Section 6. Psychosocial aspects

Job stress in video display operations

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A questionnaire survey evaluation of job stress and health complaints in VDU operators and control subjects was undertaken at three separate facilities. The response from approximately 250 VDU operators and 150 controls indicated that job task demands interacted with VDU use to produce an increased stress level and heightened health complaints in VDU operators. Ergonomic solutions to reduce VDU operator health problems should deal with job task demands in addition to work station and VDU design features.

1. Introduction

Much attention has been paid to ergonomic design factors of visual display units (VDU) and their relationship to operator health complaints, but little has been directed to job design factors that may contribute to psychological job stress. Some studies have examined the psychosocial stress aspects of VDU work as secondary aspects of broader ergonomic evaluations. For example, Gunnarsson and Östberg (1977) found that in situations where operators had little control over their job tasks, the majority complained of monotony, while in situations where the job afforded some variety and control, only a small proportion felt the work was monotonous. Cakir *et al.* (1978) found that feelings of stress expressed by a group of VDU operators did not differ in magnitude from other worker groups previously examined.

Cakir *et al.* (1979) found differences between hourly paid and piece-rate paid VDU operators in sociability, frame of mind, state of stress, fatigue, and inner security, with the piece-rate operators scoring poorer in all categories. For a different group of VDU operators who previously did clerical work, 60% complained of monotony even though their present jobs were similar to their previous clerical jobs in task requirements. The results indicated that the jobs reporting the highest levels of monotony also reported the highest levels of fatigue. All these studies have shown that the psychosocial stress aspects of VDU work need to be considered in determining the impact of VDUs on operator health.

In the United States over the past few years, complaints about VDUs have been steadily increasing. The initial efforts of the National Institute for Occupational Safety and Health in this area were concerned with evaluating the possible health risks of VDUs regarding ionizing and non-ionizing radiation emissions. Some attention was also given to ergonomic factors including workplace, equipment and job-design features. However, it remained for the current study to offer the first systematic evaluation of psychosocial stress and health complaints of VDU operators in the United States.

2. Methods

A questionnaire survey was used to gather information about job demands, job stressors, psychosocial stress level, psychological mood, health complaints and working conditions for VDU operators and control groups at each of three study sites. Included in the survey form was a cover letter explaining the purpose of the study and instructions for filling out and returning the questionnaire. The questionnaires were handed out on-site to each participant, taken home and filled out, and returned to work the next day for collection by the research team. Participants could return their questionnaire by mail if they preferred. At the first site, 102 of the total 250 VDU operators at the facility were given a questionnaire, as well as 110 control subjects. The response rate was 73% for VDU operators and 38% for control subjects.

At the second site, 103 VDU operators were surveyed; this was virtually all employees who worked on VDUs. Ninety-three control subjects were also surveyed. The response rate was 48% for the VDU operators and 23% for the control subjects. At the third site, all VDU operators available on all shifts were given questionnaires for a total of 303 VDU operators. There were 212 control subjects surveyed. The response rate was 43% for VDU operators and 44% for control subjects.

3. Results

3.1. *Psychosocial job stress*

Various measures of psychosocial job stress were contained in the questionnaire. These included scales developed to compare the level of stress in different jobs (Caplan *et al.* 1975), standardized job stress scales (Work Environment Scale, WES) (Insel and Moos 1974) and selected questions on sources of job stress.

Table 1 shows the response means for VDU operators and control subjects at each site for the ten dimensions of the WES (Insel and Moos 1974). At all sites both the VDU operators and control subjects reported mean values for nine of the ten dimensions that were divergent from established normative values in an elevated stress direction. A Wilcoxon Two Sample test (Quade 1966) was used to compare the responses of operators and controls at each site.

Table 1. Mean responses for VDU operators and controls for WES† stress scales.

	Stress scales									
	Involvement	Peer cohesion	Staff support	Autonomy	Task orientation	Work pressure	Clarity	Control (by superior)	Innovation	Physical comfort
Site (1)										
VDU	1·04	1·08	1·41	1·23	2·12	3·35*	1·80	3·15	1·34	1·52
Control	1·25	1·80*	1·38	1·56	1·69	2·05	1·63	2·72	1·42	1·58
Site (2)										
VDU	1·64	1·73	1·92	2·00	1·95	2·68	1·46	1·90	1·29	1·24
Control	2·38	2·47	2·33	2·42	2·26	2·28	2·00	2·89*	0·79	1·00
Site (3)										
VDU	1·28	2·25*	1·71	2·13*	1·73	2·27	1·31	1·50	1·04	1·10
Control	1·19	1·63	1·46	1·46	1·60	2·16	1·50	2·21*	0·99	0·94
Norms	2·80	2·73	2·94	2·69	2·51	1·77	2·33	2·32	2·40	2·04

* Significant at 0·01 level using a Wilcoxon Two Sample test.
** Significant at 0·05 level.
† Work Environment Scale (Insel and Moos 1974) Form S.

Table 2. Mean responses for VDU operators and controls for job demands† stress scales.

	Stress scales								
	Workload dis-satisfaction	Boredom	Role ambiguity	Quantitative workload —Q	Quantitative workload —E	Self-esteem	Role conflict	Workload variance	Job future ambiguity
Site (1)									
VDU	3·40**	3·43	1·86	4·19*	3·60**	12·77**	1·67	3·01	3·62
Control	2·62	3·14	1·97	3·25	3·32	10·84	1·92	2·53	3·78
Site (2)									
VDU	2·36	2·28	1·64**	3·46	3·40	9·41	1·89	2·79	3·26*
Control	1·78	1·82	1·23	3·63	3·67	8·25	1·61	2·97	2·46
Site (3)									
VDU	2·15	2·26	1·56	3·59	3·40	10·23	1·75	2·70	3·05
Control	2·27	2·40	1·76	3·53	3·59	9·96	1·99	2·86	3·14
Job demands and worker health									
High	2·90	3·37	2·41		4·06		2·01	3·51	3·61
Median	2·13	1·83	2·06	—	3·51	—	1·75	2·81	2·70
Low	1·66	1·34	1·31		3·24		1·36	2·43	1·82

* Significant at 0·01 level using a Wilcoxon Two Sample Test.
** Significant at 0·05 level.
† Scales taken from *Job Demands and Worker Health* (Caplan *et al.* 1975).

Operators at site (1) reported less peer cohesion and more work pressure; while operators at site (2) reported less supervisory control; and operators at site (3) reported more peer cohesion, more job autonomy, and less supervisory control. A Kruskal Wallis test (Quade 1966) was used to compare the VDU operator responses across the three sites. Operators at site (1) reported less peer cohesion, less autonomy, more work pressure, and more supervisory control than operators at sites (2) and (3).

Table 2 shows the response means for VDU operators and control subjects at each site for nine of the dimensions reported by Caplan *et al.* (1975). At site (1), operators reported more workload dissatisfaction, quantitative workload, job future ambiguity and higher self-esteem than the control subjects. In comparing the responses from this study to the Caplan *et al.* (1975) study, both operators and control subjects reported greater workload dissatisfaction, boredom, and job future ambiguity than the median Caplan group. In fact, the VDU operators at site (1) reported higher values on these three dimensions than any of the Caplan groups.

At site (2), the VDU operators reported more role ambiguity and job future ambiguity than control subjects. However, both operators and controls reported lower role ambiguity than the median Caplan group. The VDU operators reported more boredom and job future ambiguity than the median Caplan group.

At site (3), there were no significant differences between the operators and control subjects for any of the Caplan dimensions. However, both operators and controls reported more boredom and job future ambiguity than the median Caplan group. The VDU operators reported less role ambiguity than the median Caplan group.

A Kruskal Wallis test was used to compare the VDU operators across the three sites. Operators at site (1) reported higher workload dissatisfaction, quantitative workload, more boredom, higher job future ambiguity, and greater self-esteem than the operators at sites (2) and (3).

Table 3 lists the specific stressors that contributed to the stress level of VDU operators and controls at each of the three sites. VDU operators at site (1) reported three times as many significant stressors as VDU operators at either of the other two sites. The most frequent stressors for site (1) VDU operators involved problems with workload, work pace, and boredom. VDU operators at site (2) reported only one stressor more frequently than controls, "little time to complete work". On the other hand, the controls at this site reported "less time to think", "less time to daydream" and "higher workload expectations". There were no differences for specific stressors between VDU operators and controls at site (3).

3.2. *Psychological mood disturbances*

Psychological mood was evaluated using standardized scales (Profile of Mood States, POMS) (McNair *et al.* 1971) and checklist questions about

Table 3. Percentage of VDU operators and controls reporting stressful levels of particular stressors.

Stressors	VDU	Control	Site
Work very fast	71*	29	1
Work very hard	61*	29	1
Little time	32**	7	1
Great deal of work	57*	22	1
Cannot set pace	34*	7	1
Cannot choose work	77**	50	1
Full attention	80*	52	1
Never workload slowdown	48**	25	1
Never time to think	12	40**	2
Workload high	39**	18	1
Workload expectations—others	47*	23	1
Workload expectations—others	18	50**	2
Little time to complete work	14**	0	2
Time to daydream	8**	20	1
Time to daydream	7	0**	2
Increased workload	20**	3	1
Increased concentration	23**	5	1

* Significant at 0·01 level using a chi square test for homogeneity.
** Significant at 0·05 level.

Table 4. Mean scale values for mood states for VDU operators and control groups.

	Mood states					
	Anxiety	Depression	Anger	Vigour	Fatigue	Confusion
Site (1)						
VDU	11·6	10·9	8·0	14·9	10·1*	7·0
Control	10·2	11·0	9·1	17·1	6·3	6·4
Site (2)						
VDU	8·7	8·8	8·8	16·8	6·4	5·6**
Control	6·5	7·2	7·1	16·0	5·5	4·0
Site (3)						
VDU	9·5**	9·4	8·7**	17·4	7·2	6·0*
Control	7·2	6·8	6·1	18·0	5·1	4·2
Norms for college students	13·5	14·0	9·7	15·6	10·6	11·0

* Significant at 0·01 level using a Wilcoxon Two Sample test.
** Significant at 0·05 level.

mental health status. Table 4 shows the mean values for each of the separate scales of the POMS for each site. For site (1), only the fatigue scale mean was higher for operators than controls. At site (2), operators showed more confusion than controls. At site (3), operators showed higher levels of anxiety, anger and confusion than controls.

3.3. *Health complaints*

Health complaints and disease states were collected using a self-report checklist. For the health complaints, the frequency of occurrence in the past year was recorded for 59 separate items, and for the disease states the presence or absence of a medical diagnosis in the past five years for 23 disease states was recorded. None of the disease states showed significant differences between the VDU operators and their controls at the three sites. Table 5 lists the health complaints for which there were significant differences between the VDU operators and control subjects for the various sites. As can be seen, a greater number of VDU operators than controls at site (1) reported the following health complaints: fever, eye strain, blurred vision, burning eyes, problems of colour perception, nervousness, fatigue, neck pain, neck pressure, neck pain into shoulder, sore shoulder, loss of arm strength, sore wrist, hand cramps, swollen muscles, numbness, pain in arms and legs, and pounding heart. At site (1), there were no health complaints for which control subjects reported more problems than operators.

Table 5. Percentage of VDU operators and control subjects with selected health complaints showing a significant effect†.

Health complaint	VDU	Control	Site
Eye strain	90	61	1
Eye strain	80	61	3
Blurred vision	75	52	1
Burning eyes	72	47	1
Irritated eyes	52	36	3
Colour perception	45	21	1
Fatigue	85	59	1
Irritability	79	41	2
Depression	64	26	2
Anxiety	56	21	2
Nervous	56	26	1
Neck pain	90	60	1
Sore shoulder	74	49	1
Sore shoulder	49	31	3
Pain in arms and legs	73	46	1
Neck pressure	67	39	1
Neck pain into shoulder	63	30	1
Swollen muscles	57	32	1
Sore wrist	57	19	1
Hand cramps	57	36	1
Numbness	54	25	1
Pounding heart	49	27	1
Loss of arm strength	42	18	1

† At 95% level of confidence or greater using a Wilcoxon Two Sample test.

For site (2), a greater number of VDU operators than controls reported the following health complaints: irritability, depression, and anxiety. None of the health complaints had a higher frequency for controls than VDU operators at site (2). At site (3), a greater number of VDU operators reported the following health complaints: eye strain, irritated eyes and sore shoulder. There were no health complaints that were more frequently reported by controls than VDU operators at site (3).

Differences in reporting of health complaints for VDU operators across the three sites were evaluated using a Kruskal Wallis test (Quade 1966). Of the 59 health complaints, 28 were significantly higher for the VDU operators at site (1) than for VDU operators at sites (2) and (3). These health complaints were spread across many ailments including respiratory, gastro-intestinal, musculoskeletal, visual, and psychological mood problems.

4. Discussion

Two issues stand out when examining the results of this study. First, all worker groups including control subjects reported high levels of psychosocial stress when measured against comparison worker groups examined in previous studies (Insel and Moos 1974, Caplan *et al.* 1975). Such elevated stress levels may account for the lack of clear-cut differences between operators and control subjects at two of the three sites studied. Secondly, job demands, in the form of task requirements, appear to be responsible for a significant portion of the job stress and health complaints of VDU operators independent of their use of VDUs. This is reflected by the much higher levels of both job stress and health complaints reported by the VDU operators at site (1) over the VDU operators at sites (2) and (3).

The heightened stress level for both operators and controls suggests that comparisons between the operators and controls may not be the most satisfactory means for evaluating the impact of VDUs on worker stress level and health complaints. Logical comparisons may also be made with other occupations previously studied (Caplan *et al.* 1975, Insel and Moos 1974). This could be necessary due to organizational factors such as strained employee/management relations, which could have produced a heightened stress level for all employees in the organizations being studied, thereby washing out the impact of the VDUs. While this factor was not measured, such strained relations may have been produced by difficult labour negotiations in progress at all the sites. At site (1), many of the control subjects were aware that they might lose their jobs by the end of the year due to a business slowdown, and that those who would be retained would have to become VDU operators. Also, at sites (2) and (3), many of the control subjects knew that they would be converting to VDUs within the next few months. These factors undoubtedly contributed to the elevated stress levels of the control subjects.

Even with the elevated stress levels, VDU operators at site (1) showed increased stress and heightened health complaints over their controls and other VDU operators at sites (2) and (3). This illustrates the extreme influence that the VDU operation at this facility had on these employees. If we examine only the results from site (1), then the conclusion to be drawn would be that the VDUs were the primary cause of the operators' problems, since the job tasks of the operators and controls were almost the same, except that the controls used pencil and paper rather than VDUs to carry out their tasks. However, comparison of VDU operators at site (1) with those at sites (2) and (3) shows even greater differences than between the site (1) operators and their controls, with higher stress and more health complaints for site (1) operators. This would suggest that the VDU usage cannot be the only source of the operators' problems and that job demands in the form of task requirements and task control were important interactive factors in producing operator stress and health complaints at site (1).

The majority of VDU operators at site (1) held jobs that involved rigid work procedures with high-production standards, constant pressure for performance, very little operator control over job tasks, and little identification with and satisfaction from the end-product of the work activity. The impact of these working conditions is reflected in their reporting of high work pressure and workload, fast work pace, and boring and repetitive work tasks as their major sources of stress. On the other hand, the majority of VDU operators at sites (2) and (3) held jobs that allowed for flexibility, control, autonomy, and a great deal of job satisfaction and pride in their end-product. While these jobs also had high-production demands and tight deadlines, the operators had a great deal of control over how these demands would be met, which was reflected in their lower level of complaints about their job demands. Such flexibility probably allowed these operators to choose work strategies individually for minimizing stress while meeting the job demands. The greatest stress problems for these operators revolved around career development and future job activities as opposed to the job task demands for VDU operators at site (1).

Job demand factors also appear to have had an influence on the type of health complaints of the VDU operators at the various sites. At site (1), the significant health complaints of VDU operators dealt mainly with visual problems and musculoskeletal problems. These findings are in agreement with previous studies of VDU operators (Gunnarsson and Östberg 1977, Hollar *et al.* 1975) except that the relative frequency of complaints is somewhat higher in this group than in the previous studies. At sites (2) and (3), job demands in the form of job future and career growth influenced the type of health complaints of the VDU operators. In contrast to the visual and musculoskeletal problems of operators at site (1), operators at these two sites displayed psychological problems such as anxiety and irritability.

Overall, the study results suggest that there is an interactive effect between the type of work activity and the use of VDUs that is related to the level and

type of stress and health complaints experienced by VDU operators. Ergonomic solutions that deal with the design of the work station and the VDU must be supplemented with proper job task design to maximize the protection of operator health.

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