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LEAVE TAKING AND OVERTIME BEHAVIOR AS RELATED TO DEMOGRAPHIC, HEALTH, AND JOB VARIABLES

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The Division of Occupational Medicine and Enviromental Health of NASA Headquarters is planning a NASA-wide study of the leave taking and overtime behavior pattern of its employees. It is anticipated that the relationships of demographic, health and job related variables to the various types and amounts of leave and overtime taken can be ascertained for each installation and the meaningful interrelationships studied.

Greater knowledge concerning leave taking behavior of employees is desired for at least the following reasons: 1) to detect administrative, job, and employee problems at an installation where leave taking behavior is associated with medical or psychological factors, 2) to determine the relationships between the types and amounts of leave and overtime taken and the physical condition of the employee, 3) to determine how periodic increases in an installation's work load with its concomitant stress is related to leave taking and, 4) to provide data for intra as well as inter installation comparisons of leave taking and overtime behavior as related to the demographic, health, and job variables of the employees.

Before attempting a broader study, it was deemed desirable to gather data on a single installation chosen to exemplify the major factors upon which leave taking behavior patterns may depend. From data gathered at the selected installation, a research model would be developed. The model would not only stipulate the precise variables for which data would be gathered but, when carefully scrutinized for omissions, redundancies, and needed modifications, would provide a valid design for future data collection, analysis, and interpretation. Although the generalizability of the results of the present study to other installations is risky, the design model produced in this investigation is valid for conducting intra-installation studies and thus obtaining basic data from which later inter-installation studies using a related comparative model can be made.

METHOD AND PROCEDURES

The installation chosen was one which undergoes periods of drastically increased activity associated with the performance of its primary mission. During these periods, which range from three to five exaggerated peaks per year, tension runs high, long hours of continuous work by certain personnel is demanded, and personal convenience and comfort are sacrificed

for the good of the mission. During the data collection phase of the present study, five of these work activity peaks occurred. (Figure 1)

As can be seen from Figure 1, the peaks of increased activity occurred at fairly separated intervals. Data were collected in relation to two of the selected peaks: the first and fourth. These two were selected because they occurred at two completely different times of the year and thus involve the sampling of two contrasting vacation periods, probably not equally desirable or utilized for the taking of annual leave. One of these peaks occurred in January, the other in July.

Although leave information was gathered throughout the year, data after December 17th were not used in any analysis because of the usual excessive use of annual leave during the latter part of each December.

The following dependent variables were ultimately selected and appropriate measurements obtained on them throughout the study. (Figure 2)

An attempt was made to obtain complete data on 51 subjects. For various reasons some items of data were missing on some of the subjects. When it was found that incomplete data existed on a subject for a particular comparison, he was excluded from the analysis. This resulted in the maximum number of subjects involved in any one statistical comparison being 48; the minimum number involved in any one comparison was 35.

The following charts not only further describe the sample of subjects used in the study but provide, as well, definitions of the independent variables hypothesized as being related to the overtime and leave taking dependent measurements.

Let us look more closely at these independent variables. (Figure 3)

Chart 4 shows the distribution of subjects by health rating. A rating of 2 indicates all functions and capacities were reported within normal limits; 1 indicates only non-permanent or correctable abnormalities reported, i.e., myopia, hernia, etc., 0 indicates one or more potentially incapacitating abnormalities reported, i.e., hypertension, heart disease, etc. Thus, the higher the health rating the better the health of the employee. Since those subjects receiving ratings of 2 or 1 were essentially healthy subjects, they were combined in the statistical analyses as a single group and contrasted with those subjects receiving a rating of 0. Composite health ratings were assigned to the subjects based upon independent judgments by a physician who used clinical criteria and by a bio-statistician who based his ratings on norms, projection tables and other statistical criteria. (Figure 4)

The distribution of subjects by age is presented in Figure 5. Mean age was 42 years, range 25 to 58 years. (Figure 5)

Figure 6 presents the distribution of subjects by sex. (Figure 6)

The distribution of subjects by GS grade is shown in Figure 7. The distribution is clearly dichotomous. The lower group was almost exclusively clerical. (Figure 7)

In Figure 8 the distribution of subjects by step level within grade is shown. The slightly positively skewed curve indicates that the bulk of the subjects were at the lower step levels, which are earned primarily through automatic increases. (Figure 8)

The distribution of subjects by time in months since last promotion is shown in Figure 9. The median number of months since last promotion was 35 with a range from 2 to 102 months. (Figure 9)

Figure 10 presents the distribution of types of jobs held by the subjects. Sixty-six percent of the sample were scientists, engineers or technicians; 13 percent were managers and, 21 percent were clerical. (Figure 10)

The distribution of length of total federal service of the subjects in months is shown in Figure 11. In terms of years, the mean total federal service was 17.3, and the range was from 1.5 to 36 years. (Figure 11)

Figure 12 presents the distribution of subjects by their educational level. Each subject's educational level was recorded in years with an individual being given one year credit for any graduate work past a Bachelor's degree, and two years' credit past a Bachelor's if he had been awarded a Master's degree. (Figure 12)

Figure 13 shows the number of dependents reported by the subjects. The mean number of dependents was 2.7, and the range was from 0 to 8. (Figure 13)

Distribution of office assignment is shown in Figure 14. It is to be noted that the spread of subjects throughout the various offices was essentially rectilinear. (Figure 14)

The demographic data comprising the independent variables were secured by means of questionnaires. A questionnaire was completed on each subject by a clerical helper who obtained the required information from the subject's personnel file.

Overtime, and annual, sick and compensatory leave times were obtained from time cards and were recorded as hours of leave taken.

The health rating for each individual was based upon the results of his most recent physical examination available.

RESULTS

The results of this study have been gathered to provide information concerning the following three problem areas: 1) the relationship of certain demographic and job variables to the health of the employee and to his use of overtime and leave, 2) the effects of peak periods of job stress on the overtime and leave taking behavior of employees, and 3) the identification of the characteristics of a model for conducting a NASA-wide study at the intra and inter installation levels to achieve the goals expressed above in items one and two.

Let us now examine the results obtained in this study as to their usefulness in meeting the above goals.

Figure 15 presents the independent variables which were found to be significantly related to the health of the employees. It is not surprising to note that those employees who took the most annual leave as well as sick leave were the ones who had the poorest health ratings. We know that annual leave is often substituted for sick leave and vice versa. Thus there is an acceptable rationale for the existence of the relationship between health and the use of annual and sick leave. What we did find that is of interest to occupational medicine is that the employees who had put in the most overtime were the ones who had the poorest health. (Figure 15)

It is possible, however, that the correlation between overtime and poor health might have occurred because of some third uncontrolled factor. Variables which might have been related to both the health and the overtime behavior of the employees could be statistically controlled by a partial correlation technique with the result that their effects on the correlation would thus be removed. As a basis for performing the partialling operations, all relationships were converted to equivalent, estimated Pearson coefficients of correlation (r). Since we have found a correlation between age and health ratings and between type of job and health rating it is possible that the correlation between overtime taken and health ratings was simply due to the older employees being the ones who filled certain types of jobs wherein their duties required that they work more overtime. Because older employees tend to have poorer health ratings, then the correlation between overtime and health ratings would be harmlessly explained away. When the effect of type of job was systematically removed from the correlation between overtime and health by a partialling technique the following results were achieved: using all type of subjects, i.e., clerical, technicians, managers, and scientists and engineers, the correlation between overtime and health rating dropped from significance at the .05 level to insignificance ($r = .13$). Eliminating the clerical workers from the data (these were all healthy young women) the correlation rose to .26. Eliminating the scientists and engineers as well as the

clerical workers and leaving only the managers and technicians the correlation between overtime and health rose to a significant .63. This trend would appear to indicate that among employees who function as technicians or managers, those who work the most overtime have the poorest health. This finding is in complete accord with other NASA studies which show that the health of the technicians, trades and crafts, and managers is poorer than the health of scientists and engineers. In fact, the incidence of cardiovascular disease is five times higher in the technicians, trades and crafts, and managers (ages 35-54) than it is in scientists and engineers. Is it possible that the results of the present study have revealed that large amounts of overtime adversely affect the health of the trades and crafts and managers but not the scientists and engineers, and that the unhealthy state of the trades and crafts, technicians, and managers as compared to scientists and engineers is due to the interactive effect of their type of job and the overtime they work in performing it?

A further interesting result along this line was the significant correlation yielded by the following analysis: the employees who worked overtime were divided into two groups on the basis of the health ratings. One was classified perfectly healthy and the second was classified as having a potentially disabling condition. Through the use of biserial correlation these groups were correlated with the amount of sick leave each group used. The data yielded a correlation of .52 ($P = .01$). This means that for people who worked overtime, sick persons use more sick leave than well persons, which is not surprising although it does indicate that sick leave is not completely abused. However, when equating all individuals on overtime, i.e., partialling out the effects of differences in overtime used, the correlation jumped to .56 ($P = .01$). This may be interpreted as supporting the hypothesis that the adverse effects of overtime on the health of employees is greater for those employees who are classified as having a potentially disabling condition than those who are classified as healthy.

The second area of interest in this study, i.e., the stress effects of peak periods of mission activity on the leave taking behavior of employees yielded the following results. (Figure 16) The overtime column reflects the peaks and valleys of activity. Annual leave is little used just prior to a launch and most used immediately after launch. Use of sick leave is at a low just prior to launch, increases immediately after launch, and continues to increase as time passes after a launch. Although the sick leave data are not statistically significant, (apparently due to the small number of subjects) the trend is unmistakeable in the direction noted. Thus, it appears that the pattern of sick leave use just before launch, just after launch and independent of launch differs from that for annual leave. Several hypotheses may be advanced to account for this, the most tenable perhaps being that the stress of the peak activity associated with a launch produces a steady increase in sick leave during the succeeding months while the effect on annual leave is simply an expected normal rises immediately after launch and throughout the succeeding months.

Let us now look at the present study as suggesting a model for the conduction of future NASA-wide studies of the same type. For an intra installation study, the present approach appears adequate in terms of the categorical information with which it deals. However, there are important questions which cannot be answered from the application of the model because of inadequacies within each category. Future research applying the general concept of the model employed in this study must consider the following necessary modifications:

1) The use of a large number of subjects is a necessity in research of this nature. Since one most often wishes to break down the total number of subjects into categories and then compare one category against another as to their relative degree of possession of some variable, the total number of subjects involved in the analysis is reduced to the sum of the number of subjects in each category dealt with, or in some analyses (such as tests of significance on correlated data) to one half this number. Thus the minimum total N in this type of research is, at best, equal to the sum of the desired N's in each category designated for future analyses.

2) When dealing with employees across such variables as type of job, age, grade, etc., one must be careful not to build gaps into his data. For instance, in the present study we found that type of job was significantly correlated with health. Under scrutiny we found this to be due in certain instances to the fact that the clerical jobs were mostly filled with young, healthy women while, for instance, managers were older and less healthy. The managers were not necessarily less healthy as a function of their type of job but rather because older persons tend to have more physical infirmities. Thus the gap in age between the two groups really accounted for the correlation between type of job and health rating in at least this one instance.

A further requirement in order for this model to operate fully is the need for more complete physical examination data. In the present study only one physical examination report was available for each individual. It is important that the results of at least two physical examinations including laboratory findings and separated by approximately one year be available for analysis if the job, demographic, and overtime and leave variables are to be related to <u>change</u> in health status.

This modified model when applied to a single installation is considered adequate to provide the basic data of use in making inter installation comparisions. Plans are now in process to apply the intra installation model to a second installation and thus make inter installation comparisons possible. As theresult of obtaining data in this second instance further reshaping of the research model, where necessary, will be undertaken before it is applied generally to other NASA installations.

FIGURE 1: PEAK PERIODS OF MISSION ACTIVITY DURING THE YEAR OF THE STUDY (ESTIMATED LEVELS)

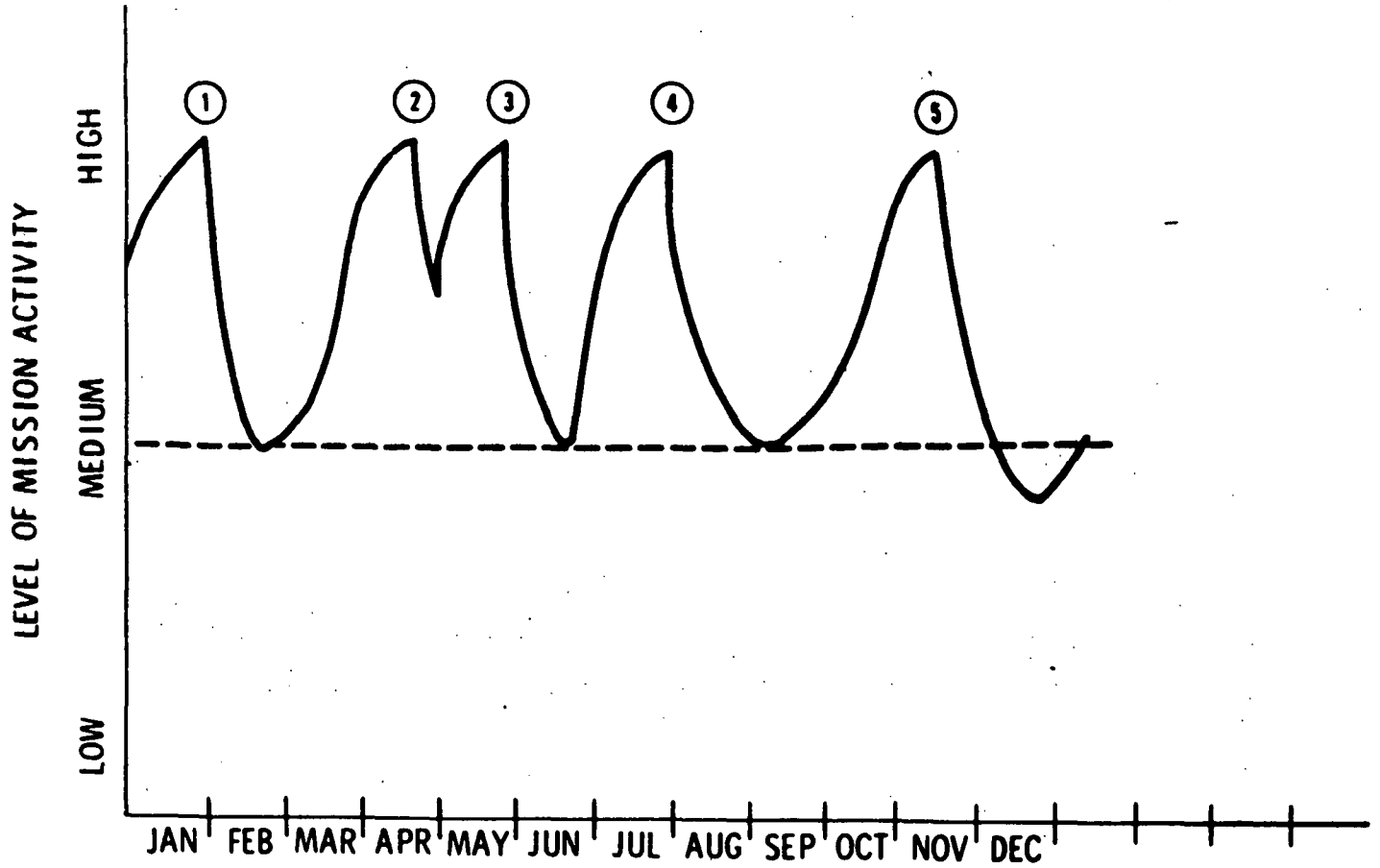

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FIGURE 2: DEPENDENT VARIABLES MEASURED IN THE STUDY

1) TOTAL COMPENSATORY LEAVE TAKEN DURING THE YEAR
2) TOTAL OVERTIME, ANNUAL LEAVE, AND SICK LEAVE, RESPECTIVELY, TAKEN DURING THE YEAR
3) NUMBER OF HOURS OF OVERTIME, ANNUAL LEAVE, AND SICK LEAVE (EACH TREATED SEPARATELY) TAKEN DURING OR JUST PRIOR TO A PERIOD OF PEAK MISSION ACTIVITY DURING JANUARY AND JULY, RESPECTIVELY, AND COMBINED AS AN AVERAGE
4) HOURS OF OVERTIME, ANNUAL LEAVE, AND SICK LEAVE (EACH TREATED SEPARATELY) TAKEN DURING THE PAY PERIOD IMMEDIATELY FOLLOWING A PERIOD OF PEAK MISSION ACTIVITY DURING JANUARY AND JULY, RESPECTIVELY, AND COMBINED AS AN AVERAGE
5) NUMBER OF HOURS OF OVERTIME, ANNUAL LEAVE, AND SICK LEAVE (EACH TREATED SEPARATELY) INDEPENDENT OF THE PERIODS DURING AND SURROUNDING PEAK MISSION ACTIVITY, TAKEN DURING THE SPRING AND FALL, RESPECTIVELY, AND COMBINED AS AN AVERAGE.

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(7)

FIGURE 3: INDEPENDENT VARIABLES INVESTIGATED IN THE STUDY

1) HEALTH RATING
2) AGE
3) SEX
4) GS GRADE
5) GS STEP LEVEL
6) TIME SINCE LAST PROMOTION
7) TYPE OF JOB
8) TIME WITH NASA
9) LENGTH OF TOTAL FEDERAL SERVICE
10) EDUCATIONAL LEVEL
11) NUMBER OF DEPENDENTS
12) OFFICE WITHIN WHICH ASSIGNED

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FIGURE 4: DISTRIBUTION OF SUBJECTS BY HEALTH RATING

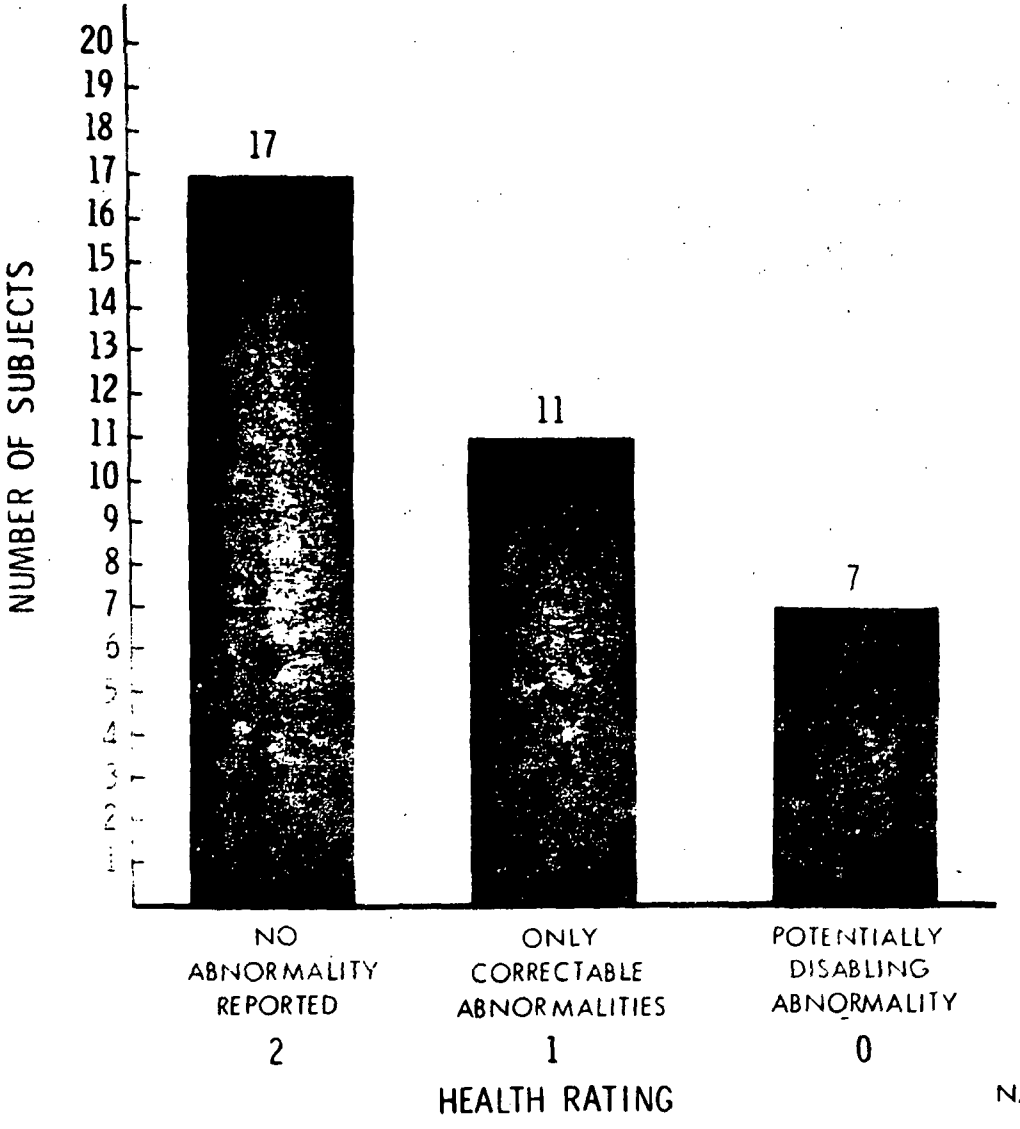

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FIGURE 5: DISTRIBUTION OF SUBJECTS BY AGE

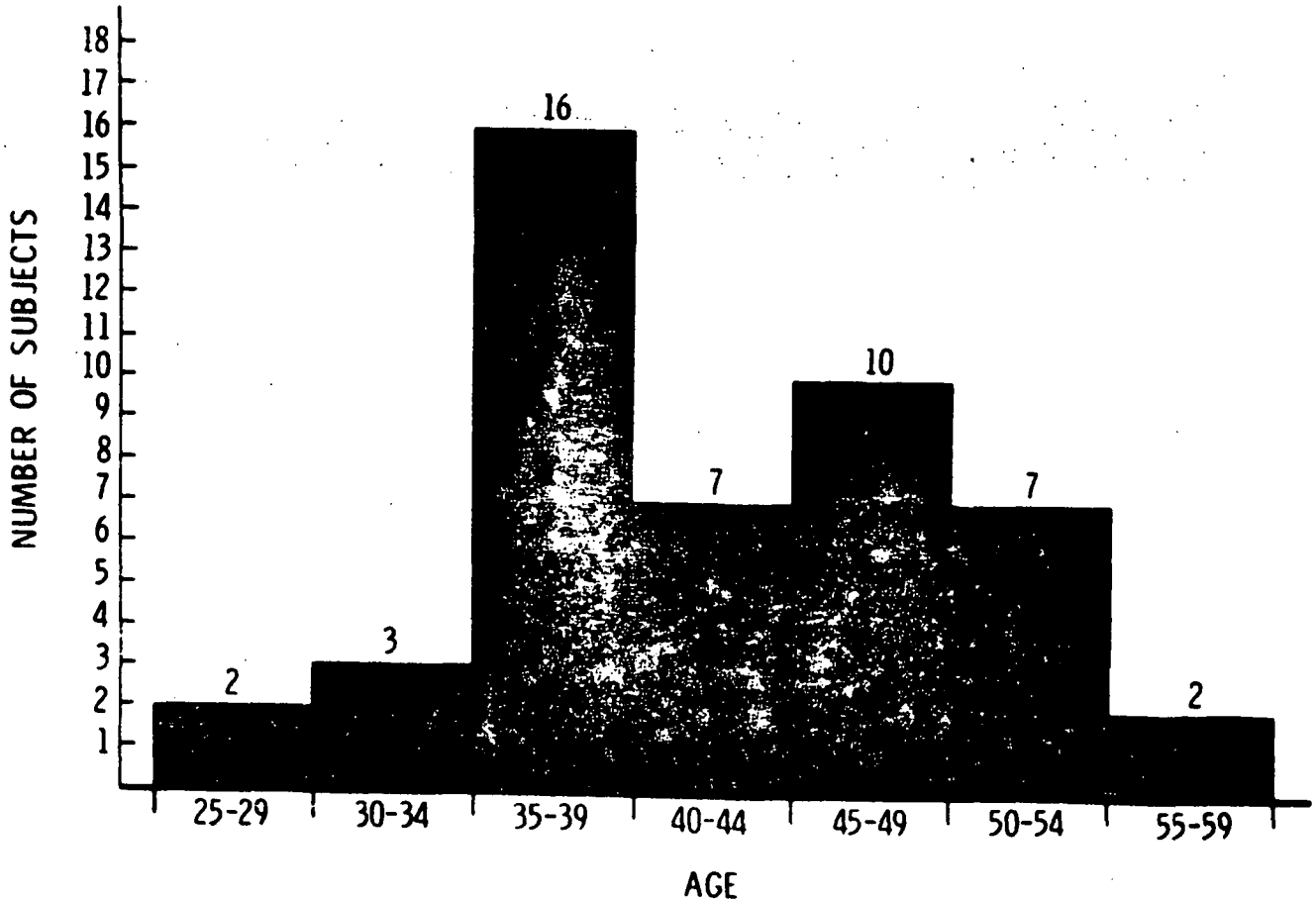

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FIGURE 6: DISTRIBUTION OF SUBJECTS BY SEX

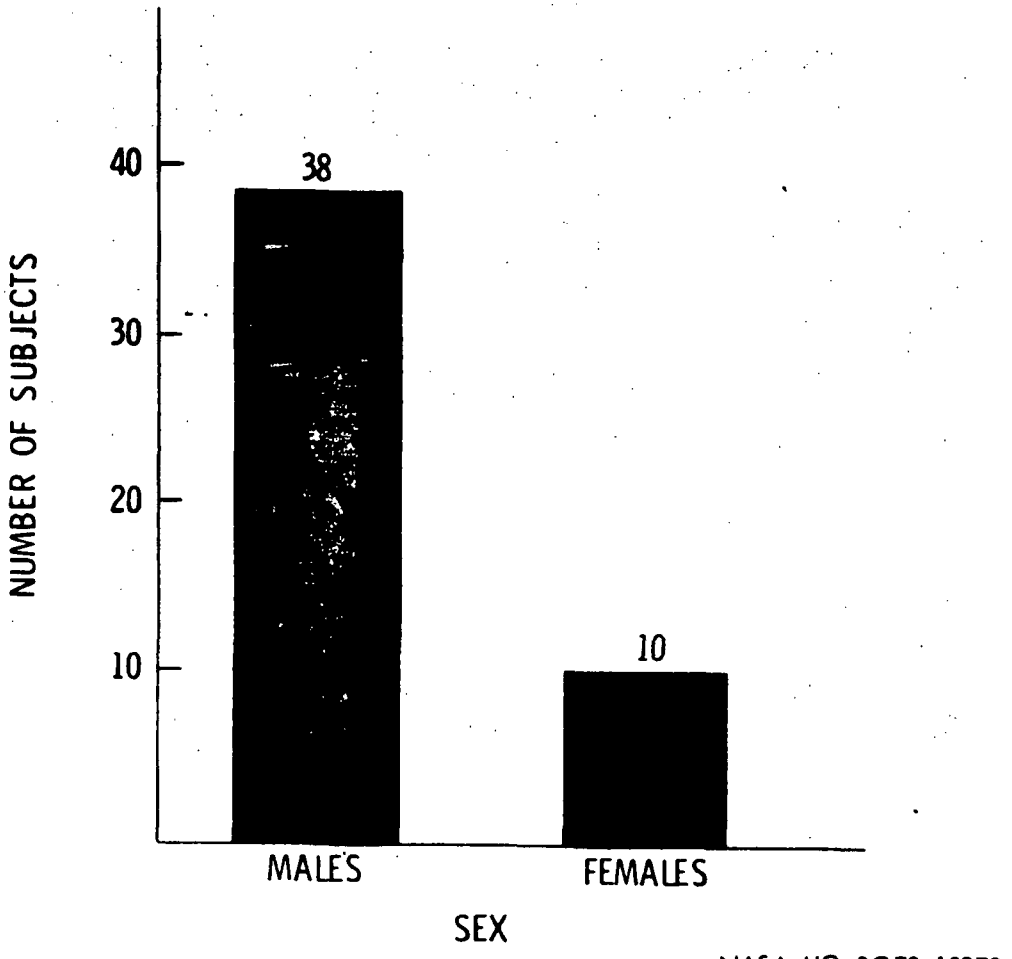

FIGURE 7: DISTRIBUTION OF SUBJECTS BY GS GRADE

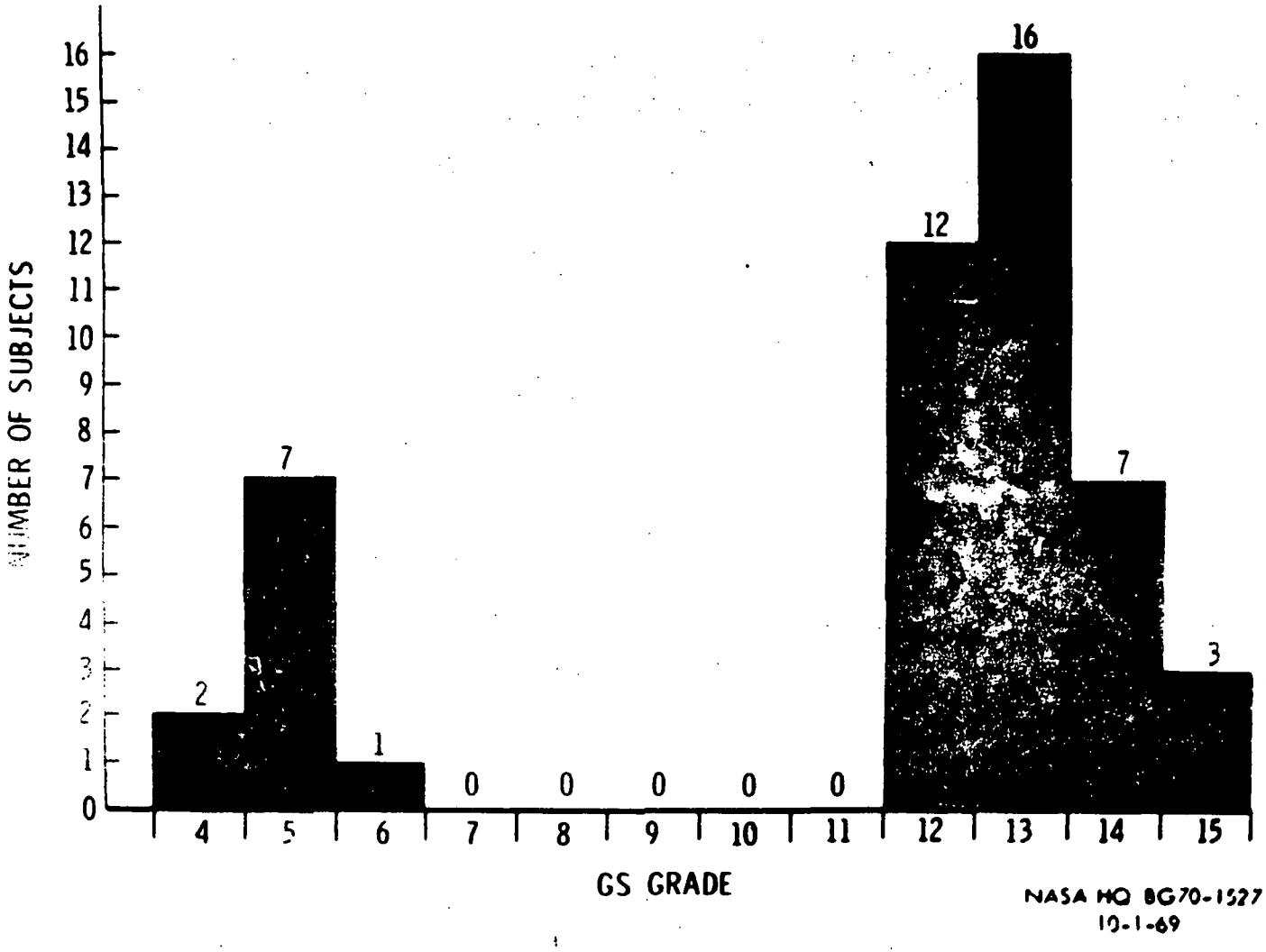

FIGURE 8: DISTRIBUTION OF SUBJECTS BY STEP LEVEL WITHIN GRADE

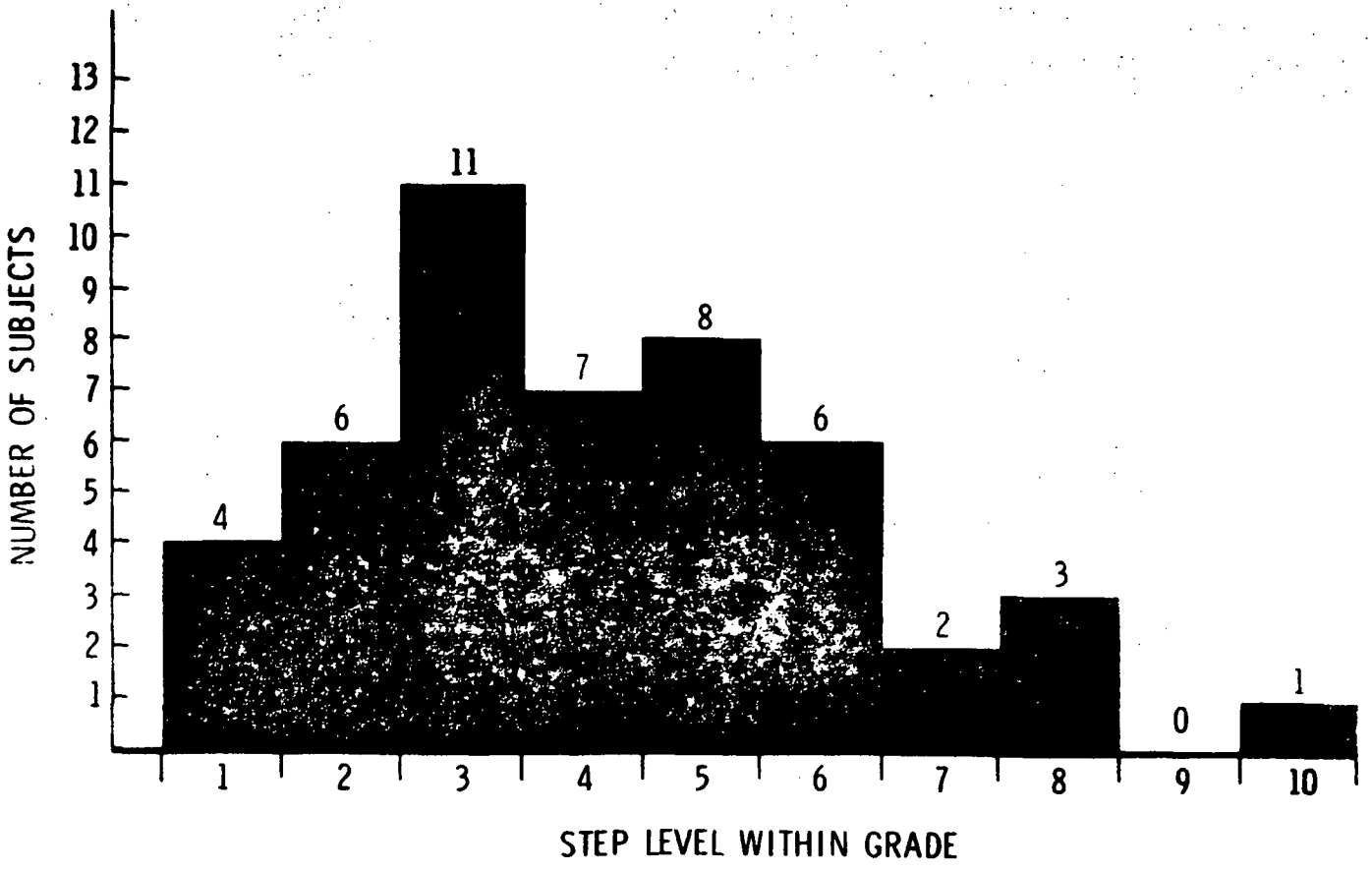

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FIGURE 9: DISTRIBUTION OF SUBJECTS BY TIME SINCE LAST PROMOTION

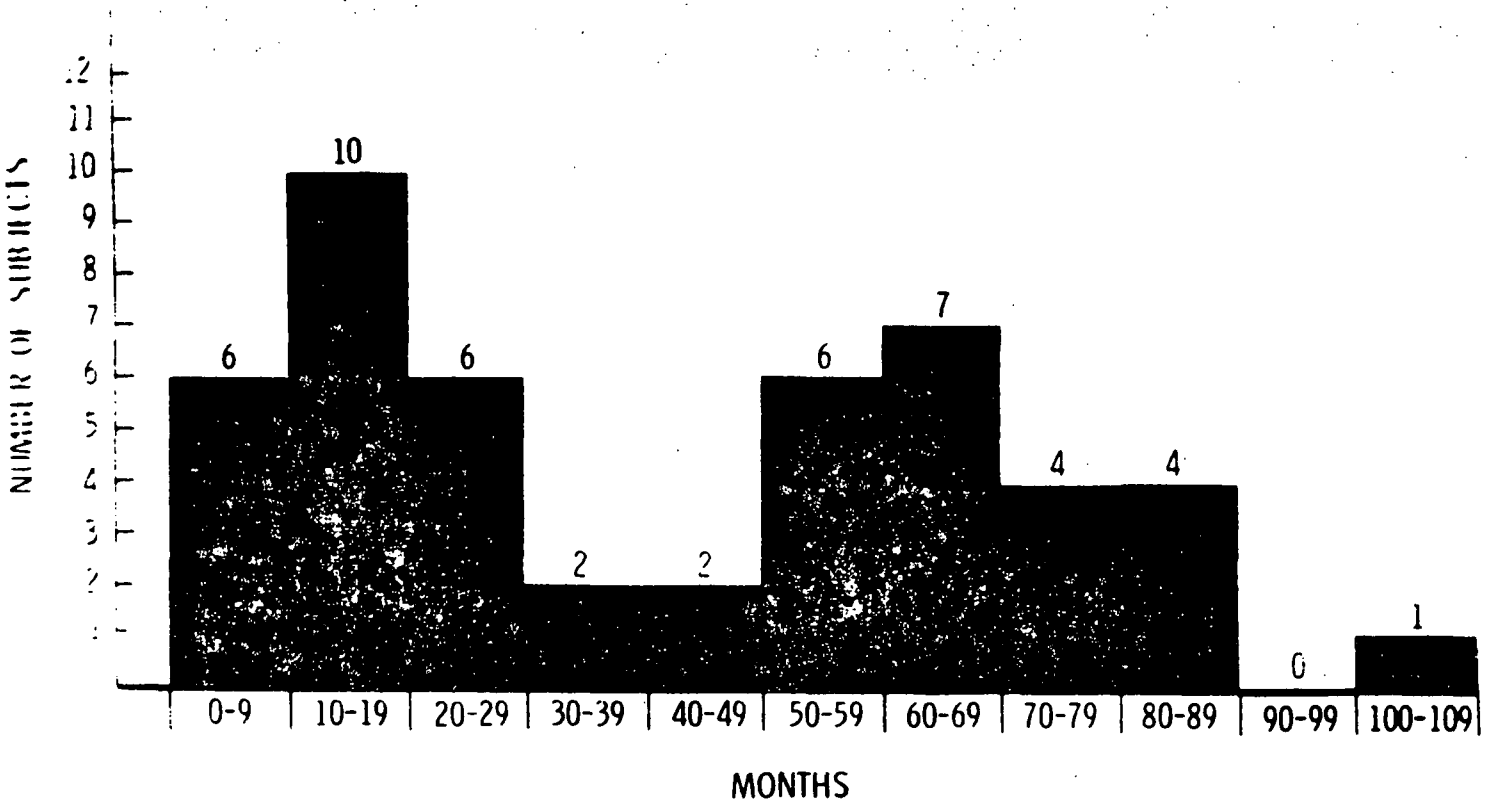

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FIGURE 10: DISTRIBUTION OF SUBJECTS BY TYPE OF JOB HELD

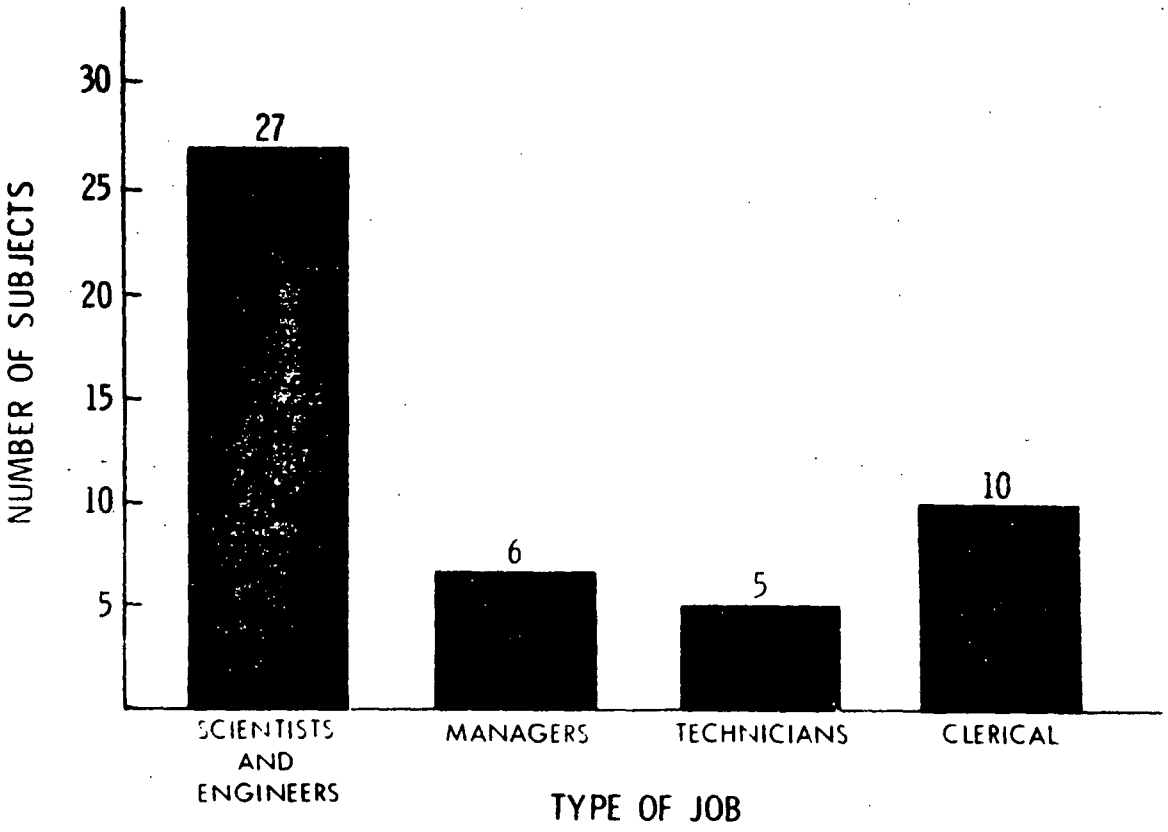

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FIGURE 11: DISTRIBUTION OF LENGTH OF TOTAL SERVICE OF THE SUBJECTS

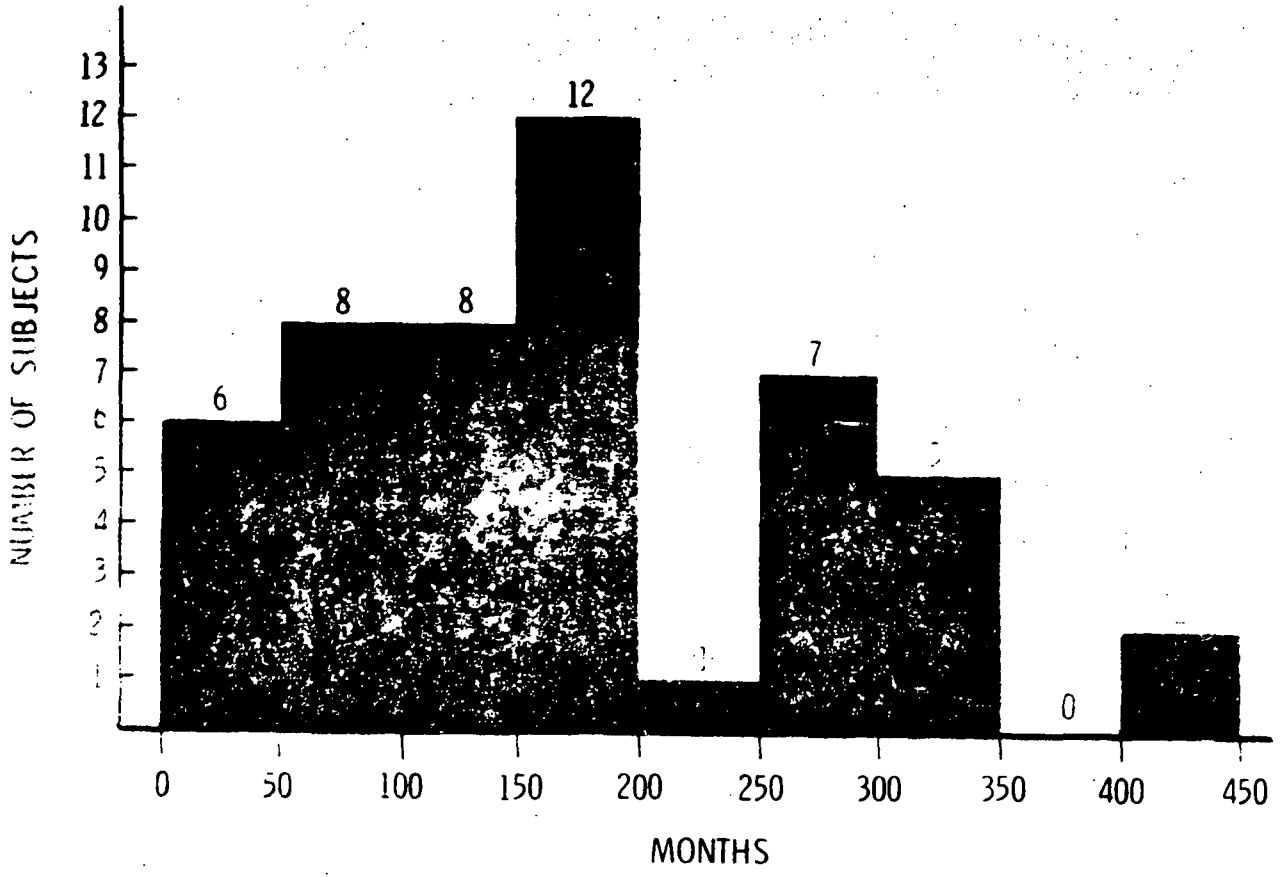

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FIGURE 12: DISTRIBUTION OF SUBJECTS BY EDUCATIONAL LEVEL

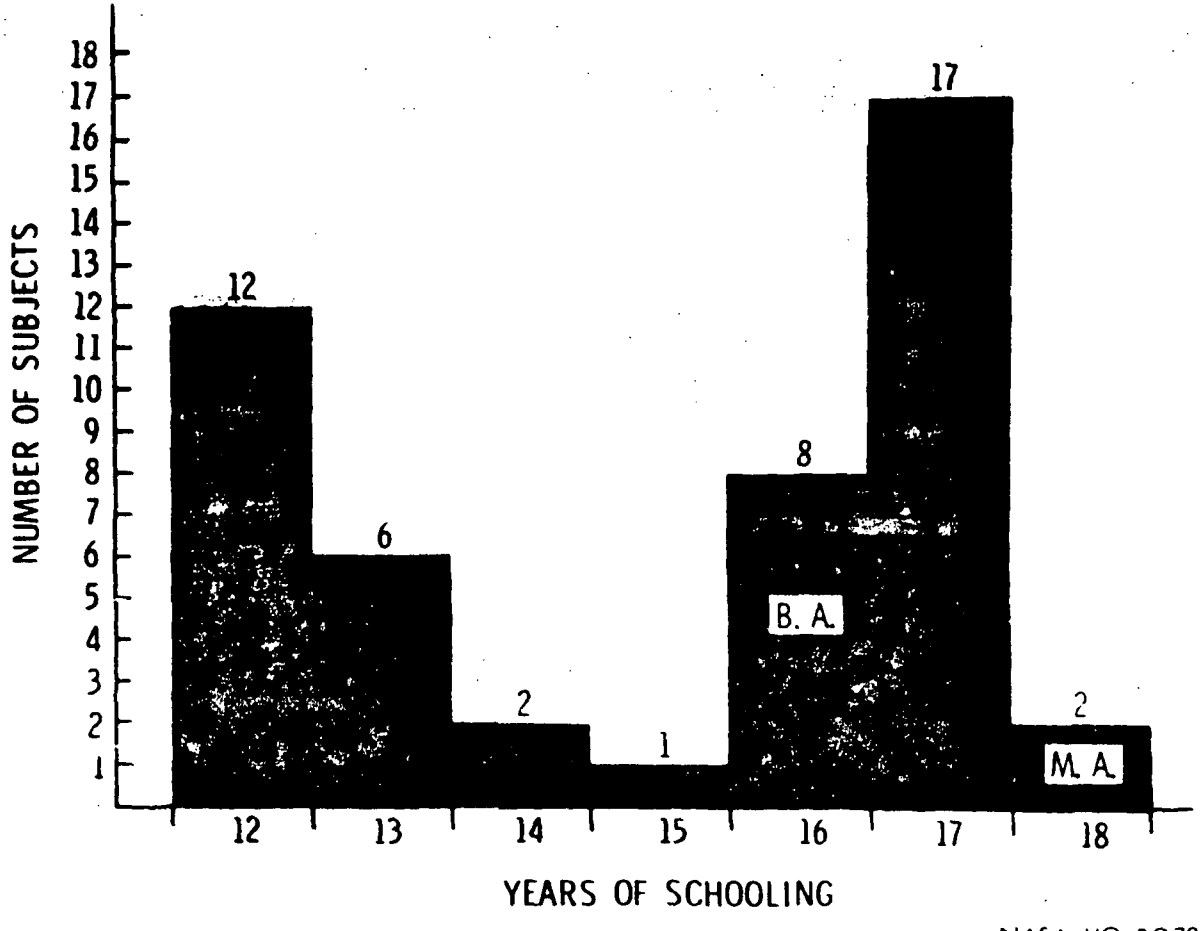

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FIGURE 13: NUMBER OF DEPENDENTS REPORTED BY SUBJECTS

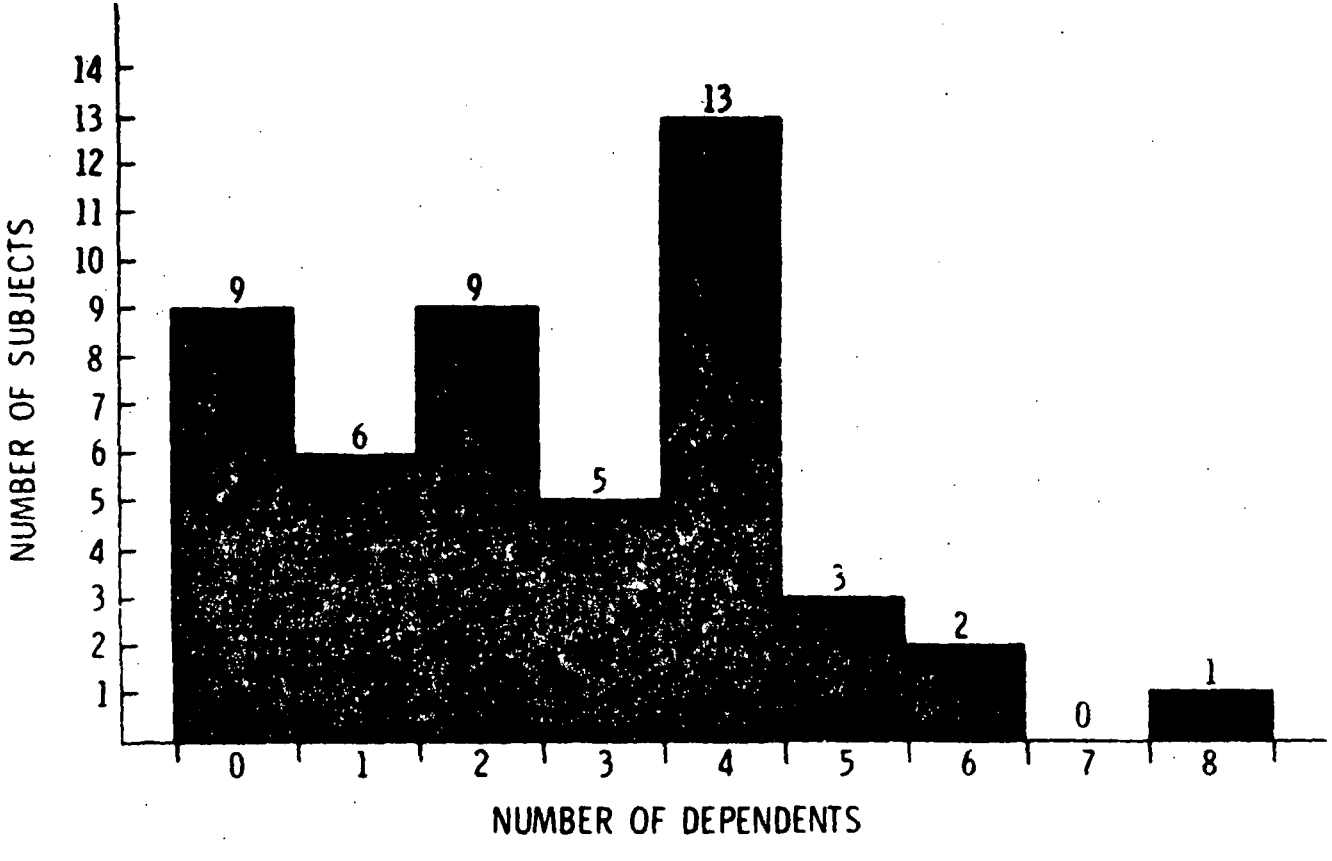

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FIGURE 14: DISTRIBUTION OF SUBJECTS BY OFFICE ASSIGNMENT

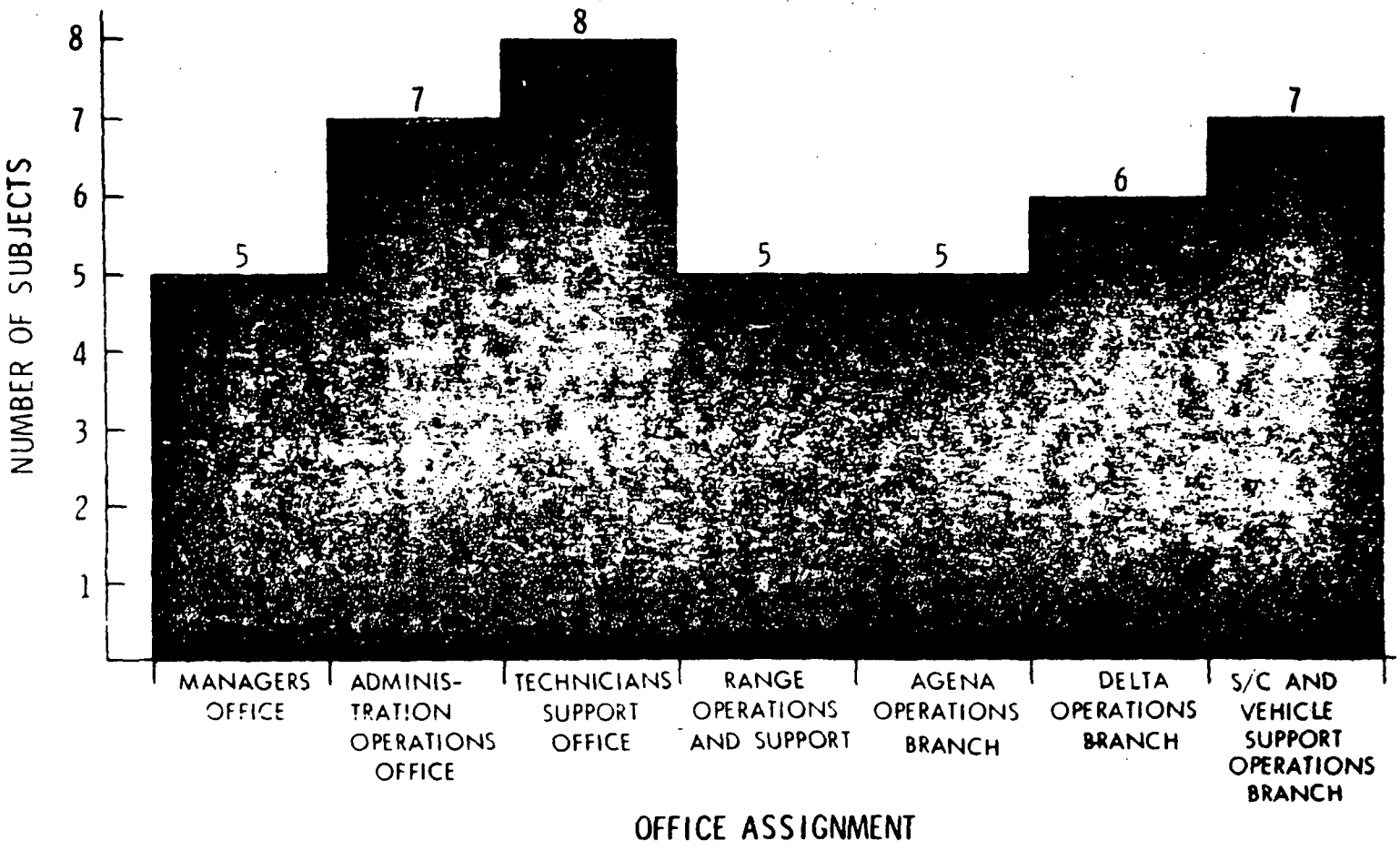

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FIGURE 15: CORRELATION BETWEEN HEALTH RATINGS AND CERTAIN RELEVANT VARIABLES UNDER STUDY

	HEALTH RATING	SIGNIFICANCE
YEAR'S TOTAL COMPENSATORY LEAVE	r = .11	NS
YEAR'S TOTAL OVERTIME	-.34	S(.01)
YEAR'S TOTAL ANNUAL LEAVE	-.40	S(.01)
YEAR'S TOTAL SICK LEAVE	-.44	S(.01)
AGE	-.62	S(.01)
SEX	*	*
GS GRADE	-.22	NS
GS STEP LEVEL	.25	NS
TIME SINCE LAST PROMOTION	-.03	NS
TYPE OF JOB	.47	S(.01)
TIME WITH NASA	-.04	NS
TIME WITH FEDERAL GOVERNMENT	-.66	S(.01)
EDUCATIONAL LEVEL	*	*
OFFICE WHERE WORKING	.02	NS

* POPULATION INAPPROPRIATE FOR ANALYSIS DUE TO ALL FEMALE EMPLOYEES HAVING BEST HEALTH, LOWEST EDUCATIONAL LEVELS, AND LOWEST LEVEL JOBS.

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FIGURE 16: OVERTIME AND LEAVE AS RELATED TO PERIODS OF PEAK (STRESS) AND LOW (NON-STRESS) MISSION ACTIVITY LEVELS

PAY PERIOD	MEAN TIME (HOURS)		
	OVERTIME	ANNUAL LEAVE	SICK LEAVE
JUST PRIOR TO LAUNCH	14.52	2.19	.93
IMMEDIATELY POST LAUNCH	.33	8.34	1.61
INDEPENDENT OF LAUNCH	.91	7.70	2.41

S(.05) — 2.19 vs 8.34

S(.01) — 2.19 vs 7.70

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