between Call Centre and Referents With 95% Confidence Intervals (95% CI)

Characteristics	Women			Men		
	CC n = 29	Ref n = 756	Difference [95% CI]	CC n = 28	Ref n = 470	Difference [95% CI]
Mean age, in years, of responders (range)	28 (20-52)	45 (20-65)	-17 [-21-(-13)]	29 (20-53)	43 (19-65)	-14 [-18-(-10)]
College or higher education (%)	7	41	-34 [-44-(-24)]	14	58	-44 [-57-(-30)]
Seniority, in months, in present profession (range)	27 (3-192)	165 (2-495)	-138 [-183-(-93)]	14 (2-61)	121 (1-576)	-107 [-148-(-66)]
Experience, in months, of computer work	48 (12-120)	132 (12-336)	-84 [-120-(-48)]	60 (12-192)	144 (12-408)	-84 [-108-(-60)]

TABLE 3. Number (No.) and Frequency (%) of Reports of Symptoms (Ache, Pain, or Numbness) in the Neck, Back, or Upper Extremities Lasting Minimum 3 Days During the Last 31 days (Case) in the Call Centre (CC) and Reference Groups (Ref)

Frequency of Symptoms	Women						Men					
	CC n = 29			Ref n = 756			CC n = 28			Ref n = 470		
	No.	%	Difference [95% CI]	No.	%	Difference [95% CI]	No.	%	Difference [95% CI]	No.	%	Difference [95% CI]
Never	4	14	-1 [-14-12]	112	15		3	11	-21 [-33-(-9)]	148	32	
Only at baseline	5	17	2 [-12-16]	113	15		7	25	11 [-5-28]	63	13	
Incident case	5	17	-24 [-39-(-10)]	315	42		13	46	5 [-15-23]	199	42	
Always	15	52	23 [5-42]	216	29		5	18	5 [-9-20]	60	13	

Notes. Participants were grouped into those who were cases; neither at baseline nor any follow-up (never); only at baseline (baseline); both at baseline and all follow-ups (always); or after being a noncase at least at baseline or any period during follow-up (incident case). Differences in frequencies between Call Centre and Reference Groups with 95% confidence intervals (95% CI).

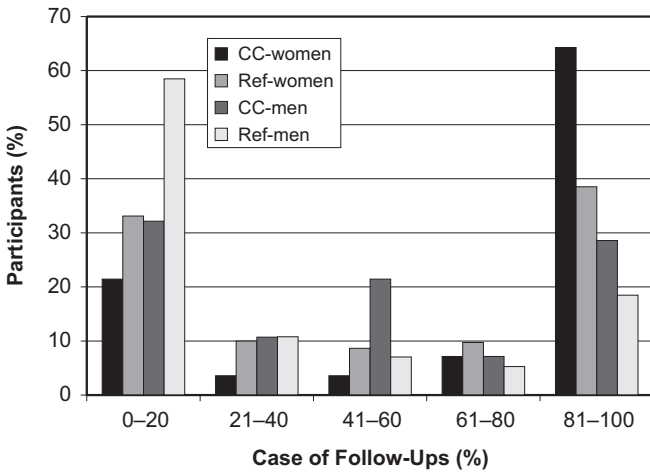


Figure 1. Individual proportions (% on x axis) of case-status in the 10 (maximum) follow-up questionnaires. Distribution of proportions among call centre (CC) and reference (Ref) groups. Notes. Case—ache or pain in the neck, back, or upper extremities, or numbness in the hands lasting minimum 3 days during the last 31 days. Men (in CC, $n = 28$; in Ref, $n = 455$) and women (in CC, $n = 29$; in Ref, $n = 740$) separated.

Fourteen out of the 18 incident cases (78%) at the call centre were medically examined and 389 out of 514 in the reference group (76%, Table 1). The major reasons for no examination were that the participants did not reply to the call for examination or they declared a lack of time.

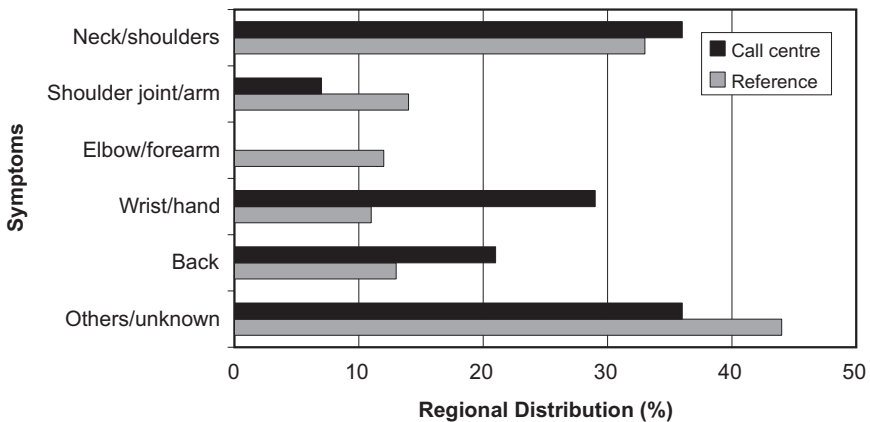


Figure 2. Regional distribution of clinical findings at medical examination of 14 incident symptom cases at the call centre and 389 cases in the reference group of professional computer workers in other occupations. Notes. More than one clinical finding on some participants.

Pathological findings were made in the neck-shoulder region in 5 operators; the shoulder joint in 1 operator, wrists and hands in 4, and in the back in 3 operators (Figure 2). Affected structures or tissues were considered to be muscles (mainly tenderness) in 4 operators, nerves in 4, joint in 1, and miscellaneous or unclear in 5 operators (Figure 3). Three operators were classified as cases of neck-shoulder pain syndromes and another 3 as cases of nerve compression. The results from the reference group were similar but with a somewhat lower frequency of nerve related findings and a higher frequency of tendon related findings and diagnoses.

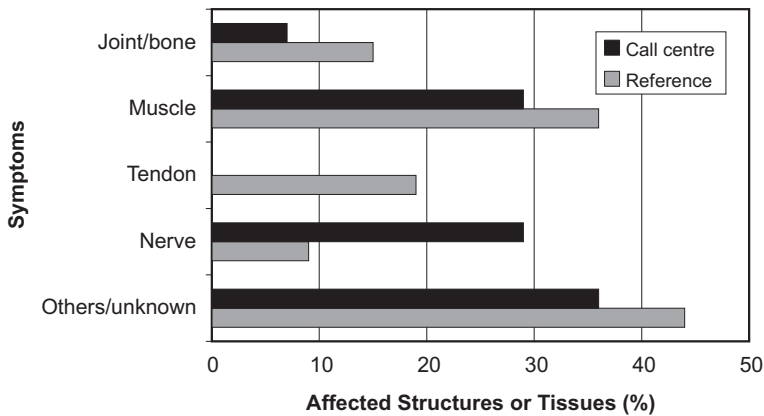


Figure 3. Affected structures or tissues as judged from medical examination of 14 incident symptom cases at the call centre and 389 cases in the reference group of professional computer workers in other occupations. *Notes.* More than one structure on some participants.

6. DISCUSSION

This study demonstrated a high prevalence of symptoms from the upper body regions among call centre operators. The prevalence was substantially higher than among other professional computer users in the study. In fact, the call centre operators was one the occupational groups with most symptoms among all the 15 different occupations (Karlqvist, Wigaeus Tornqvist, Hagberg, Hagman, & Toomingas, 2002).

Symptoms were long-lasting or relapsing. On the average, female call centre operators experienced symptoms, lasting 3 days or more, during 3 months out of 4 during the study period, and male operators during 2 months out of 4. Similar high symptom load have been reported from other studies of call centre staff (Ferreira & Saldiva, 2002; Hoekstra, et al., 1995).

The incidence of new symptom cases was about 1 case/person-year. The incidence was substantially higher among call centre operators than referents, but only among men (1.7 case/person-year), however. The female operators had a somewhat lower incidence (0.93 case/person-year). This is contradictory to the much higher prevalence values among female operators. One explanation of this could be that fact that more than 50% of the female operators had symptoms every month and therefore never fulfilled the criteria for a new incident case. The remaining female operators probably represented a “healthy worker” selection resulting in a low incidence. Due to the low number of cases these data are imprecise, however. No other studies about incidence of symptom-data from call centres have been found. Ferreira and co-workers reported an incidence of 0.26 case/person-year of medically confirmed upper extremity musculoskeletal disorders leading to sick leave (recalculated from Ferreira, Conceicao & Saldiva, 1997).

The call centre operators were mostly under 30 years of age compared to the middle-aged reference group. They had been working at call centres for only 1–2 years, which was about one tenth of the corresponding seniority among those in the reference group. There are several plausible explanations why these young and novice professional computer workers would be in such a bad health condition. The working conditions, both the psychosocial and the workstation design, were worse at the call centre than in the reference group (Norman et al., 2001). This was most prominent concerning the workstation design and the level of influence at work. The work tasks at the call centre were less varied than among the referents and the call centre operators also worked longer at the computer workstation without taking rests. These are well known risk factors for, for example, neck-shoulder disorders among computer users (Karlqvist et al., 2002; Punnet & Bergqvist, 1997). Ferreira and co-workers found time pressure and rest-work schedule at a call centre to be independent predictors of medically confirmed upper extremity musculoskeletal disorders with time away from work (Ferreira et al., 1997). Unfavourable working conditions and their associations with health problems have been reported also from other call centre studies (DiTecco, Cwitco, Arsenault, & André, 1992; Smith et al., 1992; Westin, 1992).

The location of the findings at medical examination of the call centre operators confirmed the picture of the distribution the symptoms: the domination of the neck and shoulder regions. Commonly affected tissue was muscles, with findings of tenderness. This was also reflected in the diagnosis of the neck-shoulder pain syndrome. Nerve-related findings and diagnoses were also noted in the call centre group. However, as usually seen in clinical set-

tings, it was often not possible to judge what structure or tissue was affected or to conclude the case with a precise diagnosis. Due to the limited number of examined participants in the call centre group, comparisons with the reference group are therefore nonconclusive. Similar medical findings and diagnoses are reported from other studies of professional computer users (Bergqvist, Wolgast, Nilsson, & Voss, 1995a, 1995b; Pascarella & Kella, 1993). Hales and co-workers, however, found more tendon and nerve related disorders and mainly in the hand-wrist region among telecommunication workers, whereof some had call centre duties (Hales et al., 1994).

As found in many other studies, the women both at the call centre and in the reference group reported more symptoms than the men (Punnett & Bergqvist 1997). One common explanation for this frequently found higher symptom load among women is that women, even if they have the same the job-titles as men, tend to have monotonous and repetitive content of their work. Another explanation is that women tend to have more physically and psychosocially taxing working conditions. In our study of call centre operators both men and women performed the same tasks with the same time-frame, with the same ergonomical, physical, and psychosocial conditions and had the same reward system. The reason for this female symptom load should thus be found somewhere else, for example, in individual factors, working technique, coping strategies, factors outside work.

This study has reported results from one Swedish call centre. As our results, like some other studies, indicate unfavourable health conditions among young people in a rapidly growing sector, further studies should be done on working conditions and health at call centres.

7. LIMITATIONS

Operators at the call centre were selected by the supervisor among those who were supposed to remain during the follow-up period. This could have introduced a selection bias at the call centre as probably those more well-motivated and healthy were included. Participants in the reference group were included department-wise and therefore not individually selected. This could have attenuated the differences in prevalences or incidences between the call centre and reference groups.

All the cases at the call centre were examined by the one of the doctors in the team (TN). Cases from the other companies were examined by seven other doctors. This could have introduced bias in the examination and diag-

nostic process, which can explain some of the differences in findings and diagnoses.

This study was not designed to be a study of work and health at call centres specifically. The call centre group was only one of 15 other professional computer users of interest in this study. The low number of participants in the call centre group limits the precision and the power to study differences between the call centre and the reference group. Anyhow, substantial and statistically significant differences were noted. These could be occasional, however, and specific to the call centre in this study. The results in this study should therefore be confirmed by other studies.

8. CONCLUSIONS

Operators at this call centre were more symptom-loaded than other professional computer users in spite of their younger age and shorter exposure to computer work. Symptoms were long lasting or recurrent. Clinical findings among incident cases indicated lesions mainly affecting muscles or peripheral nerves. More extensive studies should be done on the working conditions and health status among call centre workers.

REFERENCES

- Aronsson, G., Dallner, M., & Åborg, C. (1994). Winners and losers from computerization: A study of the psychosocial work conditions and health of Swedish state employees. *International Journal of Human-Computer Interaction*, 6(1), 17–35.
- Austin Knight & Calcom Group. (1997). *Call centre practice not theory. The first national survey of call centre management & staff attitudes*. London, UK: Austin Knight UK.
- Bagnara, S., Gabrielli, F., & Marti, P. (2000). *Human work in the call centres*. In *Proceedings of the IEA 2000/HFES 2000 Congress. July 29–August 4, 2000, San Diego, California USA* (Vol. 1, pp. 553–556). Santa Monica, CA, USA: Human Factors and Ergonomic Society.
- Bain, P., & Taylor, P. (1999). *Call centres in Scotland—An overview* (Payline Briefing No. 5). Glasgow, UK: Scottish Low Pay Unit.
- Bergqvist, U., Wolgast, E., Nilsson, B., & Voss, M. (1995a). The influence of VDT work on musculoskeletal disorders. *Ergonomics*, 38, 754–762.
- Bergqvist, U., Wolgast, E., Nilsson, B., & Voss, M. (1995b). Musculoskeletal disorders among visual display terminal workers: individual, ergonomic, and work organizational factors. *Ergonomics*, 38, 763–776.
- DiTecco, D., Cwitco, G., Arsenault, A., & André, M. (1992). Operator stress and monitoring practices. *Applied Ergonomics*, 23, 29–34.

- Ferreira, M., Conceicao, G.M., & Saldiva, P.H. (1997). Work organization is significantly associated with upper extremities musculoskeletal disorders among employees engaged in interactive computer-telephone tasks of an international bank subsidiary in Sao Paulo, Brazil. *American Journal of Industrial Medicine*, *31*, 468–473.
- Ferreira, M.J., & Saldiva, P.H.N. (2002). Computer-telephone interactive tasks: predictors of musculoskeletal disorders according to work analysis and workers' perception. *Applied Ergonomics*, *33*, 147–153.
- Hales, T.R., Sauter, S.L., Peterson, M.R., Fine, L.J., Putz-Anderson, V., Schleifer, L.R., et al. (1994). Musculoskeletal disorders among visual display terminal users in a telecommunications company. *Ergonomics*, *37*, 1603–1621.
- Hoekstra, E., Hurell, J., & Swanson, N. (1995). Evaluation of work-related musculoskeletal disorders and job stress among teleservice center representatives. *Applied Occupational and Environmental Hygiene*, *10*, 812–817.
- Invest in Sweden Agency. (2002, September). *Invest in Sweden. Contact centers*. Retrieved August 5, 2003, from <http://www.isa.se>
- Karlqvist, L., Wigaeus Tornqvist, E., Hagberg, M., Hagman, M., & Toomingas, A. (2002). Self-reported working conditions of VDU operators and associations with musculoskeletal symptoms: A cross-sectional study focussing on gender differences. *International Journal of Industrial Ergonomics*, *30*, 277–294.
- National Institute for Working Life, Department for Work and Health. (1997). Questions about computer work and computer input devices. Retrieved August 5, 2003, from http://www.arbetslivsinstitutet.se/datorarbete/pdf/Questionnaire_970814.pdf
- Norman, K., Toomingas, A., Nilsson, T., Hagberg, M., & Wigaeus Tornqvist, E. (2001). Working conditions and health among female and male employees at a callcenter in Sweden. In *Fourth International Scientific Conference on Prevention of Work-Related Musculoskeletal Disorders* (p. 192). Amsterdam, The Netherlands: Coronel Instituut, University of Amsterdam.
- Pascarelli, E.F., & Kella, J.J. (1993). Soft-tissue injuries related to use of the computer keyboard. *Journal of Occupational Medicine*, *35*, 522–532.
- Punnet, L., & Bergqvist, U. (1997). *Visual display unit work and upper extremity musculoskeletal disorders. A review of epidemiological findings*. Stockholm, Sweden: National Institute for Working Life.
- Rothman, K., & Greenland, S. (1998). *Modern epidemiology*. Philadelphia, PA, USA: Lippincot-Raven.
- SAS/STAT user's guide, version 8. (1999). Cary, NC, USA: SAS Institute.
- Smith, M., Carayon, P., Sanders, K.J., Lim, S.-Y., & LeGrande, D. (1992). Employee stress and health complaints in jobs with and without electronic performance monitoring. *Applied Ergonomics*, *23*, 17–27.
- Taylor, P., Baldry, C., Ellis, V., & Bain, P. (2002). A unique working environment: health, sickness and absence management in UK call centres. In *British Universities Industrial Relations Association 52nd Annual Conference at University of Stirling, Scotland* (pp. 1–22). Stirling, UK: University of Stirling.
- Westin, A.F. (1992). Two key factors that belong in a macroergonomic analysis of electronic monitoring: employee perceptions of fairness and the climate of organizational trust or distrust. *Applied Ergonomics*, *23*, 35–42.