# Workstation layout and work postures at call centres in Sweden in relation to national law, EU-directives and ISO-standards, and to operators' comfort and symptoms

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## ARTICLE INFO

## ABSTRACT

A survey of workstation layout and work postures among 156 computer operators was performed in 16 call centers (CCs) in Sweden, relating data to operators' comfort, symptoms and existing ISO-standards, EU-directives and National Work Environment Law.

The quality of the furniture and equipments was generally good and mainly fulfilled the demands of the law, directives and standards. The main problem was how these were used—how they were positioned and adjusted to fit the individual operator and to allow good and flexible work postures. Awkward postures were, therefore, seen in shoulder joints and wrists. Lack of easy height adjustability of many desks was noted. This was associated with more seated postures and back pain. Desk and chair quality were associated with operators' satisfaction and work postures and thick keyboards with dissatisfaction and neck or back pain. Optimal adjustments were associated with operators' satisfaction and good work postures and in some aspects also with fewer symptoms. The conditions were more optimal at internal CCs as opposed to freestanding external (outsourced) enterprises.

**Relevance to industry**

CCs are one of the fastest expanding business sectors. Besides, investments in more flexible desks, optimizing basic adjustments would improve conditions substantially in many cases. There is thus a potential for improvements in the conditions for CC work with possibilities for gain in comfort, health and productivity.

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## 1. Introduction

More than 1% of the European working population is estimated to work in call centres (CCs) (Datamonitor, 1998). Total agent positions in Europe, Middle-East and Africa were expected to grow from 1.5 million at the end of 2003 to 2.1 million by 2008 (Datamonitor, 2004). CCs handle telephone calls, both inbound, e.g. customer support, and outbound, e.g. sales or market survey. Multimedia communication for this handling (fax, e-mail, SMS and web chat) is rapidly growing within the business. The character and content complexity of the services vary from simple, such as information desk (e.g. phone directory) and booking services, to complex, such as computer support, economical and medical advice.

The number of reports about adverse working conditions in CCs has increased rapidly since the middle of the 1990s. Aspects of both the organization of work, psychosocial issues, ergonomics and other environmental issues have been focused on (Bain et al., 2002; Dieckhoff et al., 2001; Ferreira and Saldiva, 2002; Hoekstra et al., 1995; Norman et al., 2004; Sprigg et al., 2003). Physical working conditions have recently been reported indicating that the conditions quite often are out of range of current directives and recommendations for sound working environment (Gavhed and Toomingas, 2007).

Awkward work postures and factors in the computer work environment may cause or aggravate musculoskeletal disorders (Hildebrandt et al., 2002; Karlqvist et al., 2002; Norman, 2005; Punnett and Bergqvist, 1997). Office furniture and equipment of high quality are thus important, but also how they are positioned and adjusted.

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Few studies on qualities of office furniture and information and communication technology (ICT) at CCs have been published in the peer-reviewed scientific literature. Existing studies have been restricted regarding the selection of CCs. This scarcity of studies in the international literature also applies to the situation in Sweden. One complication is that neither does a national register exist nor any other comprehensive source of information about CC enterprises or CC employees in Sweden. Thus, there is no possibility to obtain a statistically representative sample of CCs or their employees. One way to increase the external validity of studies of CCs is to make a strategic sample such that companies are selected to cover a wide range of the potentially important organizational models and exposure conditions. One important organizational aspect is whether the CC is an external independent company offering its service to other organizations (EXCC) or internal within an organization handling its customer service matters (INCC) (Batt et al., 2005). INCC have been found to have somewhat better physical working conditions (Gavhed and Toomingas, 2007).

A study of health and working conditions at customer service work in strategic sample of Swedish CCs was, therefore, initiated and performed. The study was part of a cross-sectional project where many aspects of work and health among 1183 CC workers were studied (Norman, 2005). The present study adds to earlier reports about physical and other working conditions and musculoskeletal disorders at these CCs (Gavhed and Toomingas, 2007; Norman et al., 2008; Toomingas and Hansson Risberg, 2007).

## 2. Aim

The aim of this study was to describe the workstation layout and work postures at a strategic sample of Swedish INCCs and EXCCs, and relate them to existing national law, EU-directives and ISO-standards, and to operator's comfort and symptoms.

## 3. Methods

### 3.1. Sample of CCs, the study group and workstations

Sixteen enterprises, six INCC and 10 EXCC, participated in this study. Among those on duty on the study days, ten operators and their workstations at each of the 16 companies were randomly selected and invited to participate in the study whereof 156 participated: 109 women and 47 men (mean age 34.3 yr, sd. 10.8, range 18–62 yr; median seniority at the CC 1.5 yr, range 0.2–25.8 yr). All workstations except four were located in open-plan offices, the largest number in one room being 225. Workstations were frequently shared between operators in different work shifts. For more details about the CCs, the working tasks and the selection process—see Gavhed and Toomingas (2007).

The study was approved by the Ethics Committee at the Karolinska Institutet.

### 3.2. Questionnaire

A questionnaire was distributed to all operators at the observed workstations prior to the day of observations (Toomingas, 2008a). Only data relevant to this study are reported here (question no.38). The operators were asked to rate their opinion during the past month about their workspace and posture, chair, desk, VDU, keyboard and pointing devices including their placement, using a five-point scale with the alternatives: *very satisfied, rather satisfied, neither dissatisfied nor satisfied, rather dissatisfied* and *very dissatisfied*.

### 3.3. Observations and measurements

Following a checklist that had been tested for interrater reliability, trained ergonomists made observations and measurements of the workstations (Table 2, 3) and the operators' work postures (Table 5) during a regular workday when they performed typical tasks (Norman et al., 2006; Toomingas, 2008b). Observations were made only during customer calls. The checklist included measurements of the office furniture, properties and positioning of the ICT-equipment. Postures of the upper body were observed and categorized according to previous studies (Lindegård et al., 2005). Postures were measured as shown in Fig. 1. The viewing angle between a horizontal line and the line from the eye to the upper and lower edge of the display, were estimated using a manual goniometer with a laser beam. The observations took about 15 minutes/workstation.

During the workday (about 8 h) a portable data-logger (Posimeter, Biolin AB, Mölndal, Sweden) recorded seated standing/walking postures, defined as the thigh angle against vertical. The aggregated total duration of the positions above (seated) and below (standing/walking) 45°, respectively, was registered (threshold 3 s; sampling frequency = 3 Hz).

The observed qualities of the workstations were compared with relevant parts of the Swedish Work Environment Law (SWEA, 1998) and the Directives of the European—90/270/EEC (EU, 1990) and also to recommendations given in international standards—EN 527-1:2000 (CEN, 2000), EN 527-1:2000/AC:2002 (CEN, 2002) and ISO 9241.4 and 5 (ISO, 1998, 1999).

### 3.4. Medical interview

A physician asked the operators by using standardized questions, if they had experienced pain or other symptoms at least once a week during the last month in the following five regions of the body: (1) head; (2) neck/scapulae; (3) shoulder joints/upper arms; (4) elbows/forearms, wrists or hands/fingers and (5) back (thoracic or lumbar).

### 3.5. Data treatment

A quality index (0–8) was constructed for chairs by adding points assigned when: (a) the chair had a swivel function; (b) backrest supported both lower and upper back; (c) backrest allowed shoulder extension; (d) backrest inclination and (e) height could be adjusted; (f) height and (g) width of armrest could be adjusted; and (h) seat height was adjusted by gas-lift. A similar index (0–7) was constructed for work desks assigning points when: (a) height was adjusted by pneumatic or electric control; (b) the desk surface was even or had a separate surface for the display; (c) the front edge was concave; (d) the space for the operator's legs was adequate and free; (e) the surface for documents was adequate; (f) there was space to rest at least half of the forearms on the desk surface at keyboard work and (g) at work with the pointing device. Seat, armrest or desk height was measured and those that deviated $\geqslant \pm 5$ cm from the optimal, as judged by the ergonomist, were considered as adjusted too high or low.

A posture index was constructed describing how close to optimal (neutral) the posture in each observed joint was during work. The components A–C were summated as $100 \times (A+B+C)/$ maximum, where the maximum was the sum of optimal postures (Table 1). The index for each joint was used in the analysis of association with ratings of satisfaction and with symptoms.

Ratings of satisfaction were categorized into: Satisfied = *very* or *rather satisfied*; Neutral = *neither dissatisfied nor satisfied*, Dissatisfied = *rather* or *very dissatisfied*.