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Winners and Losers From Computerization: A Study of the Psychosocial Work Conditions and Health of Swedish State Employees

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This study was comprised of 1,738 state-employed visual-display terminal (VDT) users whose work environment and health were examined through questionnaires. The aim of the study was to analyze the relationship between work organization and mental/somatic symptoms. The results showed that work conditions vary considerably, both between groups of users and between men and women. Data-entry tasks and a combination of data-entry and data-acquisition tasks were more common among women. The data-entry group reported a greater number of somatic and psychological problems and contained the greatest percentage of people spending more than 6 hours per day at a terminal. There appeared to be a critical limit of 5 to 6 hours per day beyond which the incidence of symptoms rose sharply. Recommendations for preventive measures are presented.

1. INTRODUCTION

Computer technology is now transforming working life at an ever-increasing rate. It is no longer a matter of importance only for personnel in computer departments...
and for computer specialists but affects everyone within a company. The consequences vary between occupational groups (Åronsson, Tönnes, & Petterson, 1989; Roskies, Liker, & Roitman, 1988). For some, computer techniques and visual-display terminals (VDTs) have become powerful tools that people can develop themselves, and with whose assistance complex tasks can be mastered more satisfactorily than before. For others, computer technology and VDT work have become control factors that reduce their own job control and the variation in their work (Berlinguet & Berthelette, 1990; Stellman, Klitzman, Gordon, & Snow, 1987). This study examines the consequences of computerization for different types of VDT users and tries to identify the winners and losers in psychosocial terms.

Psychosocial aspects of VDT work and their health effects have been the subject of study by work environment researchers (World Health Organization [WHO], 1989). A general conclusion is that a stress research paradigm may be a useful tool for studying many critical aspects of VDT use (Frese, 1987). A transactional stress model presumes stress reactions to be the consequence of an imbalance between job demands and the opportunities for individuals to control and cope with these demands (Appley & Trumbull, 1986; Karasek & Theorell, 1990). On a general level, job demands are usually treated in terms of quantitative and qualitative overload or underload and task pacing. Control is a multifaceted concept (Åronsson, 1989a); despite different operationalizations in different studies, it is a good predictor of stress reactions and stress-related diseases (Karasek & Theorell, 1990; Sauter, Hurrell, & Cooper, 1989).

A further concept related to this model is social support, which has been shown to modulate stress reactions and ill health (Johnson & Hall, 1988). The introduction of VDTs may change the nature of social support and the frequency with which it is offered by changing the pattern and content of communication (Åronsson, 1989b).

In addition to this general stress perspective, two specific aspects of VDT work should be mentioned. First, stress reactions have been shown to be related to computer breakdowns, interruptions, and slow response times. The consequences are greatest when the individual is working under time pressure, is involved in so-called "double dialogue," is highly motivated, lacks alternative job tasks, and has no information on the duration of the disruption (Boucsein, 1988; Johansson & Aronsson, 1984). Second, there is the question of shift length (and breaks), which has become a major issue in the debate on VDT use and health. Placing limits on shift length has been seen as a strategy for preventing the negative short-term consequences of VDT work as well as being relevant to long-term outcomes (WHO, 1989). Because VDTs are used in so many ways and under very different circumstances, it has been difficult to formulate satisfactory guidelines.

In this study, we employed a classification of VDT work that had been developed by the American Academy of Science (National Research Council, 1983). The classification takes into account a series of social and psychosocial aspects of the work (such as pace of work and control over it, decision making, degree of
standardization of tasks, etc.) that can be related to the stress model sketched previously. Five different kinds of VDT work are differentiated:

1. **Data entry (DE).** Information is typed in, often in standard format. The information may or may not have contextual significance. The pace of work is often fast and there are few interruptions. Workers have a low level of control over their own work, and there are few decision-making opportunities. Attention is primarily directed at the manuscript rather than the screen.

2. **Data acquisition (DA).** Data are displayed on the screen, which means that attention is principally directed at the screen itself. The rate of data entry is moderate, with interruptions. Levels of control over the pace of work and opportunities for decision making vary.

3. **Interactive communication (DE + DA).** This involves both data entry and data acquisition. The data may be more complicated than those involved in data-entry jobs. To some degree, an operator sustains a dialogue with the computer and has some opportunity for decision making and control over the pace of work. The rate of data entry is moderate, with interruptions. Attention is often directed at the screen and delays in response times occur. Examples include insurance companies and travel agencies.

4. **Word processing (WP).** Text entry, text recall, searching text for errors, keying in corrections, and organizing formats are involved. Some of the task elements are document-intensive, some are screen-intensive, and WP jobs usually involve different combinations of these elements at different times. There is a wide variation among these jobs as to the degree of control an operator may have over the structure and pace of work.

5. **Programming (PROG) and Computer-aided design (CAD).** Time spent at the VDT varies. The rate of data entry is low and intermittent, and attention is directed at both the screen and the manuscript. There are many interruptions and, in general, there is a high level of control over the pace of work and good opportunities for decision making.

Use of this classification should therefore enable VDT users to be divided into groups with different job contents, and one aim of this study is simply to describe the pattern that emerges. The central questions that then arise are:

1. With respect to psychologically and socially relevant work characteristics (job demands, control, social factors, etc.), are there differences between the various user groups?
2. How are health complaints related to time spent daily on VDT work and to types of VDT activities?
3. Are there differences between the work situations of men and women, and is there a relationship between gender on the one hand and health complaints, sickness, and absenteeism on the other?
2. METHOD

2.1 Design of the Study

The investigated group consisted of all those people who, over a 2-year period, responded to a questionnaire on VDT work issued by the Swedish Foundation for Occupational Health and Safety for State Employees (Statshälso) and to the foundation's standard questionnaire. The foundation is the organizer of occupational health services for public employees in Sweden. Data collection was conducted through the foundation's local occupational health care centers. The subjects were neither randomly nor systematically selected; instead, the material consists of all the complete sets of questionnaires received during the period of August 1985 to August 1987. The samples of workplaces and participants were therefore not controlled by the researchers.

The data collection procedure was such that all the participants in the study first filled in the questionnaire on their own and then brought it to a private meeting with a nurse or health adviser at one of the centers. At this meeting, any uncertainties relating to the questionnaire were talked over and cleared up.

In total, 1,738 people filled out a complete standard questionnaire plus the questionnaire on VDT work (see later). The material comes from 37 centers and covers 52 administrative departments and authorities. The participants themselves had to specify their own type of VDT work in accordance with the categories presented in the introduction. A question on occupation was also included using a Nordic system for occupational classification. Every VDT user group contains a large number of different occupations (36-75). For this reason, no account of occupations is given here, but a detailed description can be found in Aronsson, Åborg, & Örelius (1988).

The study was principally designed to make comparisons between different types of VDT users, whereas time spent at the terminal was a second, recurring sort variable. Comparisons were also made between men and women, but these were limited to two user groups: those involved in programming, system tasks, and computer-aided design, and those involved in the combination of data entry and data acquisition. In these two groups, the proportion of men was sufficient for analyses to be conducted, and the patterns of time spent by the genders were relatively similar.

2.2 Measuring Instruments

A number of standardized, well-tested psychosocial questionnaires, developed by the Clinic for Occupational Medicine in Örebro, were used as measuring instruments. The questionnaires were tested for reliability and validity, have been used for many years by the Swedish Foundation for Occupational Health and Safety for State Employees, and were documented in an extensive body of reference material (Bodin, 1987; Ydreborg & Kraftling, 1987). In the case of psychological complaints and stomach disorders, composite measures (index), developed by the Foundation
Winners and Losers From Computerization

for Occupational Medicine in Örebro, were employed (Andersson, 1986). In addition, a specially designed questionnaire was used for employees doing VDT work. Job demands, job control, social support, and health complaints were measured using the following variables and indices:

**Job Demands**

- Type of computer work.
- Time spent at VDT.
- Work load.
- Degree of difficulty.
- Demands on attention and concentration.
- Stimulation and variation of the tasks.
- Computer breakdown, system overload, and alternative tasks.

**Job Control**

- Influence on working conditions.
- Computers as assistance or as means of control.
- Sufficient information about computerization.

**Social Support**

- Relations with colleagues.
- Relations with management.
- Cooperation with others.
- Job recognition.
- Opportunity for obtaining assistance with computer tasks.

**Health Complaints**

All the health complaints questions concerned the previous 12-month period, and an affirmative reply by the subject to any one (or several) of the questions in an index was counted as a "yes" response.

The *psychological complaints* index was based on the following five items:

1. Often lacking in concentration.
2. Often restless or tense.
3. Often irritated or impatient.
4. Often anxious, uneasy, or nervous.
5. Often depressed, dejected, or sad.

The *stomach disorders* index incorporated the following three complaints:

1. Troubled by an upset stomach.
2. Frequent pain in the pit of the stomach or heartburn.
3. Troubled on occasion by stomach pains.

In addition to the earlier indices, *headaches* were measured by a single question.
2.3 Statistical Analysis

The statistical tests used were chi-square and analysis of variance (ANOVA). Significance values are provided in the Results section. Because the study participants were not randomly selected, tests of significance were not totally appropriate. The significance values should thus be regarded only as normative measures used to decide if a difference should be considered or not.

3. RESULTS

In line with the previously presented perspective, results were reported under the headings of job demands, job control, and social support. These were classified by type of VDT work and the number of hours devoted to it per day.

3.1 Personal Characteristics

Table 1 provides an overview of the background data on the study group (N = 1,738). This is designed to facilitate interpretation of the results.

3.2 Job Demands

3.2.1 Time Spent at the VDT. Table 2 shows the groups of VDT users broken down into categories by time spent at the terminal per day and by gender. It emerged that it was only in the data-entry plus data-acquisition group and in the programming, system tasks, and computer-aided design group that the distributions of time spent by men and women were similar; in the former group they were very similar, whereas in the latter group women tended to devote somewhat more time to work at a VDT than did men.

<table>
<thead>
<tr>
<th></th>
<th>DE</th>
<th>DA</th>
<th>DE + DA</th>
<th>WP</th>
<th>PROG</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender F/M (%)</td>
<td>96/4</td>
<td>70/30</td>
<td>77/23</td>
<td>86/14</td>
<td>32/68</td>
<td>75/25</td>
</tr>
<tr>
<td>Age (M)</td>
<td>39</td>
<td>39</td>
<td>40</td>
<td>40</td>
<td>35</td>
<td>39</td>
</tr>
<tr>
<td>Part-Time Employment (%)</td>
<td>33</td>
<td>22</td>
<td>30</td>
<td>27</td>
<td>13</td>
<td>27</td>
</tr>
<tr>
<td>Years of Employment (M)</td>
<td>9</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Years With VDTs (M)</td>
<td>5.5</td>
<td>5</td>
<td>5</td>
<td>3.5</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Employed &gt; 7 Years (%)</td>
<td>31</td>
<td>29</td>
<td>12</td>
<td>11</td>
<td>36</td>
<td>27</td>
</tr>
<tr>
<td>Travel Time &gt; 45 min (%)</td>
<td>23</td>
<td>17</td>
<td>19</td>
<td>24</td>
<td>31</td>
<td>22</td>
</tr>
<tr>
<td>Children Younger Than 12 Years at Home (%)</td>
<td>35</td>
<td>34</td>
<td>35</td>
<td>26</td>
<td>42</td>
<td>34</td>
</tr>
</tbody>
</table>

Note. DE = data entry, DA = data acquisition, WP = word processing, and PROG = programming.
Table 2. Groups of VDT users, length of time spent at the VDT, and gender. Percentage distributions \((N = 1,684)\).

<table>
<thead>
<tr>
<th>Time Spent (Hours)</th>
<th>DE</th>
<th>DA</th>
<th>DE + DA</th>
<th>WP</th>
<th>PROG</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
</tr>
<tr>
<td>&lt;1</td>
<td>36</td>
<td>9</td>
<td>65</td>
<td>34</td>
<td>19</td>
<td>14</td>
</tr>
<tr>
<td>1-2</td>
<td>14</td>
<td>19</td>
<td>27</td>
<td>12</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>2-4</td>
<td>21</td>
<td>19</td>
<td>25</td>
<td>25</td>
<td>22</td>
<td>12</td>
</tr>
<tr>
<td>4-6</td>
<td>14</td>
<td>19</td>
<td>25</td>
<td>20</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>6-8</td>
<td>(n = 14)</td>
<td>(n = 132)</td>
<td>(n = 68)</td>
<td>(n = 157)</td>
<td>(n = 494)</td>
<td>(n = 1252)</td>
</tr>
</tbody>
</table>

Table 3. Percentages of different groups of VDT users working daily/continuously at the VDT \((N = 1,738)\).

<table>
<thead>
<tr>
<th>Worked Every Day at the VDT</th>
<th>Total</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE</td>
<td>82</td>
<td>64</td>
<td>83</td>
</tr>
<tr>
<td>DA</td>
<td>83</td>
<td>72</td>
<td>89</td>
</tr>
<tr>
<td>DE + DA</td>
<td>91</td>
<td>90</td>
<td>91</td>
</tr>
<tr>
<td>WP</td>
<td>73</td>
<td>68</td>
<td>73</td>
</tr>
<tr>
<td>PROG</td>
<td>90</td>
<td>87</td>
<td>94</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Worked Continuously at the VDT</th>
<th>Total</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE</td>
<td>72</td>
<td>29</td>
<td>74</td>
</tr>
<tr>
<td>DA</td>
<td>25</td>
<td>18</td>
<td>28</td>
</tr>
<tr>
<td>DE + DA</td>
<td>32</td>
<td>24</td>
<td>34</td>
</tr>
<tr>
<td>WP</td>
<td>52</td>
<td>33</td>
<td>55</td>
</tr>
<tr>
<td>PROG</td>
<td>25</td>
<td>21</td>
<td>33</td>
</tr>
</tbody>
</table>

**Note.** VDT = visual display terminal, DE = data entry, DA = data acquisition, WP = word processing, PROG = programming, M = male, and F = female.

The time spent at a VDT per day has been significantly regarded in terms of possible health complaints. Recommendations have been issued from a variety of sources that a maximum limit of 2 to 4 hours should be set for continuous work at a display screen. Table 3 shows that the vast majority of people within all groups worked at a VDT daily and that continuous periods of working were common.

With respect to time spent per day at the VDT, there were significant differences between the different groups of users (chi-square: \(p < .0001; df = 16\)). The data-entry group differed clearly from the others in that far greater proportions of its members fell into the categories of working "more than 4" and "more than 6" hours a day at the screen.

Table 3. Percentages of different groups of VDT users working daily/continuously at the VDT \((N = 1,738)\).

<table>
<thead>
<tr>
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</tr>
<tr>
<td>DA</td>
<td>83</td>
<td>72</td>
<td>89</td>
</tr>
<tr>
<td>DE + DA</td>
<td>91</td>
<td>90</td>
<td>91</td>
</tr>
<tr>
<td>WP</td>
<td>73</td>
<td>68</td>
<td>73</td>
</tr>
<tr>
<td>PROG</td>
<td>90</td>
<td>87</td>
<td>94</td>
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</table>

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<td>29</td>
<td>74</td>
</tr>
<tr>
<td>DA</td>
<td>25</td>
<td>18</td>
<td>28</td>
</tr>
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<td>DE + DA</td>
<td>32</td>
<td>24</td>
<td>34</td>
</tr>
<tr>
<td>WP</td>
<td>52</td>
<td>33</td>
<td>55</td>
</tr>
<tr>
<td>PROG</td>
<td>25</td>
<td>21</td>
<td>33</td>
</tr>
</tbody>
</table>

**Note.** DE = data entry, DA = data acquisition, WP = word processing, and PROG = programming.
3.2.2 Amount of Work and Degree of Difficulty. The proportion of people who considered that their amount of work was too great were largest among the data-acquisition group (41%) and the data-entry plus data-acquisition group (31%). For the other groups, the percentages ranged between 23 and 27.

A majority of members of all groups regarded the level of difficulty of their tasks as just about right (78–90%). Nevertheless, a fifth of the data-entry clerks considered their tasks to be too easy. Majorities within all groups (between 85 and 93%) stated that demands on attention and concentration were low in computer work.

3.2.3 Stimulation and Variation. Majorities within all user groups considered that they had tasks that, at least occasionally, were interesting and stimulating. There was, however, a considerable difference between those who were only occupied with data entry and the other groups. About a third of the data-entry clerks either seldom or never perceived their tasks to be interesting or stimulating. An even larger proportion (41%) considered that job tasks seldom or never provided sufficient variation. A large proportion of the data-entry workers (47%) thought that their tasks at the computer terminal were far too repetitive; a quarter of those involved with data acquisition thought the same, whereas great majorities in the other user groups considered that the variability in the work they carried out on a computer screen was just about right.

3.2.4 Computer Breakdowns, System Overload, and Alternative Tasks. People in occupations involving the use of a computer were periodically subjected to operational disturbances. The results of this study show that it was the data-acquisition group and the data-entry plus data-acquisition group that were most often exposed to interruptions, the length of which was unknown to the users. In these groups, 5 to 8% reported that this occurred daily, and 39% that it happened several times a week. These were the groups whose members had the greatest contact with customers, either on the telephone or through personal visits, while they were working at the screen (around 70%). Thus they were often involved in “double dialogue,” having one conversation with the screen/computer and another with the customer. Within other groups, between 20 and 30% were involved in “double dialogue” at work.

Members of these two groups reported that there were occasions of computer system overload, which led to long periods of waiting and prevented work from being conducted. About 20% reported that this occurred daily and 34 to 39% reported that it happened several times a week.

Those working with word processing were disrupted and inconvenienced the least by computer breakdowns and system overload. This is probably because they worked with personal computers and had alternative job tasks. Moreover, such personnel had both the skills and the equipment available to carry out their computer work “by hand” when breakdowns occurred. By contrast, as many as 60% of data-entry clerks lacked the skills or equipment needed to carry out their tasks.
without computer facilities. A large proportion of data-entry clerks (45%) did not have a task to perform when the computer broke down or was overloaded.

3.3 Job Control

3.3.1 Opportunities for Influencing Work Conditions. It was the group of data-entry clerks whose members least considered that they had an opportunity to affect their own work conditions—that is, to work at a pace that was just about right. Thirty-six percent of data-entry workers felt that they seldom or never could affect their work conditions, which compares with a figure of just 6% for programmers, system specialists, and designers (analysis of variance [ANOVA]: p < .0001, df = 4).

Similar relationships between the groups were demonstrated by responses to the question on whether workers had sufficient influence on decisions made concerning computerization (e.g., purchase of equipment or new computer programs) that affected their own job and work conditions. In total, 70% considered that they did not have enough influence in this respect. Among data-entry workers, the figure was 85% compared with only 35% for programmers, system specialists, and designers.

3.3.2 Computers as a Form of Assistance or as a Means of Control. To the question of whether they considered computer equipment to be an aid in carrying out their work or a means through which management exercised control, the great majority of both word-processing clerks and programmers, systems specialists, and designers responded that they saw it as a form of assistance (see Figure 1). So too did over half of those working with data acquisition and a combination of

![Figure 1. Percentages of VDT users who regard computer facilities as a form of assistance/means of control (N = 1,738). DE = data entry, DA = data acquisition, WP = word processing, and PROG = programming.](image)
data entry and data acquisition. Among those occupied only with data entry, however, a far smaller proportion regarded computer equipment as an aid. Over a fifth of the data-entry clerks usually regarded it as a way in which work was managed or controlled.

### 3.3.3 Information on the Consequences of Computerization

About 25% of VDT users from all groups taken together did not consider that they had received sufficient information on the consequences of computerization for their own work conditions. This view was more widely held among the groups occupied with data entry (35%) and data acquisition (32%) than it was among word-processing clerks (22%) and programmers, system specialists, and designers (7%).

On the other hand, most workers involved with data entry (73%) and data acquisition (61%) considered that they had not obtained sufficient information and training on the design and functioning of the computer system (meaning, in this context, the knowledge required to be able to make proposals or effect changes to the system). The corresponding value for programmers, system specialists, and designers was 15%, whereas for word-processing clerks it was 47%.

### 3.4 Social Support

#### 3.4.1 Contact with Colleagues and Management

The overwhelming majority within all the user groups considered that their relations with workmates, in terms of harmony and solidarity, were either quite or very good (between 93 and 97%). A large majority also considered that they had good relations with their immediate superior (between 86 and 91%). The largest proportion of those who considered that relations with job supervisors and workmates were poor was found among data-entry clerks (see Figure 2). In the material as a whole, there was a weak tendency (ANOVA: $p < .05, df = 4$) for people who had worked longest at a computer terminal to report poorer relations with their colleagues at work. With respect to relations with job supervisors and managers, there was no indication that time spent per day at the VDT was of significance for any of the groups.

#### 3.4.2 Job Recognition

From among all the respondents, over 40% considered that they seldom or never got to know whether or not they were doing a good job. This tendency was most accentuated among data-entry clerks and workers in the data-acquisition group, where over 50% seldom or never received feedback related to their job performance (52 and 55%, respectively).

#### 3.4.3 Opportunities for Obtaining Assistance With Computer Tasks

Data-entry clerks (58%) and data-acquisition workers (45%) were more inclined than word-processing clerks (33%) and programmers, system specialists, and designers (35%) to believe that they had opportunities for obtaining assistance with their job tasks (ANOVA: $p < .0001, df = 4$). The fact that the latter group had such limited opportunities might depend on the specialized nature of their tasks, which
only its members could accomplish. In the case of the other groups, the opportunities for getting help were largely dependent on how the work was organized.

3.5 **Changes and Reorganization as a Result of Computerization**

Responses to a general question on how computerization affected the work situation were most favorable among word-processing clerks. (Programmers, system specialists, and designers were not asked this question because their tasks presupposed the use of computers.) However, taking all groups together, attitudes toward the impact of computers were less favorable among those who devoted lengthy periods of time per day to work at a computer screen (see Figure 3).

3.5.1 **Reorganization as a Result of Computerization.** Around 20% of all respondents reported some form of reorganization resulting from computerization during the previous year. A third of these respondents experienced a deterioration in work conditions; somewhat fewer workers perceived them to have improved, whereas somewhat more (36%) did not notice any difference. Table 4 shows that it was among word-processing clerks that reorganization due to computerization had been most favorably received (58%). Among data-entry clerks, 40% considered that computerization represented a deterioration, but 23% considered that their situation had improved.

3.5.2 **Concern Over Future Reorganization and Change.** Regarding the question “Are you worried that your own work situation will change as a result of some form of reorganization or from wholly new ways of working?” there were great differences between the groups. This concern was most explicit among data-
entry clerks, 51% of whom were concerned about possible changes, as contrasted with 13% for programmers, system specialists, and designers. Among the other groups, around 30% expressed such concern.

### 3.6 Health Complaints

In this subsection, we compare different types of VDT users with respect to three symptoms that might be suspected of being related to psychosocial work conditions and self-reported absence because of sickness.

#### Table 4. Percentages of different groups of VDT users who referred to improvement and deterioration in work conditions in relation to organizational change due to computerization ($N = 336$).

<table>
<thead>
<tr>
<th></th>
<th>Improvement</th>
<th>No Difference</th>
<th>Deterioration</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE</td>
<td>23</td>
<td>38</td>
<td>40</td>
</tr>
<tr>
<td>DA</td>
<td>20</td>
<td>53</td>
<td>27</td>
</tr>
<tr>
<td>DE + DA</td>
<td>28</td>
<td>33</td>
<td>39</td>
</tr>
<tr>
<td>WP</td>
<td>58</td>
<td>23</td>
<td>19</td>
</tr>
<tr>
<td>PROG</td>
<td>30</td>
<td>45</td>
<td>25</td>
</tr>
</tbody>
</table>

*Note. DE = data entry, DA = data acquisition, WP = word processing, and PROG = programming.*
3.6.1 Psychosocial Complaints. In total, 38% of respondents gave an affirmative response to one or more of the questions that made up the psychologi-cal complaints index (see Figure 4). The greatest frequencies of complaints (45%) were found in the data-entry and data-acquisition groups (chi-square test: \( p < .005, df = 4 \)).

The group that performed a combination of data-entry and data-acquisition work and the group involved in programming, system tasks, and computer-aided design were sufficiently similar with respect to gender distribution and time spent at a terminal to permit comparisons to be made between men and women. In neither case was there any statistically significant difference between the genders (chi-square test) when the analysis was performed by job category.

3.6.2 Stomach Disorders. The data-entry group reported the highest frequency of stomach disorders, and there was a linear relationship between complexity of work and frequency of complaints. For all groups, there was a clear and, in some cases, major rise in the frequency of complaints among those who spent more than 6 hours per day at VDT work (see Figure 5). In none of these cases was the difference between men and women statistically significant.

3.6.3 Headaches. The headache variable was based on the question “Are you often troubled by headaches?” to which 26% of the total study group responded “yes.” This figure can be compared with the reference material of the Swedish Foundation for Occupational Health and Safety for State Employees for 1986 in which there were affirmative responses from 27% of the women and 13% of the men. There were clear differences between groups with different VDT tasks: The

![Figure 4](image-url)
Figure 5. Stomach disorders by user group and time spent per day at a VDT (N = 1,738). DE = data entry, DA = data acquisition, WP = word processing, and PROG = programming.

greatest proportion of headache sufferers was found among data-entry clerks (36%), and the lowest among programmers, systems specialists, and designers (18%).

With respect to headaches, there was also a discontinuity in the trend when time spent per day exceeded 6 hours. Up to this level, difficulties were encountered by 22 to 25% of subjects, but the figure rose to 41% in the group spending over 6 hours per day at a computer screen. This discontinuity emerged even more clearly when the type of VDT user and time spent per day at the VDT were combined. In the two categories of data entry and data acquisition with more than 6 hours per day spent at the VDT, around 50% of respondents complained of frequent headaches (see Figure 6).

A gender comparison was made by comparing those who spent more than 2 hours a day at a computer screen in the data-entry plus the data-acquisition group and in the programming, system tasks, and computer-aided design group. In the data-entry plus data-acquisition group, 11% of the men (n = 82) stated that they were often troubled by headaches compared with 29% of the women (n = 291); this was a statistically significant result (chi-square test: p < .0001, df = 1). In the programming, system tasks, and computer-aided design group the difference between men (n = 93) and women (n = 48) was smaller, with 15% of the men and 19% of the women reporting that they suffered from headaches; this was not a statistically significant difference.

3.6.4 Absence Because of Sickness. The absenteeism measure refers to absence of more than 4 week's duration due to sickness over the preceding 12-month period. This can be seen as a collective measure of different types of com-
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Figure 6. Relations between time spent per day at a VDT, user group, and headaches ($N = 1,738$). DE = data entry, DA = data acquisition, WP = word processing, and PROG = programming.

plaints and can thereby be regarded as an indicator of the total stress arising from both work and life environments. Figure 7 relates the absenteeism of the various computer user groups to time spent per day at the computer terminal. Around 40% of those who performed data-entry work for more than 6 hours per day at the VDT had been absent from work for more than a month during the previous year.

It emerged from the material as a whole ($N = 1,709$) that absence due to sickness among women was considerably higher than it was among men (17% of women were away for more than 4 weeks, compared with 7% of men). The difference was highly significant statistically (chi-square test: $p < .0001$, $df = 1$), but it largely resulted from the great preponderance of women in the user groups where absenteeism was high. When type of work was taken into account, the picture changed. The group of data-entry workers (the group where absenteeism was greatest) contained only 14 men. Among this group of men, absenteeism was at roughly the same high level as it was among the women (21% of the men were absent due to sickness for more than 4 weeks during the immediately preceding year compared with 25% of the women). For neither of the two user groups that were directly comparable—that is, the combination of the data-entry and data-acquisition group and the programming, system tasks, and computer-aided design group—was there a statistically significant difference with respect to absenteeism and gender.

4. DISCUSSION AND CONCLUSIONS

The most striking result obtained was that the consequences of computerization varied considerably between groups. This was in line with the findings of other
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Figure 7. Percentages of those absent due to sickness of more than 4 weeks' duration over the previous 12-month period, by categories of time spent per day at the VDT and user group (N = 1,738). DE = data entry, DA = data acquisition, WP = word processing, and PROG = programming.

studies (Aronsson et al., 1989; Stellman et al., 1987), but it emerged particularly stronger here. Clearly, there were winners and losers from computerization. In the first instance, the losers were to be found in the group performing repetitive, monotonous data-entry work and, to a certain extent, among the group involved with a combination of data entry and data acquisition (interactive communication). This was dramatically reflected in differences in absence due to sickness. Absenteeism was in general highest within the data-entry group and, more extremely, in the restricted group of data-entry clerks who spent more than 6 hours per day at a terminal; around 40% in the latter group had been absent for more than 1 month during the preceding 12-month period. There is reason to believe that this pattern of absenteeism was related to psychosocial work conditions. The data-entry group contained the highest percentage of people who perceived their work conditions to be problematical which could be regarded as crucial from the perspective of stress—that is, job control, work content, social support, and disruptions to work resulting from computer breakdowns. On one point the data-entry group deviated in a positive sense—that is, with respect to opportunities for obtaining assistance with VDT tasks when it was difficult to keep up with the work.

The study showed that the distribution of VDT work was very strongly gender related. Data entry was the most extreme example where 90% of the workers were women. Men were in a minority in all groups with the exception of the one requiring the greatest skills—that is, programming, system tasks, and computer-aided design. In previous studies of VDT work, women reported a greater number of health complaints than men. In this study where men and women with the same type of VDT work were compared, such gender-related differences emerged only
with respect to headaches. This indicated that there was a case for subjecting the differences between the genders detected in other studies to critical examination.

One result of this study was the greater incidence of symptoms of ill health and absenteeism among personnel who worked for 6 hours or more per day at a computer terminal. This tendency was strongest in the data-entry and data-acquisition work but also appeared with some exceptions in word processing and programming work. One question that has been discussed in Sweden, and that can also be posed just on the basis of the results of this study, is whether a time limit should be set on the amount of computer terminal work. In general, we should like to answer no, but with respect to data-entry work the picture is different. At many workplaces, where this type of work takes place, there are agreements at the local level that not more than a certain number of hours are to be worked per day, and that the worker has a right to take breaks during the course of the working day. Despite such agreements and other efforts made in this direction, it is clear that there are a large number of people who spend more or less their entire working day at a computer terminal—that is, between 6 and 8 hours per day. The increased level of symptoms of ill health supports arguments for recommending the setting of a limit of 5 hours a day for repetitive, monotonous work such as that associated with the entry or acquisition of data at a computer terminal. In the discussion on time limits, a counterargument has been made that such limits would encourage the creation of part-time posts, to be occupied mostly by women, which would be undesirable in other respects. Thus, a more aggressive version of the “time limitation strategy” is to combine the demand for time limits with an insistence on an absolute right to other types of work: for example, work that takes up 3 hours per day, in the case of full-time workers. In this way, it is also hoped that the slow progress made in working toward the redistribution of job tasks and changes in work organization might be accelerated. In this case, time limitation would form one part of an overall strategy designed to achieve a change of work organization.

In this study, the group of programmers and designers had the distinction of being the only group to obtain job satisfaction in terms of job demands, job control, and social support and to be, relatively speaking, in good health. People from these occupational categories are currently the beneficiaries of computerization. However, there is a long-term question mark even in relation to this group. Rissler (1988) studied both physiological parameters and the way of life of people in skilled computer occupations. She found this sector of working life to be characterized, among other things, by intensive job demands over prolonged planning and design periods, and by a scarcity of opportunities for employees to recuperate before becoming involved in the next project. The demanding nature of the work and the prevailing “overtime culture” become obstacles to the recognition of bodily warning signals and stress symptoms, and to the taking of appropriate corrective action.

One possible objection to these conclusions is that the results of the study might have been affected by conditions outside of work. Health and absence due to sickness are multifactorial phenomena, and the background for the observed differences may be found in life spheres other than working life. However, with respect to two external factors for which data were available (traveling time to and
from work and number of children under 12 years of age living at home), there were only small differences between different VDT users. It has not been possible to carry out any empirical tests for the influence of other external factors, and the possibility that they play a role in determining dissimilarities in health and absenteeism cannot be excluded.

REFERENCES


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