

Classification of municipal occupations

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ILMARINEN J, SUURNÄKKI T, NYGÅRD C-H, LANDAU K. Classification of municipal occupations. *Scand J Work Environ Health* 1991;17(suppl 1):12-29. Eighty-eight job titles were analyzed with the "ergonomic job analysis procedure" [Arbeitswissenschaftliche Erhebungsverfahren zur Tätigkeitsanalyse abbreviated (AET) in German]. The objective was to classify the wide range of municipal jobs into homogeneous groups according to job demand and to provide better possibilities to study the relationships between work and health among the aging municipal working population. Altogether 216 items were classified. First, a hierarchical cluster analysis was made, and a dendrogram of the analyzed job titles was drawn. Second, a profile analysis was done in which the single items were grouped into 39 sum items, and a graphic profile was drawn. Finally, the stress factors were listed and drawn in ranking order. The cluster analysis formed 13 groups. Groups exposed to the highest stress factor level were kitchen supervisors, dentists, and physicians. More than 10 stress factors (> 50 % of the maximum) were found in nursing, administration, installation, transport, and technical supervision.

Key terms: aging worker, cluster groups, job analysis, stress factors, work profiles.

A comprehensive description of an occupation can be obtained with several methods. The one used depends on the purpose of the study in which it has been included. With respect to the load and strain on the human body more than 50 different observation methods have been developed in European countries, and they differ considerably (1-3).

The "ergonomic job analysis procedure," commonly known as AET (Arbeitswissenschaftliche Erhebungsverfahren zur Tätigkeitsanalyse), covers the physical, mental, environmental, and organizational aspects of work and offers possibilities for clustering jobs (4-8). It has already proved useful in research in the field of occupational health (9-11). The AET data bank of universities in Darmstadt and Hohenheim, Germany, includes more than 5000 job analyses, and that of the Institute of Occupational Health in Helsinki, Finland, has more than 1000.

As a part of a comprehensive research project on the work, health, and retirement age of municipal employees ("Grounds for the Determination of Retirement Ages in Municipal Occupations"), the objective of this AET study was to classify the wide range of single municipal jobs into homogeneous occupational groups according to job content and job demands. This standardization of work was meant to provide better possibilities for studying the relationships between

work and health among the aging municipal working population of Finland.

Subjects and methods

Subjects

From 109 job titles taken from a questionnaire administered to municipal workers in another phase (12) of this comprehensive research project, we chose 88 job titles for our field study. The excluded 21 job titles represented only a small number of employees in municipal occupations. The representatives of the included 88 job titles were selected at random. From an occupation which consisted of only one job title (eg, painter or cleaner) two employees were sampled for the job analysis. If the occupation included several job titles (eg, machine operator, construction worker, office worker), one subject was selected for each job title. For example, from the office worker category there was a draftsman, a typist, and an office assistant.

The subjects were chosen from six different Finnish communities (Helsinki, Jyväskylä, Kuopio, Lappeenranta, Oulu, and Vaasa) and their surrounding regions. The total number of subjects studied was 129. For four of these subjects the work changed so drastically during the study that a new job analysis had to be made. Because their new and old jobs were both typical occupations, the data of both were included in the study material. Thus the final number of job analyses was 133. Most of the analyses were done for technical professions (39 %), health care (22 %), social welfare (13 %), and administrative and office work (10 %). About 46 % of the analyses were done in the Helsinki region, and 7 to 12 % took place in each of the other regions so that the distribution of the em-

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ployees studied would be representative with respect to both the jobs and the regions.

The AET method

The AET method is based on the concepts of stress and strain and the man-at-work system (4–8). The various tasks done in an occupation are the study objects (ie, the tasks of a nurse, of a carpenter, of an office manager) and the objective features of the tasks, which are independent of the characteristics of the worker (ie, gender, age, and skill), are registered according to a standardized procedure.

The method incorporates observations of the work and interviews of the workers and foremen. The interviews cover those features which cannot be observed (ie, education, experience, work-rest schedules). Altogether 216 items are classified under the topics given in table 1.

The work environment items and the work demands represent the stress factors of a job. In the analysis of the single items, interval scales are used (mostly from 0 to 5). The items are rated by means of codes representing the level (or significance) of the stress, the duration of the stress, and the frequency (or temporal distribution) of the stress. Alternative and nominal scale codes document the characteristics of the work system. The task analysis indicates the tasks in which the stress factors are to be found. Only one given code is used for one item. (See reference 8.)

Cluster analysis

For the cluster analysis hierarchical and polythetic clustering was used. (See, eg, references 13–17.) The hierarchical structure of the data is given as a job dendrogram, which describes the similarity of the jobs. (See figure 1.) The similarity of the jobs grows weaker as the scale increases from 1 to 25. In our study we used a cut-off level of 16 for similarity because the jobs were clearly clustered. The polythetic concept means that all 216 items of the AET job analysis were used, and therefore the clusters were based on the “overall similarity” of the jobs (15).

Profile analysis

For the profile analysis the 216 single AET items (eg, extremely bent posture, night work) of a job were grouped into 39 sum items (eg, work posture, temporal organization of work). From all the single jobs within one cluster a united profile was calculated and called a cluster profile.

The length of the columns was the mean value of the items included. For only one sum item (work posture) was a factor of energy expenditure used for the calculations. (See reference 15.)

Stress factors

The stress factors revealed in the profile analysis were listed in ranking order. They were taken from the items concerning the work environment, information input, information processing, and physical load and transformed from the interval scale into a relative scale so that 0 = 0 %, 3 = 60 %, and 5 = 100 %. Stress factors with a value greater than 40 % of the theoretical maximum score were selected for the analysis.

Interobserver differences

The data were collected by eight observers, all of whom were trained as a group in the use of the AET method. After the training five of the observers individually collected and analyzed the data of a nurse working in a ward. The individual analyses of the observers were compared with the reference analysis done afterwards by the teacher and the five observers together. The results showed that the number of uniform classifications varied from 75 to 89 % of the items (table 2).

Correspondence of the AET analyses with the results of a questionnaire administered to the workers

Altogether 13 items of the AET analyses were included also in the self-administered questionnaire used by Tuomi et al (12) in another phase of the project (ie,

Table 1. Main characteristics of a job and the number of items covered by the job description.

Characteristics	Number of items
Work system	143
Work objects	33
Work equipment	36
Work environment	74
Work tasks	31
Work demands	42
Perception	17
Decision making	2
Education, knowledge, skills, experience	6
Physical load	17
All	216

Table 2. Number of uniform classifications of single items made by the five observers (A–E).

Observer	Items classified (N)	Items classified uniformly	
		N	%
A	174	139	80
B	170	151	89
C	216	174	81
D	194	146	75
E	216	172	80

seven items on physical work demand and six items on mental work demand). The results of the two methods were compared with respect to these items. Therefore a transfer of the AET scale (0–5) to the questionnaire scale (0–4) had to be done. When several items of the AET analysis corresponded with a questionnaire item, an AET mean value was taken for comparison. The comparison was made for three of the profile groups, ie, the auxiliary, nursing, and administrative groups.

Results

Cluster groups

The cluster analysis formed 13 groups when a cut-off level of 16–17 was chosen for similarity (figure 1). Table 3 shows the 13 groups according to the nature of the work. Those groups in the physical work category (auxiliary work, installation, and home care) were dominated by muscular work and physical work load, those in the mixed work category (transport, dump work, kitchen supervision, dental work, and nursing) were characterized by both physical and mental effort, and those in the mental work category (office work, administration, technical supervision, physician's work, and teaching) demanded primarily mental effort (table 3).

In the following text, the results of one cluster group from each category are given in detail (auxiliary, nursing and administrative work). For the other 10 groups only the stress factor results have been given.

Auxiliary work

The auxiliary work group was formed from 16 job titles as shown in figure 2, which illustrates the similarity of the jobs. Outdoor laborers like men in pipe-

laying and construction formed the first part of the cluster, followed by outdoor cleaning workers, eg, streetsweepers and park workers. Then came indoor cleaners, placed together with kitchen helpers and hospital assistants at a similarity level of 12. The last jobs in the cluster were the painters. They joined the other jobs at the similarity level of 16. In other words, the difference in the overall similarity of auxiliary work was greatest between the pipelayers and the painters.

The profile analysis of the auxiliary group indicated that the sum items of physical load were accentuated (figure 3). The duration of poor work postures and of dynamic work exceeded 50 % of the maximum score. The importance of proprioceptive information input was also emphasized. The physical and social work environment was characterized by several features, especially by climatic conditions, dangerous

Table 3. Cluster groups formed from the 133 job titles according to the nature of the work.

Nature of the work	Cluster group ^a
Physical	Auxiliary work (16) Installation work (11) Home care work (3)
Mixed ^b	Transport work (13) Dump work (3) Kitchen supervision (1) Dental work (1) Nursing work (5)
Mental	Office work (8) Administrative work (14) Technical supervision (3) Physician's work (1) Teaching work (6)

^a The number of different job titles in the cluster group is presented in parentheses.

^b Work with both physical and mental effort.

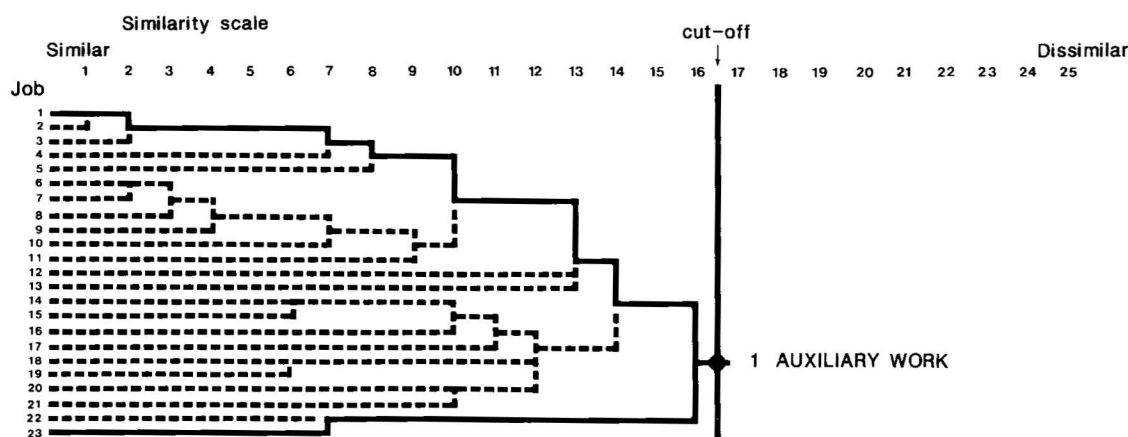
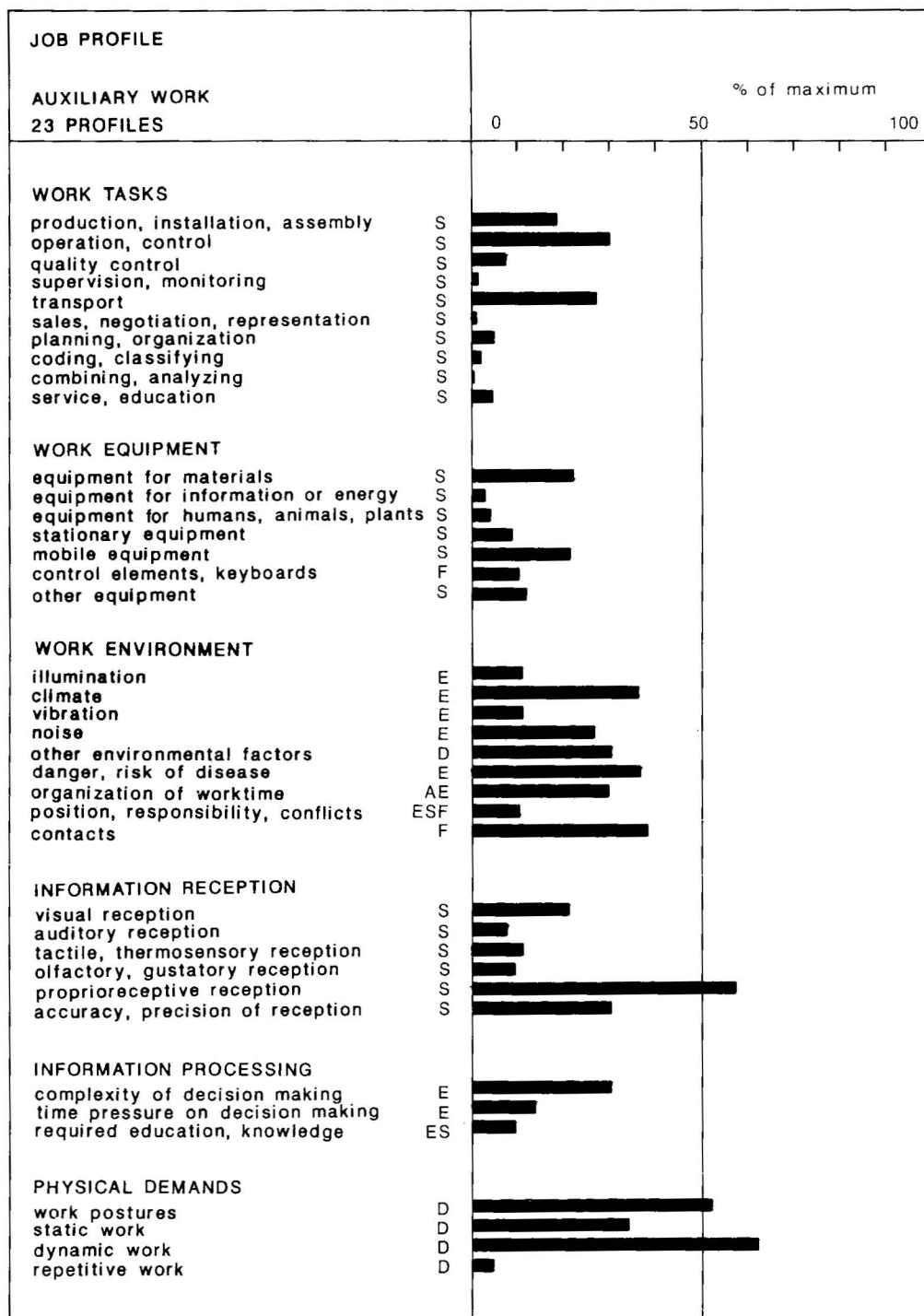


Figure 2. Dendrogram of the auxiliary work group, which was formed from 16 job titles (1 = pipelayer, 2 = pipelayer, 3 = pipelayer, 4 = construction worker, 5 = unskilled assistant, 6 = streetsweeper, 7 = district streetsweeper, 8 = sanitation worker, 9 = street cleaner, 10 = road construction laborer, 11 = building construction laborer, 12 = laborer, 13 = park worker, 14 = cleaner, 15 = cleaner, 16 = health care aide, 17 = hospital aide, 18 = kitchen helper, 19 = kitchen helper, 20 = hospital aide, 21 = health care aide, 22 = painter, 23 = painter).



classification codes: S=significance, F=frequency, E-exclusive to specific question, A=alternative (apply or not), D=duration

Figure 3. Job profile of the auxiliary work group.

work, and human contacts. The auxiliary group used handtools for cleaning, treating, and transport. Their main work tasks consisted of manual transport, public sanitation, and cleaning (figure 3).

The profile analysis gave the stress factors dynamic and static muscular work the highest rankings (figure 4). Using both legs with support of the pelvic muscles (walking, climbing, crawling) dominated with a

mean duration of about 70 % of the maximum score. Use of strength, both in static and in dynamic work, was next, followed by climatic conditions and a need for coordinated bodily movements. Altogether 11 stress factors were found which, on the average, met the criterion of >40 % of the maximum score, and seven factors averaged >50 % of the maximum score. Dynamic and static muscle work loading the legs, hands, and upper arms was combined with poor work postures, and the work was carried out under difficult climatic conditions (heat, cold) (figure 4).

Nursing work

The cluster analysis for nursing work brought five job titles together (figure 5). Child care workers in day care centers and in hospitals formed the upper part of the cluster. They were followed by practical nurses in hospitals and in public welfare institutions. These occupations joined the child care workers at a similarity level of 12. The lower part of the cluster was formed

from psychiatric nurses and nurses specialized in chronic, internal, maternity, guard ward, or operating room skills. On the similarity scale the work of the specialized nurses met at the level of 12, except that of the operating room nurses. The distance between the child care worker (day care center) and the operating room nurses was the greatest within this cluster group (figure 5).

The profile analysis indicated that nursing had strong physical, mental, and environmental features. Dynamic muscle work was the most pronounced physical load, together with postural stress. The mental load was characterized especially by demands for accuracy in information input and by complex and time-pressured decision making. The social work environment was influenced by demanding human contacts (colleagues, patients) and by difficult work schedules (shift work). The work was done with the help of numerous instruments used for patient care. The work tasks were diverse, and, in addition to service tasks (care of patients), they included the processing and transforming

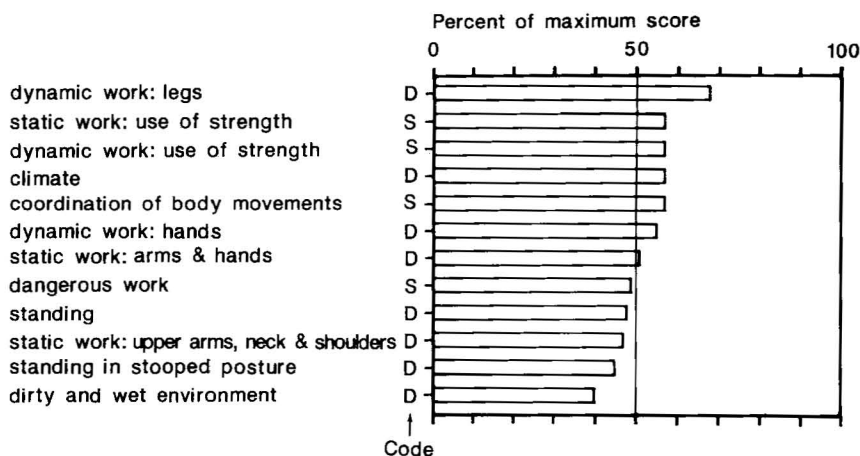


Figure 4. Stress factors of the auxiliary work group. (D = Duration, S = Significance)

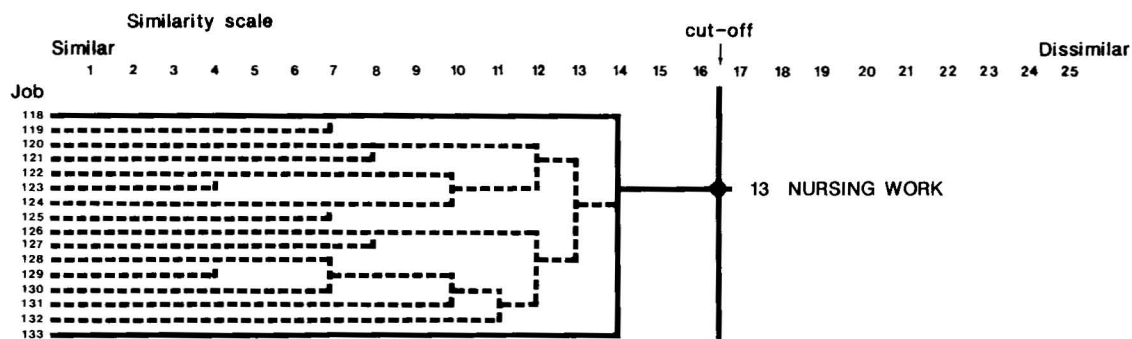
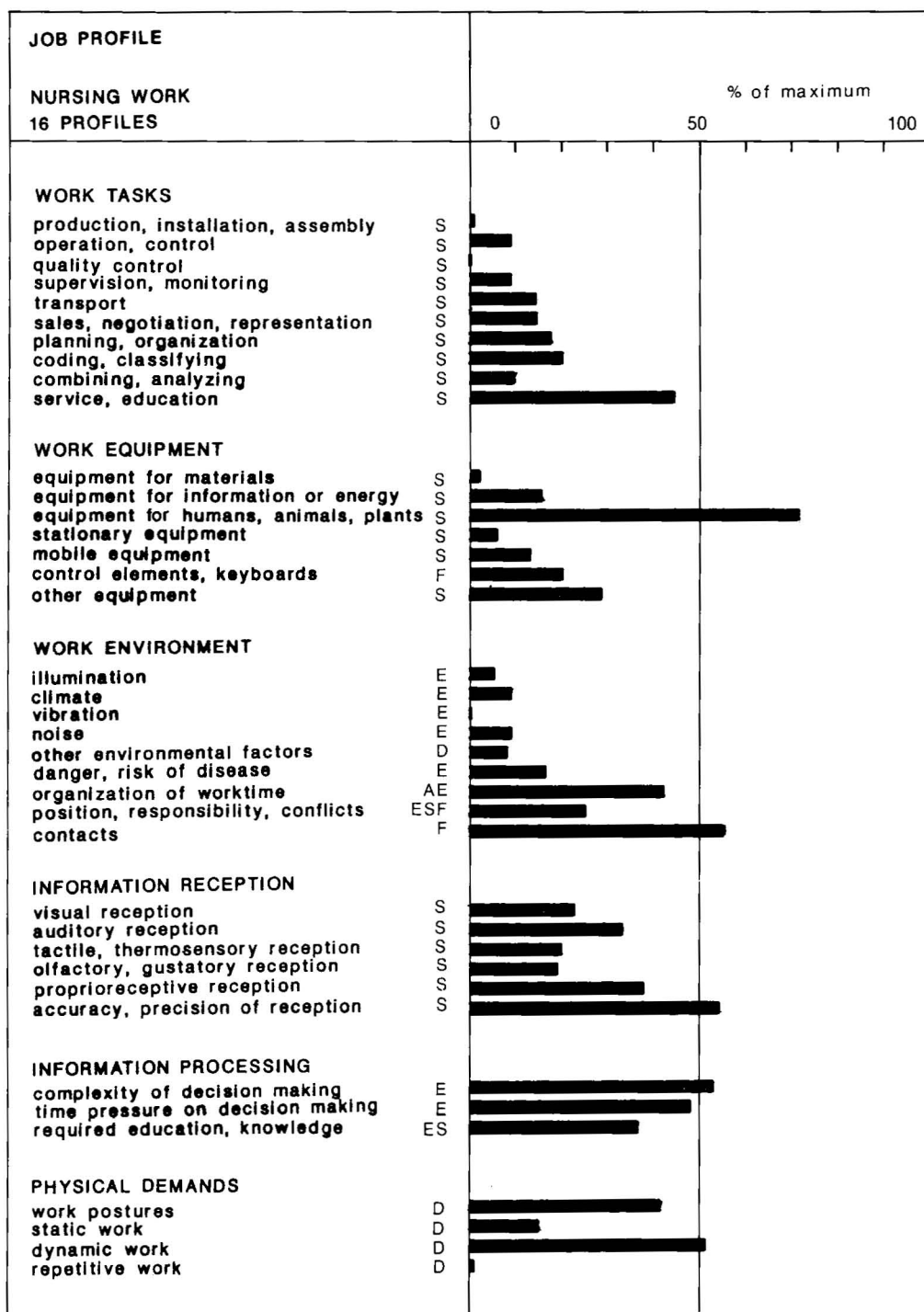


Figure 5. Dendrogram of the nursing work group (118 = child care worker, day care center, 119 = child care worker, day care center, 120 = child care worker, hospital, 121 = child care worker, hospital, 122 = practical nurse, hospital, 123 = practical nurse, social institution, 124 = practical nurse, hospital, 125 = practical nurse, social institution, 126 = psychiatric nurse, 127 = psychiatric nurse, 128 = nurse specialized in the care of chronically ill patients, 129 = nurse specialized in internal medicine, 130 = assistant head ward nurse, 131 = nurse specialized in midwifery, 132 = nurse specialized in polyclinic work, 133 = nurse specialized in surgery).



classification codes: S-significance, F-frequency, E-exclusive to specific question, A-alternative (apply or not), D-duration

Figure 6. Job profile of the nursing work group.

of information and tasks involving organization (figure 6).

The profile analysis revealed 11 stress factors with average values exceeding the 50 % level of the maxi-

um score (figure 7). Contacts with colleagues reached the maximum, and contacts with supervisors reached 80 % of the maximum. Shift work including night shifts was ranked next. Physical stress was represented

by both dynamic leg work (walking) and standing, combined with a short duration of breaks. Responsibility for patients and for safety was also pronounced. Visual and auditory information input in combination with demands for accuracy in perception was important. Use of strength in dynamic and static muscle work was also ranked as a stress factor in nursing work (figure 7).

Administrative work

The administrative cluster group was formed from 14 job titles (figure 8). The upper part of the cluster comprised fire chiefs and heads of governmental departments and offices. All the other jobs were joined in the lower part of the cluster; head nurses, social wel-

fare inspectors and workers, and psychiatric nurses were included. Interestingly, the social workers were placed near the nurses doing administrative work. The social workers having different job titles met at a similarity level of 8–12. The work of fire chiefs and the administrative work of psychiatric nurses in psychiatric wards illustrate the range of overall similarity in this cluster group (figure 8).

The processing of information proved to dominate the profile analysis of administrative work. Both complex and time-pressured decision making and the need for special education and the requirements of advanced professional training were emphasized. Demand for accuracy was the most important form of information input. The social work environment included demands

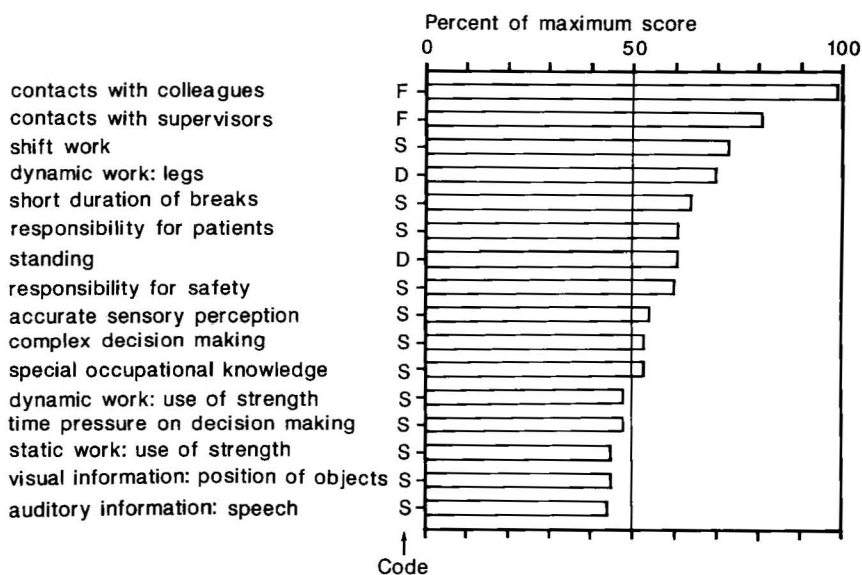


Figure 7. Stress factors of the nursing work group. (D = Duration, F = Frequency, S = Significance)

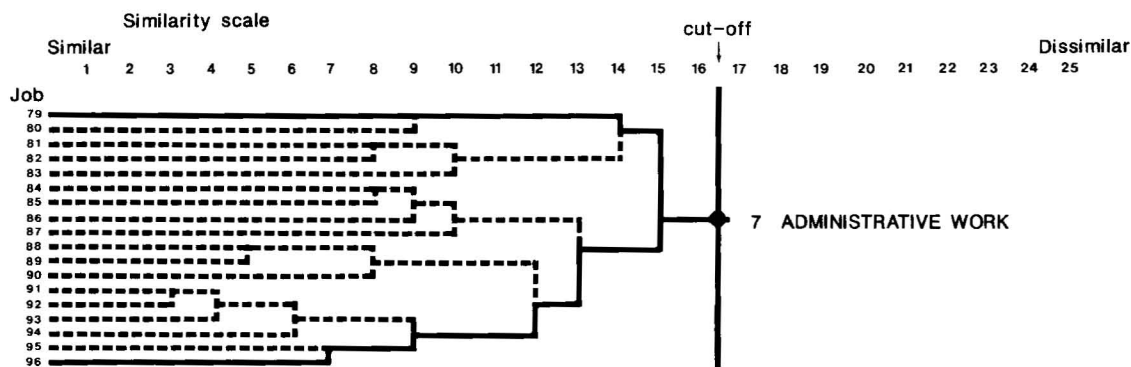
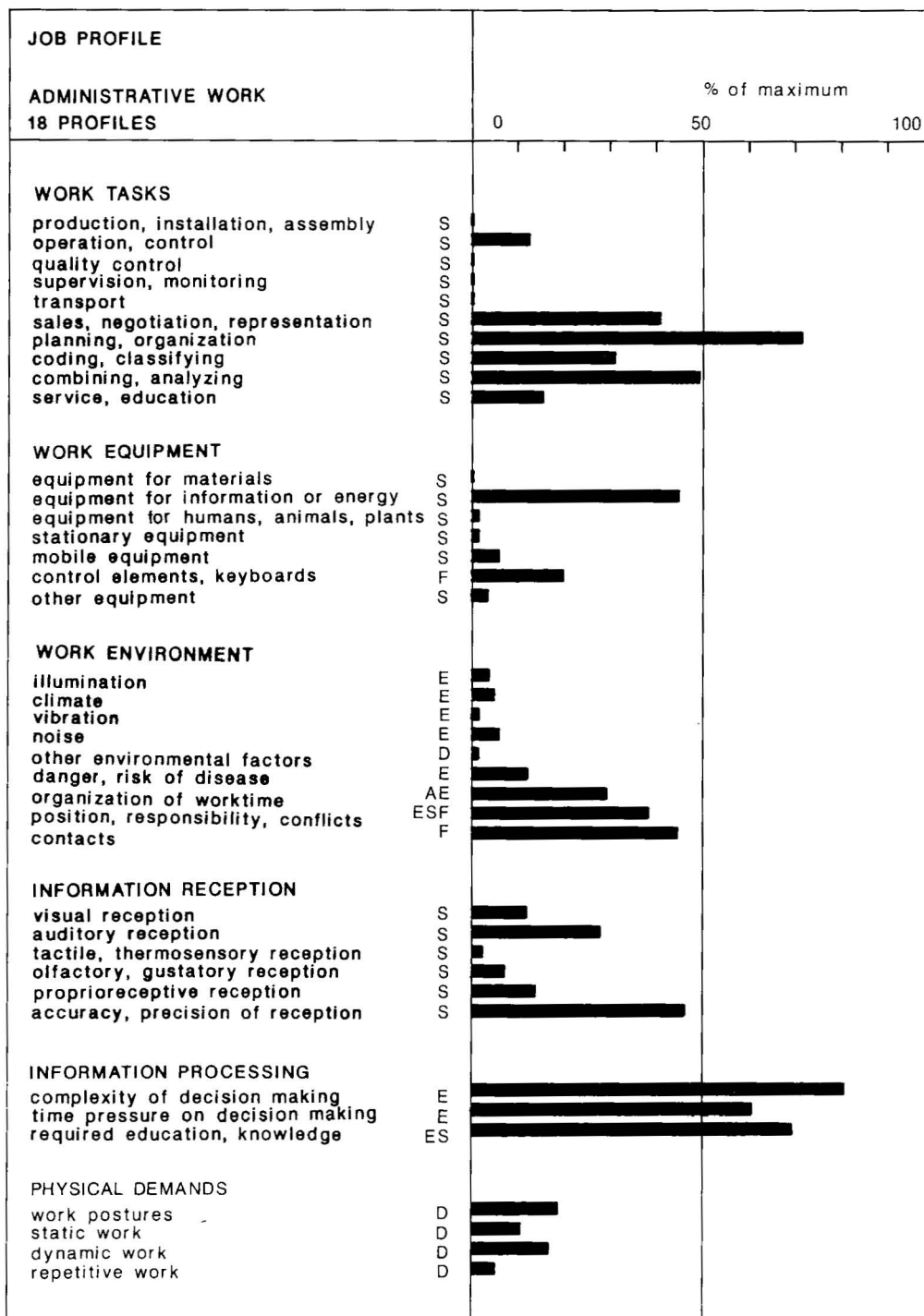


Figure 8. Dendrogram of the administrative work group (79 = fire chief, 80 = fire chief, 81 = departmental director, 82 = bureau chief, 83 = office supervisor, 84 = head nurse on night shift, 85 = head ward nurse, 86 = social worker, 87 = head nurse, 88 = social welfare officer, 89 = social welfare officer, 90 = social welfare officer, 91 = welfare inspector, 92 = social welfare inspector, 93 = social welfare inspector (manager), 94 = social welfare inspector, 95 = psychiatric nurse (responsible for a broad municipal area), 96 = psychiatric nurse responsible for a ward).



classification codes: S=significance, F=frequency, E=exclusive to specific question,
A=alternative (apply or not), D=duration

Figure 9. Job profile of the administrative work group.

due to the temporal organization of the work, to position in the organization, and to position in the hierarchy of information flow between personnel. Work equipment was connected with data processing

and transmitting. The main work tasks were planning and arranging organizational activities, negotiating, and data sorting and analyzing (figure 9).

The profile analysis gave the highest stress factor

ranking to requirements for knowledge and special education and complex decision making. Altogether 12 factors exceeded the 50 % level of the maximum score. Among them were contacts with subordinates, responsibilities for actions, and safety matters. A need for advanced professional training and the necessity for work experience was pointed out. Conflicts and demands for sensory perception and foreign languages were also a part of the ranking list (figure 10).

Stress factors of the other cluster groups

Installation work. In installation work the importance

of coordinated bodily movements and special knowledge was ranked highest. Altogether 11 factors exceeded the 50 % level of the maximum score. Among them, both demands on sensory perception and the need for strength in dynamic and static work were pointed out. The physical and chemical work environment was also in the ranking list but less pronounced than, for example, the responsibilities for materials and safety (figure 11).

Home care work. The home care group consisted of three job titles. The main tasks were helping persons

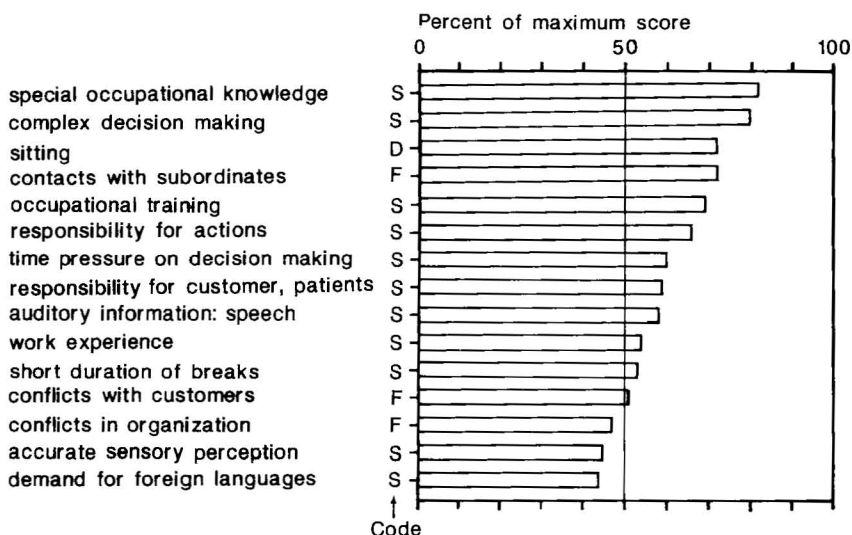


Figure 10. Stress factors of the administrative work group. (D = Duration, F = Frequency, S = Significance)

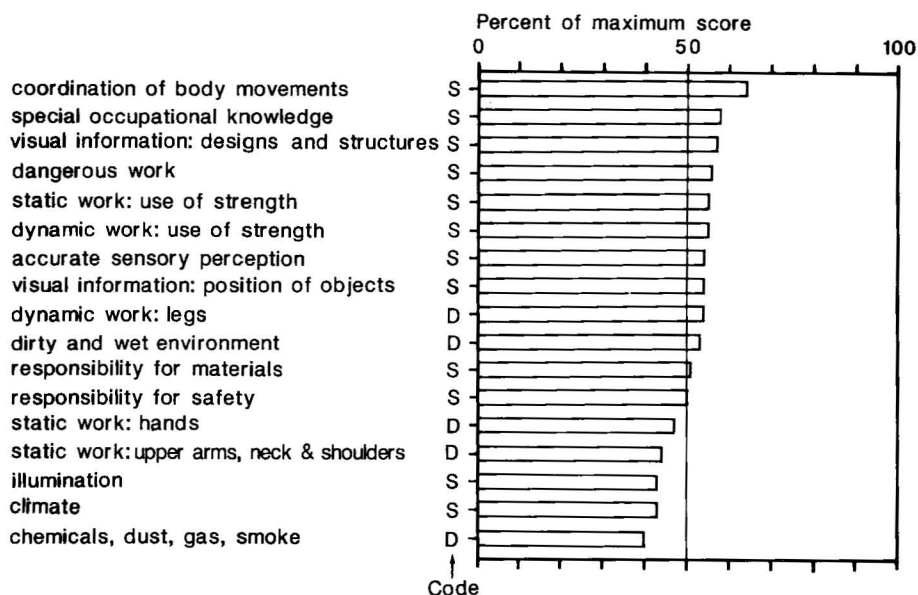


Figure 11. Stress factors of the installation work group. (D = Duration, S = Significance)

manage in daily activities in their homes. Stress factors due to physical load were highly ranked. Dynamic muscle work of the legs and arms, the use of strength in static work, and a short duration of breaks exceeded the 50 % level of the maximum score. Conflicts with patients and complex decision making were also ranked as stress factors (figure 12).

Transport work. Thirteen different job titles formed the transport cluster group. The main work task was driving a vehicle or operating a machine. Twelve stress factors exceeded the 50 % level of the maximum score. The importance of visual information in recognizing the position of objects was ranked first. Visual informa-

tion with respect to moving objects and the demands for accuracy in sensory perception and in the coordination of body movement emphasized the wide stress on the sensory functions. Static work loaded the hands and upper arms, and sitting in a stooped position was done more than 50 % of the workshift. Mental stress was linked with responsibilities for safety and materials. The dangerousness of work was increased by the high risk for damage to persons and materials. The physical work environment was stressful, mainly because of vibration, noise, and climate (figure 13).

Dump work. The dump work group consisted of three job titles. The main work task was controlling the

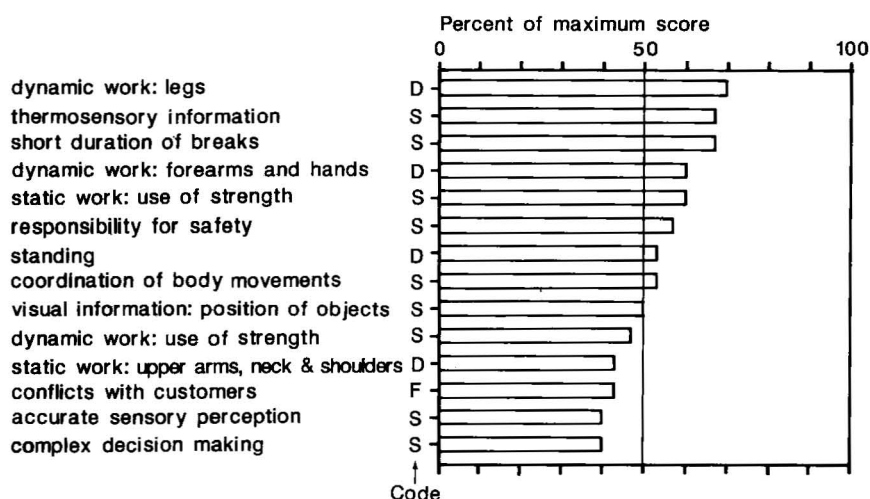


Figure 12. Stress factors of the home care work group. (D = Duration, F = Frequency, S = Significance)

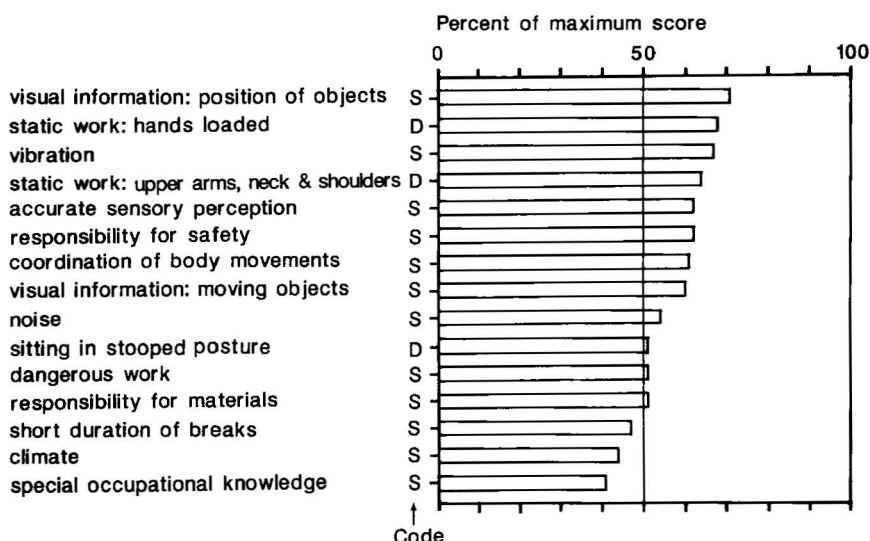


Figure 13. Stress factors of the transport work group. (D = Duration, S = Significance)

waste brought to the dump and handling the payment. Walking was the main physical stress factor. The dirtiness and wetness, the outdoor nature of the work, and the variation in temperature (warm, cold) dominated the work environment stress factors. The work involved more standing than sitting. Handling the payment demanded accurate sensory functions (figure 14).

Office work. Eight job titles formed the office work group. The main work tasks were coding, transforming, and processing data and the arrangement tasks. Demands for accuracy in sensory perception and the importance of visual information were ranked first. Nine factors exceeded the 50 % level of the maximum score. Among them were processing of auditory information, continuous contacts with supervisors, and need for knowledge and special education. In addition stress factors caused by one-sided physical loading were

recognized. The duration of sitting and static work with the hands exceeded, on the average, 50 % of the maximum score, and repetitive work stressed the office worker about 50 % of the workshift (figure 15).

Kitchen supervision. The group for kitchen supervision consisted of two household manager titles. Their main work tasks were cooking and delivering food and planning and organizing the work in the kitchen. The frequency of contacts with subordinates and the importance of information input and processing through the senses of smell and taste were ranked with maximum scores. A high frequency of conflicts in organization, responsibility for time losses, and time-pressured decision making were also common stress factors. Altogether 17 stress factors exceeded the 50 % level of the maximum score. Among them environmental stress (climate), stress due to responsibilities, sen-

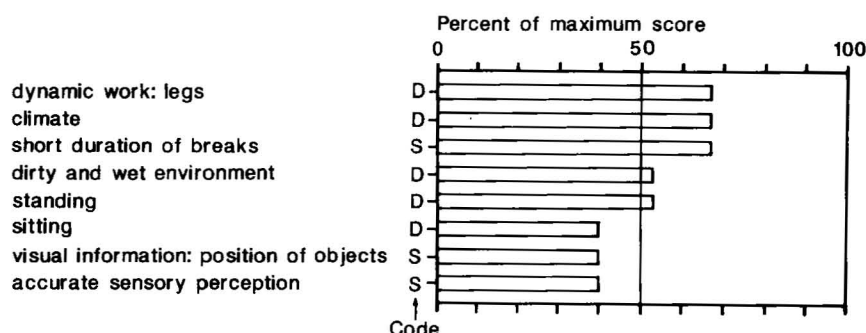


Figure 14. Stress factors of the dump work group. (D = Duration, S = Significance)

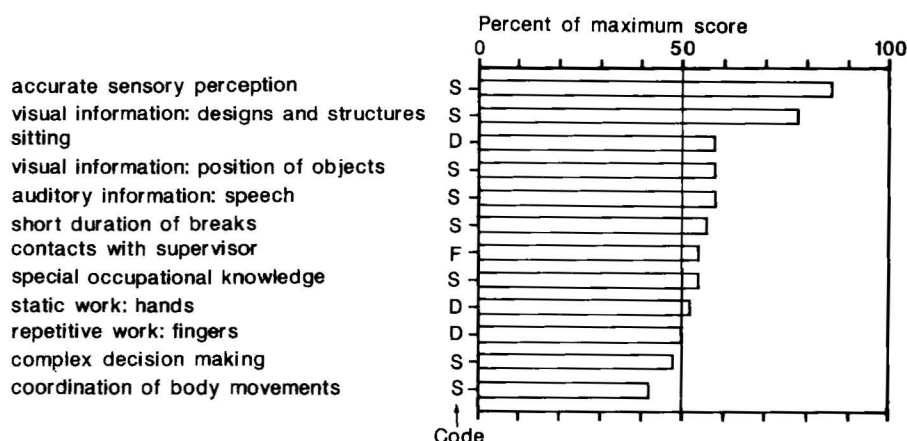


Figure 15. Stress factors of the office work group. (D = Duration, F = Frequency, S = Significance)

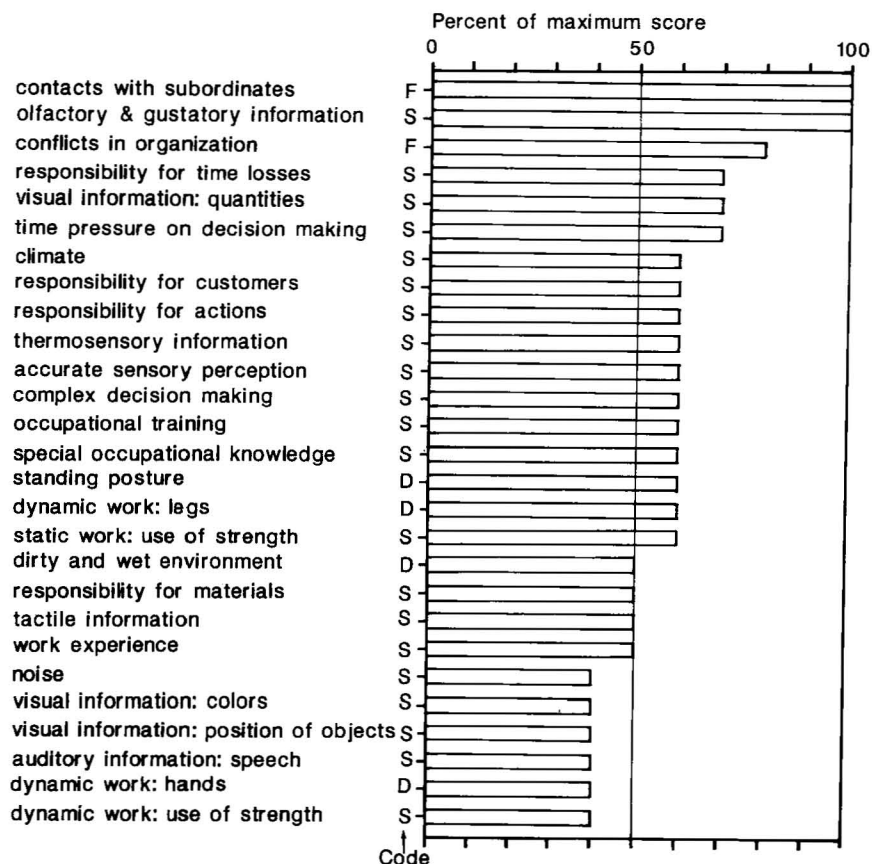


Figure 16. Stress factors of the kitchen supervision work group. (D = Duration, F = Frequency, S = Significance)

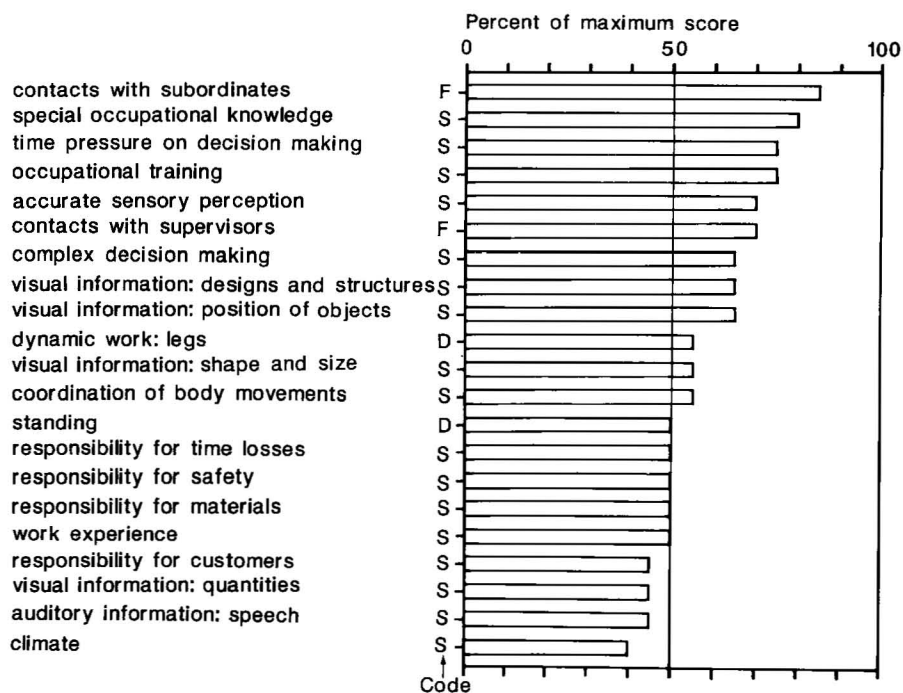


Figure 17. Stress factors of the technical supervision work group. (D = Duration, F = Frequency, S = Significance)

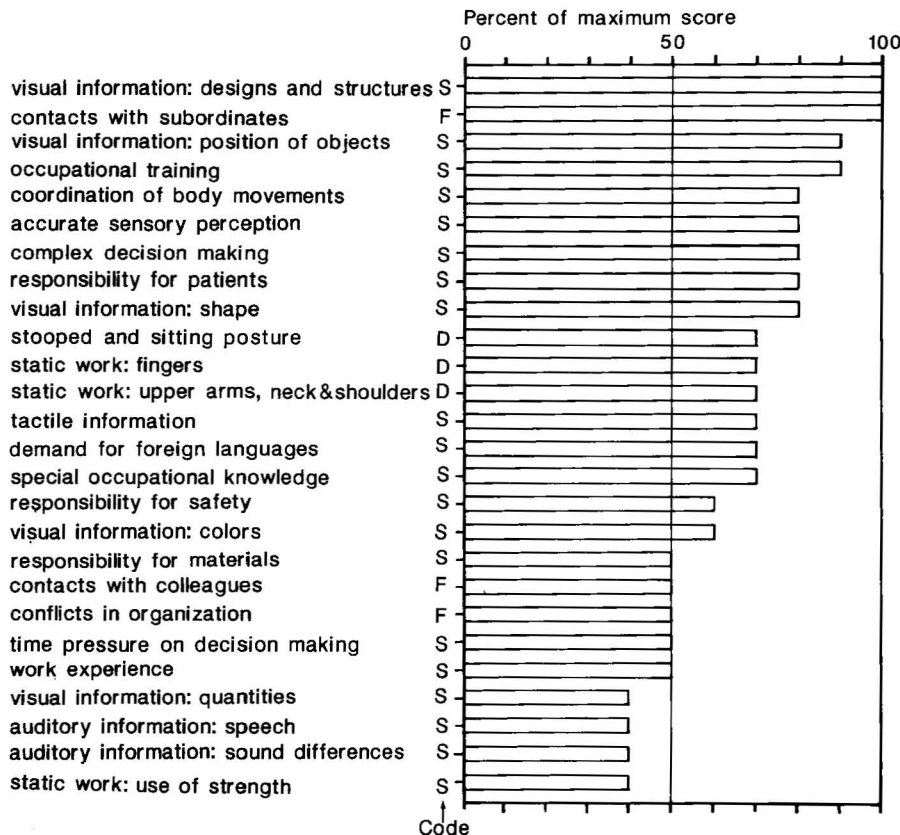


Figure 18. Stress factors of the dental work group. (D = Duration, F = Frequency, S = Significance,)

sory load, need for knowledge and special education, and physical load (standing, walking, use of strength) indicated the diverse exposure to stress in the kitchen (figure 16).

Technical supervision. The technical supervision group consisted of three jobs (supervisor and foreman in a fire brigade and supervisor of a construction site). Their main tasks were planning and leading the activities, organizing, combining and analyzing the technical data, negotiating, driving a car, and operating technical devices. Regular contacts with subordinates and the need for special knowledge were ranked as top stress factors. Altogether 12 factors exceeded 50 % of the maximum score. Typical stress sources were decision making and demands on visual perception. Responsibilities for time losses, safety, and materials averaged 50 % of the maximum score (figure 17).

Dental work. The dental work group comprised two dentist's jobs in a health care center. The main work tasks were caring for patients' teeth, using a drill and other technical devices, planning and organizing the work, and classifying and analyzing data. Two stress

factors reached the maximum score, namely, the importance of the visual reception of information (structures) and frequent contacts with subordinates. Such stress factors as the importance of visual information concerning the position of work objects and work instruments and the importance of advanced professional training reached a level of 90 % of the maximum score. The 80 % level was reached by stress factors like coordination of movements, complex decision making, and responsibility for patients. At the 70 % level the duration of static work (fingers, upper arms) and stooped sitting were listed. Altogether 17 stress factors exceeded the 50 % level of the maximum score (figure 18).

Physicians' work. This cluster group of physicians was formed from two job titles in gynecology and a maternity ward. Their main task was patient care connected with information processing and transmitting, planning the care, arranging the work, and negotiating. Six stress factors reached the maximum score, namely, complex and time-pressured decision making, demands on accuracy in sensory perception, contacts with nurses and colleagues, demands for professional work experience, and a need for advanced professional training. Altogether 16 stress factors exceeded the level of

50 % of the maximum score. Stress factors like responsibility for patients, special knowledge, and demand for foreign languages were found at the 90 % level of maximum. Responsibility for safety, visual and auditory information, and sensorimotor coordination formed a source of stress, on the average, at the 80 % level of the theoretical maximum. Overtime work was

also a marked stress factor in physicians' work (figure 19).

Teaching work. The last cluster group consisted of six job titles in teaching. The main work task, teaching, was closely connected with planning and arranging the

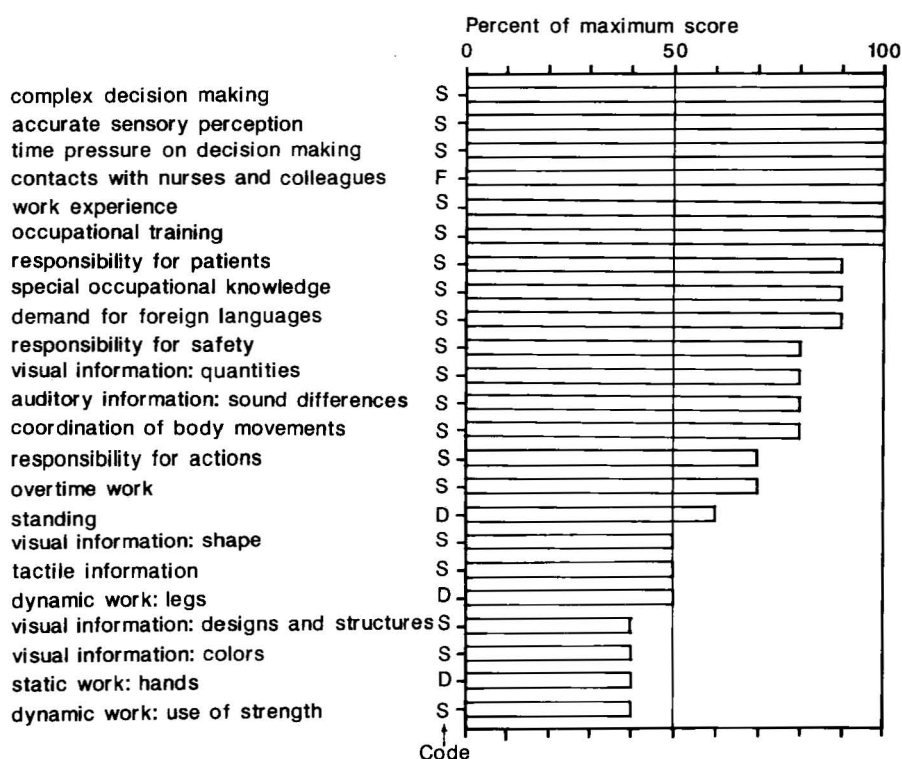


Figure 19. Stress factors of the physician's work group. (D = Duration, F = Frequency, S = Significance)

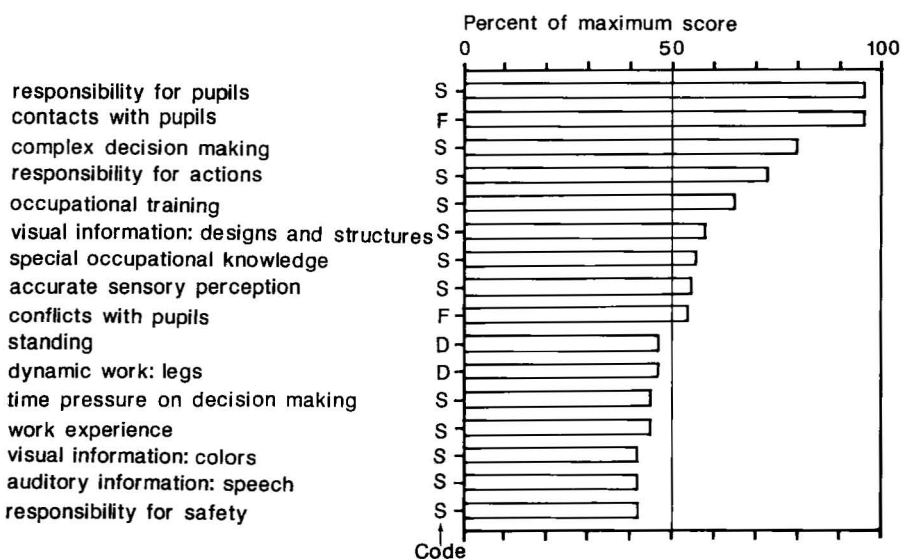


Figure 20. Stress factors of the teaching work group. (D = Duration, F = Frequency, S = Significance)

work and classifying and combining the data to be taught. The responsibility for pupils and the frequent contacts with pupils were ranked first. Complex decision making, responsibility for actions, and requirements of advanced professional training were among those nine stress factors exceeding the 50 % level of maximum (figure 20).

Intergroup comparison of stress factors

Table 4 summarizes the results of the stress factor analyses. According to the number of stress factors exceeding, on the average, 50 % of the maximum theoretical score, the cluster groups can be classified into three levels. At the highest stress factor level were the kitchen supervisors, dentists, and physicians (more than 15 stress factors > 50 % of the maximum score). At the next stress factor level (more than 10 stress factors > 50 % of the maximum score) were nursing, administration, installation, transport work, and technical supervision. The other cluster groups had, on the average, less than 10 occupational stress factors exceeding the 50 % level of the maximum. If the number of stress factors exceeding the 70 % level are taken into account, physicians' and dentists' work can be separated from supervisors' work in kitchens. The persons in technical supervision and teaching were also exposed to four stress factors over the 70 % level (table 4).

Correspondence between the AET analyses and the questionnaire administered to the workers

Figure 21 shows the agreement between the AET analyses and the responses to the self-administered questionnaire for the three cluster groups of auxiliary work, nursing work, and administrative work. In auxiliary

work the 13 items of the AET analyses corresponded fairly well with the respective items in the questionnaire, with the exception of repetitive work. Generally speaking, the scores of the job analyses were systematically lower than the scores of the questionnaire. In nursing work the AET scores for repetitive work, poor work postures, and carrying (lifting) were much lower than with the questionnaire. A similar difference was found in responsibility for persons. In administrative work the responsibility and contacts differed the most between the AET analyses and the questionnaire. The best correspondence was found for heavy physical work, standing, walking, sitting, and decision making.

Discussion

In spite of the wide variety of job titles in municipal work, the job content often included similar demands

Table 4. Number of stress factors exceeding, on the average, the 50 and 70 % level of the maximal theoretical score by cluster group.

Cluster group	Number of stress factors	
	> 50 %	> 70 %
Auxiliary work	7	—
Nursing work	11	3
Administrative work	12	2
Installation work	11	—
Home care work	8	—
Transport work	12	1
Dump work	5	—
Office work	9	2
Kitchen supervision	17	3
Technical supervision	13	4
Dental work	17	9
Physician's work	16	13
Teaching work	9	4

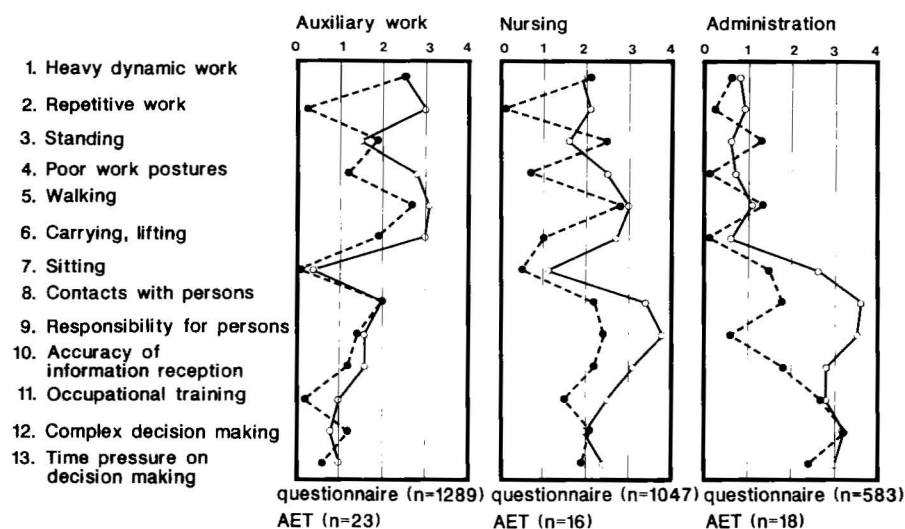


Figure 21. Correspondence between respective items of the AET job analyses and the questionnaire for the auxiliary, nursing, and administrative work groups.

and stress factors. Job titles alone can therefore be misleading or uninformative as a description of the dominating stress factors of an occupation. For example, pipelayers and painters resembled each other in respect to stress factors and job content so that, in the cluster analyses, they were categorized together in the same general group called auxiliary work. Other examples were bathers and domestic helpers (home care work), draftsmen/women and office workers (office work), day care center teachers and language teachers (teaching work), and child care workers and specialized nurses (nursing work). It was also notable that the jobs usually done by women and those usually done by men were found in the same cluster groups. For example, the work of helpers in hospitals or kitchens and the work of cleaning women were similar to the work of male outdoor workers. Job clustering does not, however, mean that no differences exist between the jobs; it only means that most of the 216 factors studied were similar.

The clustering technique has advantages in research on work-related health problems. The job content and work stress factors can be standardized to a certain degree, and exposure can be systematically defined.

The small number of descriptive analyses per job is based on the fact that the expert analyzes the "objective" features of the work. These features are fundamentally independent (like climate, noise, etc) of the individual differences. The expert does not estimate the level of occupational strain, but instead determines how strongly a stress factor is present. The number of analyses needed for describing one job title depends on the variation of stress factors within the job title. Our experience has shown that the differences within a job title are notably smaller than the differences between jobs.

This view of the intra- and interjob differences was supported by the present results. The same job titles, except a few, were grouped together in the hierarchical cluster (eg, cleaners, kitchen helpers, and painters belonging to the auxiliary group). In the auxiliary group the largest variation was found among the hospital helpers, and in the installation group it occurred among the electricians. Interestingly, the variation within one job title was small in spite of the facts that the workplaces were from different regions of Finland, the size of the organizations differed, and two to four descriptive analyses of one job title were done by different experts. The uniformity of the estimations of different experts (physiologists, psychologists, nurses, physiotherapists) was good. (See table 2.) After being trained, the five experts categorized 75–89 % of the items with the same code as was given in the model classification.

Job analysis with the AET method is based on the estimations of an expert, and the results can differ from evaluations made by the workers themselves. This situation was found also for the 13 main physical and mental stress factors that were compared in auxiliary,

nursing, and administrative work between the AET analyses and the self-administered questionnaire. However, several of the estimations of the experts and workers were similar. The differences can be due to differences in the terms used in the AET (eg, repetitive work) and questionnaire (similar repeated work movement). The conceptual idea of, for example, responsibility for persons could also have differed between the experts and the workers. Finally, the scale difference disturbed the comparison, which can be considered, more or less, as an estimation of trend.

The results indicated that there was no distortion in the sample chosen for the job analysis, although the sample represented, on the average, only 2.1 % of those who responded to the questionnaire. If the percentage of the workers participating in the AET analysis from different profile groups is compared with this sample mean, the home care (1.2 %), kitchen supervision (1.4 %), and nursing workers (1.5 %) were less represented than the dump workers (6.4 %).

Our classification of municipal jobs into 13 cluster groups was used as a work standardization method in the other phases of this project. (See, eg, references 18–20.) The results of this AET study can be used also to identify the stress factors that are the most prevalent for the aging worker. The improvements made in the work of elderly employees will require a follow-up analysis of the changes. The data gathered in this study can be used as reference when the quality or quantity of the work improvements are evaluated.

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