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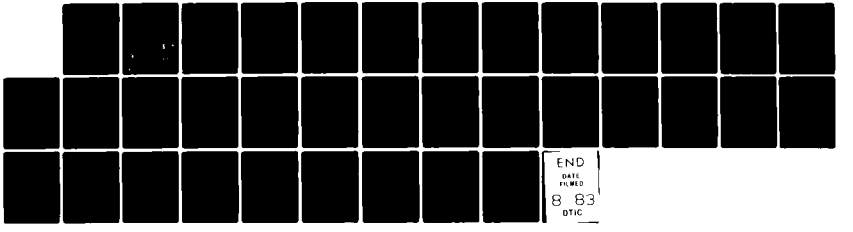

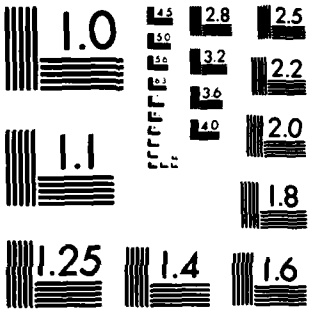

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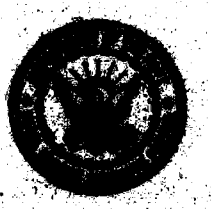

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NAVY COMPANY COMMANDERS: INTRODUCTION TO A PSYCHOBIOLOGICAL STUDY OF STRESS AND ADAPTATION*

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ABSTRACT

Navy company commanders, the senior enlisted men responsible for initial training of recruits, were selected for a longitudinal psychobiological study of occupational stress. Forty-six company commanders were followed over a six-month period while they completed schooling for this job and successfully trained their first company of recruits. Of these, 34 volunteered to be studied during their second company as well, thereby providing data pertinent to psychobiological adaptation to stress. The study design included assessments of psychological and physiological variables on two occasions during Company Commander School and on six separate days during each recruit training cycle. Study days were selected to represent a range of job stress. This report describes the study design and the biographical, personality, stress, and stress response measures employed. Stress responses were behavioral and physiological variables which presumably link stress to illness. Analyses confirmed that stress varied significantly and systematically over the recruit training cycles. This finding provides the background for future reports on behavioral and physiological responses, adaptation to repeated stress, and life history, social support, and personality variables which buffer or exacerbate the effects of job stress.

INTRODUCTION

Background

Humans' psychobiological adaptation to occupational demands is of concern to worker and employer alike. The abilities of man to adapt to a wide variety of job stresses result in sustained job performance and maintained worker health. The delineation of key psychological and biological mechanisms of such adaptation to job stress is a critical area for psychosomatic research (1-5).

Effective intervention programs designed to reduce the risk of illness secondary to insufficient adaptation to job stress require a model describing how stress develops, what are its short and long-term effects, and what can be done to alleviate both stress and its responses (6,7). Although theoretical formulations which exist indicate some agreement on various components of such a model, work remains to be done. Examples of further work needed include concise yet precise measurements of social support, psychological defense, and coping. Additional difficulties are that prior work generally utilized cross-sectional designs rather than longitudinal ones and often used indirect rather than direct measurements of job stress.

Addressing such objectives has resulted in the development of new research strategies in our own laboratory. Previously we studied self-selected groups of men exposed to extraordinarily stressful occupations, such as underwater demolition teams, deep sea divers, and fighter pilots (8-14). These groups were selected in the belief they would provide dramatic evidence for the effects of stress on man's psychobiology. In fact, early morning cortisol values in underwater demolition team trainees were seen to be substantially elevated over four

months of training (10). Also underwater swimmers and deep sea divers showed astounding serum uric acid elevations on the day prior to starting training (8). Although it was clear from this early work that severe job stress was capable of eliciting dramatic physiological responses from trainees, the generalizability of these results was questionable. Therefore, in the current investigation we selected a group of ordinary men facing periods of both low and high job stress, utilizing a repeated measures design. Such a design allowed us to investigate whether or not variations in stress levels were accompanied by correlated variations in psychological and/or physiological responses. Furthermore, this design allowed us to investigate adaptive patterns of psychobiological responses in persons exposed to repeated episodes of the same job stress experience.

This report is the first in a series concerning job stress in U.S. Navy company commanders. These men are the senior petty officers in charge of the basic military training of Navy recruits. A description of a company commander's job, along with a brief presentation of our research model and guiding hypotheses, follow below. This report also presents general descriptions of all measures employed along with results derived from our job stress instruments. The primary purpose of this paper is to present the conceptual and methodological background for the study and to demonstrate that the critical requirement of variation in stress levels was satisfied.

Company Commander: The Job and the Man

Over the course of an enlisted man's 20- to 30-year career in the Navy there is a fair chance he will be assigned a tour of duty as a recruit company commander (CC). This assignment routinely occurs at a time when the man has been away from recruit depots for 10-15 years. Previous investigation has shown that less than one-third of the men serving as CC actually volunteer

for this duty (15). Part of the reason for a reluctance to serve is that the men are not extensively trained for this particular leadership role. More importantly, long and arduous work hours are required to successfully lead a company of 60-70 recruits through their basic training (15). In nine weeks' time recruits are expected to master the full training manual.[1]

Company commanders must handle a wide variety of job stresses, from dealing with recruit learning difficulties to managing adolescent rebelliousness and home sickness. He must teach recruits from widely disparate educational backgrounds the nuances of military dress, vocabulary, and essential behaviors. The recruit training manual is spelled out in agonizing detail, with prescribed benchmarks to be achieved by selected phases of training. Most of the critical examinations and inspections take place over the first two to three weeks of training. During this first phase, the CC may work virtually around the clock. A CC is evaluated, in large part, on how well his recruits perform. This evaluation is at times augmented by CC' perceived lack of support from their battalion commanders. In addition to the foregoing, the CC' long work hours frequently affect their relationships at home.

After only a few weeks of orientation, a CC receives his first company. Upon completion of the training of that company he is given approximately one month off before receiving a second company. All job stresses are repeated with this second company. After succsssfully leading two companies of recruits, a CC is rotated to several months of light duty before returning to lead two

[1]Recruit training has since been shortened to eight weeks, and two CC are now assigned per company.

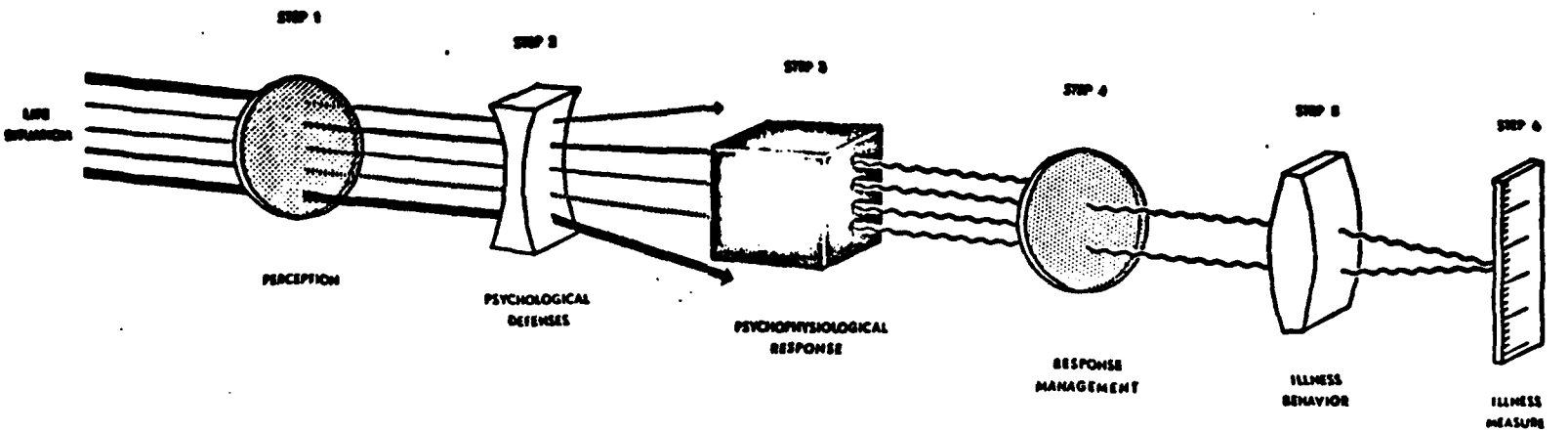

Figure 1. General research model.

variables. These collective nouns help to simplify discussion and facilitate the understanding of interrelationships between specific measures. A listing of the specific variables included in these five groups is presented below.

Stress indicators include those measures which correspond most closely to frequently used definitions of stress. The two common stress definitions are (a) stress as an environmental "force" impinging on the individual, and (b) stress as an internal psychobiological state arising from an interaction between environmental forces and salient attributes of the individual. In the present study, subjects' recent life changes and job stress ratings were used to estimate environmental forces affecting the person. Subjects' mood states were used as measures of their internal responses to these forces.

Stress tolerance factors consisted of individual attributes which are deemed to be relatively stable over time and influence individuals' responses to stress. Typically, these factors might be spoken of as "buffers" or "moderators" of stress effects. Stress tolerance factors can be social, psychological, or physiological in nature. Social attributes include social supports and social assets. Psychological factors include individual coping and defense characteristics. Physiological factors include genetic endowment and physical fitness.

Stress responses, frequently referred to as "strains," can be divided into at least two categories--behavioral responses and biological responses. Behavioral responses are actions such as drinking coffee or alcoholic beverages, smoking cigarettes, and so forth. Biological responses include heart rate, blood pressure, serum cortisol levels, serum uric acid levels, and so on.

Stress responses are also thought to have pathogenic potential. In other words, high levels of response, especially when extended over time, may lead to detrimental psychological and physical health outcomes. Health outcome is the focal variable of our research model (7).

With the relatively small sample size and limited time horizon of the present study, it was not feasible to observe health outcomes directly. Instead, we concentrated on behavioral and physiological respones to provide estimates of eventual health outcomes. We also included body symptom questionnaires and blood pressure measurements. Stress tolerance factors are also important in connection with health outcomes; if two people experience the same high level of stress, the one with less stress tolerance is presumed to be at greater risk for illness than the person with greater tolerance.

Research Hypotheses

Given the model presented in Figure 1 and the categorizations of variables listed above, the company commander study was designed to test the following hypotheses.

1. Job stress intensity will be reflected in the magnitude and the duration of selected physiological responses (e.g., serum cholesterol).
2. Persons with ample stress tolerance characteristics will show lower levels of psychological and physiological responses, with quicker recoveries of these responses, than persons with a paucity of stress tolerance characteristics.
3. Comparisons of CC' stress responses for their first recruit company with those of their second company will allow measurement of psychobiological adaptation to job stress.

4. Stress tolerance characteristics of CC should be positively related to measures of their psychobiological adaptation.
5. Men with pronounced psychobiological responses to stress will show negative health outcome estimates and impaired job performance.

These hypotheses were the central research issues behind the design of this project. Though this paper does not specifically address each of them, they identify our primary research concerns. Other questions to be addressed will become evident in our future reports. A major purpose of the current report is to demonstrate that the prerequisite of variation in job stress was indeed present.

METHODS

Participants

Sixty-four male senior petty officers, the complement of six consecutive classes of Company Commander School (CCS) at Naval Training Center, San Diego, volunteered to participate in the study. For various administrative reasons twelve of the original volunteers did not continue as company commanders during the course of this study; seven of these men were dropped from CCS for unsuitability. Six other men were relieved from duty while leading their first company. Although each of these six men were later followed through another company which they successfully led to completion, they were excluded from the primary analyses because their experiences were not entirely comparable to those who did not experience early failure. The remaining 46 successfully led their first company of recruits; 34 of these men were followed over their second

company as well. These 34 individuals comprised the sample for analyses of adaptation to job stress.

The 46 men who successfully led their first company had an average age of 33 (SD = 4) years. These men had 11.9 (SD = 1.2) years of education and 14 (SD = 4) years of active military service. Thirty-two were Caucasians, eight were black, and six were of other racial origins. Forty men were married, one was separated, three were divorced, and two had never married. These 46 men did not differ significantly on any demographic dimension from the 18 men who originally volunteered but did not continue throughout the study. Similarly, the 34 who were followed through their second company did not differ on any demographic dimension from the 12 who were not followed beyond one recruit company.

Selection of Study Days

A pilot study was conducted in order to select study days for high and low levels of job stress. During informal interviews with experienced company commanders, high agreement was reached in identifying training days markedly high or low in job stress. In addition, 127 experienced CC rated various training days for job-related "stress and strain" as well as "work load" using a five-point scale. Based on these data, two days during Company Commander School and six days during recruit training were selected. The first (CCS-1) and the last (CCS-2) days of Company Commander School were chosen for collecting baseline questionnaire and physiological measures on the men; these days had been rated as low stress days in our pilot studies. Each of the six study days during training is described below. Study days are preceded by Roman numerals I or II, indicating first or second training company.

Study Days:

CCS-1 The first day of Company Commander School which lasted six weeks. Physical fitness testing was given at a later time during the first week.

CCS-2 The last day of Company Commander School. All course work had been completed. An interval which averaged 46 days followed between graduation from CCS and the time a man received his first recruit company.

I-1 A few days prior to the formation of the company. It was a low stress, low work load day during which the company commander was "on hold" waiting for his new recruits. The possibility of anticipation stress existed.

I-2 The second day of recruit training and the first full day of high stress and high work load. The CC had received his recruits on the previous afternoon and probably worked late into the preceding night completing initial organizational tasks.

I-3 The 8th day of training. Recruits' first important evaluation which reflected the CC's effectiveness was imminent. A high stress, high work load day.

I-4 The 13th day of training. The company was due for an important inspection called "courtesy infantry evaluation." This was an important day for the CC; if his evaluation was substandard, he would be relieved from duty. A high stress, high work load day.

I-5 The 28th day of training, in the middle of "Service Week." During this week recruits provided needed services to the Training Command at large. Duties of the CC were relatively few at this time. It was often the first opportunity for the CC to relax since the start of training. A low stress, low work load day.

I-6 Near graduation, approximately nine weeks after the start of training. This final testing day was arranged to coincide with a second physical fitness testing session. This day was considered a low stress, low work load day.

II-1 to II-6 For those men who volunteered to be followed through a second company data collections were scheduled to take place on identical training days as in their first company. The average interval between the end of the first company and the beginning of the second was 30 days. No further physical fitness testing was carried out during the second company.

Data Collection

Due to considerable difficulties finding a suitable time for CC to be studied, each participant was met at his convenience in his work environment, usually between 7:00 a.m. and 12:00 noon. He was first weighed on a portable scale and then seated for approximately 2-5 minutes before a blood pressure was taken. Ten cc of venous blood (non-fasting) was drawn and then he completed questionnaires appropriate for that study day. After completion of the forms, with the person still seated, a second blood pressure was taken. This was standard procedure for most sessions except for the physical fitness testing sessions. All questionnaire and biological measures included in this study are summarized in Table 1. In line

with our research model, measures were grouped into five categories: stress indicators, stress tolerance factors, behavioral responses, biological responses, and health outcomes. Background, rationale, and reference data for these measures are summarized below.

[Insert Table 1 about here]

I. Stress Indicators

Our stress indicators were recent life changes, perceived job demands, and subjective mood states. The following questionnaires were used.

A. Recent Life Changes Questionnaire (RLCQ). Given: CCS-1, I-6, II-6. This questionnaire measures the incidence of recent life change events in the men's lives in the areas of health, work, family, and personal, social and financial adjustment. The questionnaire has been described in detail in previous communications (16, 17). In this study a modified version of the RLCQ was employed which allowed the men to indicate both recently experienced as well as anticipated life change events. Additionally, each man gave estimates as to the social desirability of events, along with his subjective estimates of the amount of life change and readjustment for items in the questionnaire.

B. Job Demands.

1. Stress/Strain and Work Load. Given: All study days except CCS-1. A self-rating questionnaire assessed CC' judgements of job stress and work load. Lay language was used to define stress and strain. Subjects rated stress/strain of their jobs on a five-point scale from "none" (1) to "extreme amount" (5). Work load was defined as hours spent at work plus the number of things to do, and was also rated by CC on a five-point scale from "not much to do" (1) to "too much to do (5).

TABLE 1

QUESTIONNAIRE AND BIOLOGICAL MEASURES AND THEIR COLLECTION SCHEDULES

	Study Days Collected
Stress Indicators	
Job Perceptions	
Stress/Strain and Work Load Questionnaire	All except CCS-1
Job-related Tension Index	II-5
Job Description Index	II-5
Recent Life Changes Questionnaire	CCS-1, I-6, II-6
Mood Questionnaire	All
Stress Tolerance Factors	
Stress Tolerance Questionnaire	1st Physical Fitness Test
Behavior Patterns Questionnaires	
Work, Striving, Time Urgency and Life Satisfactions Scale	I-5
Behavior Pattern Adjective Scale	I-5
Behavior Pattern Activity Scale	I-5
Jenkins Activity Survey	Post Study
Physical Fitness Profile[a]	Pre- and Post- 1st Company—see Text
Behavioral Response Measures	
Sleep Log	All
Coffee/Tea, Alcohol and Smoking Log	All
Exercise Log	All
Job Performance	Post Study
Biological Response Measures	
Cortisol	All
Testosterone	All
Cholesterol	All
Uric Acid	All
Dopamine-Beta-Hydroxylase	All
Pepsinogen I	All
Total Protein	All
Blood Pressure	All
Weight	All
Health Outcomes	
Cornell Medical Index	CCS-1, I-3, I-6, II-3, II-6
Current Medical Status	All except CCS-1

[a]The physical fitness profile included measurement of the following: Blood pressure, weight, height, percent body fat, heart rate, resting electrocardiogram, stress electrocardiogram, maximum oxygen consumption, forced expired air volume (1- and 3-second), forced vital capacity, maximum ventilatory volume, hand grip strength, abdominal strength, and lumbar flexibility.

2. Job Description Index (JDI). Given: II-5.

The JDI is a widely-used, 67-item questionnaire that measures satisfaction in five job areas: Work, Pay, Promotion, Supervision and Co-Workers. It was developed and validated by Smith, Kendall, and Hulin (18).

3. Job-related Tension Index (JRTI). Given: II-5.

This questionnaire was developed by Gurin, Veroff, and Feld and was used by Kahn, et al. in a national survey as a global measure of job tension and anxiety (19, 20). MacKinnon suggested four factor scales: Ambiguity in Interpersonal Relations, Work Load-Conflict, Overload-Self Competence, and Lack of Resources (21).

C. Mood Questionnaire (MQ). Given: All study days.

The MQ is a 40-item, three-choice response questionnaire used to measure state affect. The MQ has six factors: Depression, Anger, Fatigue, Fear, Happiness, and Activity (22). Subsequent work at this laboratory has shown good internal reliability and low repeat reliability for these factors, as would be expected of transitory mood states.

II. Stress Tolerance Factors

Stress tolerance measures consisted of biographical, social, psychological, and physiologicalvariables reported in the literature to affect individuals' stress responses as well as their illness susceptibilities (7). Measurement of these factors included:

A. Stress Tolerance Questionnaire. Given: First physical fitness test.

This questionnaire was constructed in our laboratory to gather biographical, family history, social, life satisfaction, psychological defenses, coping strategies, and illness behavior characteristics of an individual (7). The questionnaire is new and is still in an

exploratory stage of development.

B. Behavior Pattern Questionnaires

1. Work, Striving, Time Urgency and Life Satisfactions Scale. Given: I-5. This instrument briefly measures attributes shown to be related to risk of developing coronary heart disease (23).

2. Behavior Pattern Adjective Scale. Given: I-5.
This scale consists of 20 items selected from the Gough 300 Adjective Checklist. These items correlated with the Type A behavior pattern (interview) at a level of 0.50 in a sample of American male twins (24).

3. Behavior Pattern Activity Scale. Given: I-5.
This scale consists of items from the Thurstone Temperament Schedule which correlated with Type A behavior pattern (interview) at a level of 0.37 in the study mentioned in II, B, 2.

4. Jenkins Activity Survey (JAS). Given: Post Study. The JAS was developed as a pencil-paper measure of Type A behavior pattern (25). This survey was administered as a mail-out questionnaire after completion of primary data collection.

C. Physical Fitness Testing. Given first week of CCS and I-6.
Since many of the rigors of leading recruits were physical ones, overall physical fitness of CC was considered an important (coping) factor in their ability to deal with job demands. A battery of fitness tests included height, weight, estimated percent body fat, heart rate, resting and stress electrocardiograms, estimated maximum oxygen consumption, forced expired air volume, hand grip strength, abdominal strength, and lumbar flexibility.

III. Behavioral Responses

A. Sleep Log. Given: All study days.

This questionnaire queried participants as to the quantity and quality of their sleep over the past 24 hours. Items used were similar to those developed by Hartman and Cantrell (26).

B. Coffee/Tea, Alcohol, and Smoking Log. Given: All study days. Participants were asked to estimate their weekly consumption of coffee/tea and alcohol prior to CCS and for various intervals throughout the study. On each study day men also were asked to estimate the average number of cigarettes, cigars, and/or pipefuls of tobacco they smoked.

C. Exercise Log. Given: All study days.

Participants (retrospectively) estimated their weekly exercise throughout the study. They were asked specifically about running, swimming, bicycling, playing racquet sports, weight lifting and/or calisthenics.

D. Job Performance. Three general indicators were used: CC grades and class standing in CCS; their performance marks for each company, and supervisors' ratings of the men.

IV. Biological Responses

Blood pressure, weight, and blood samples were taken on all study days. Due to collections made in the field, tubes of blood sometimes remained at ambient temperatures for 2-3 hours. Subsequent to centrifugation serum was extracted and frozen at -70C until the time of analysis. Determinations made from these serum samples were:

A. Cortisol. This hormone was measured by a radioimmunoassay using the method and antibody (anticortisol-21-thyroglobulin) of Miles Research Products. (1,2,6,7-H) cortisol (82 curies per millimole) was purchased from Amersham Corporation for standards. All samples for a given man were run in the same assay.

B. Testosterone. This hormone was measured using the method described by Odell, Swerdloff, Bain, et al., with the modification that the preparatory column chromatographic step was not performed. Therefore, both testosterone and dihydrotestosterone were measured (27). All samples from a given man were run in the same assay.

C. Cholesterol. Total serum cholesterol was measured by adding 0.013 milliliters of serum to 1.30 milliliters of "A-Gent" cholesterol reagent (Abbott Laboratories). Incubation was described by Abbott, and absorbance of standard and tests was measured at 500 nanometers.

D. Uric Acid. Phosphotungstate reagent (American Monitor) with a uricase-treated blank for each test was used to measure uric acid. The procedure followed was that described by the American Monitor, except that volumes were reduced by 50 percent of those given. Absorbance was measured at 750 nanometers.

E. Dopamine-Beta-Hydroxylase. This enzyme was measured using the procedure of Nagatsu and Udenfriend, with a minor modification which will be described in a future report (28). Absorbance was read at 330 nanometers.

F. Pepsinogen I. The concentration of pepsinogen I was determined by a competitive binding, double antibody radioimmunoassay, as described by Samloff and Liebman (29). The standard used was isolated from gastric mucosa and was 1.75 times more immunoreactive than the original standard (isolated from urine). Consequently, the normal range, previously 50 to 175 nanograms per milliliter, was 28 to 100 nanograms per milliliter.

G. Total Protein. Serum samples (0.020 milliliters) were assayed using a biuret reaction. A Bausch and Lomb 400-4 automated spectrophotometric

system was used and absorbance was measured at 545 nanometers.

V. Health Outcomes

A. Cornell Medical Index-Health Questionnaire (CMI) Given: CCS-1, I-3, I-6, II-3, II-6. This standardized illness symptom questionnaire was developed in 1949 to aid physicians in documenting patients' past medical and psychiatric histories (30). It served in the present study both as a diagnostic instrument of the men's previous illness symptomatologies as well as an assessment of new symptoms developed over the course of observation.

B. Current Medical Status (CMS). Given: All study days, except CCS-1. This questionnaire is a brief inventory of commonly experienced physical symptoms, as well as frequently-taken medications.

Statistical Procedures

The sample was divided into age-matched halves to provide cross-validation of significant trends. Matching was based on age because several of the biological variables change with age. The matching procedure first ranked the men according to age, then took pairs in order from the resulting list (i.e., the first and second men, the third and fourth, etc.). One member from each pair was randomly assigned to each of the analysis groups. This procedure produced two groups of 23 men who successfully completed their first training company. Seventeen of the men in each group were followed through two training companies. These age-matched groups provide the "Groups" factor in the analyses of variance that follow.

Two analysis of variance procedures were used to establish patterns of stress and pattern consistency across training companies. The first procedure was designed to compare the study days in the recruit training schedule to the nominal base line of the Company Commander School days. This ANOVA was a 2 x 8 "Groups x Days" analysis with repeated measures on the "Days" factor (31). The 8 days in the analysis included the two days of CCS and the six study days of the first training company. Because only data from the first training company were used, there were 23 men in each group.

The second ANOVA was designed to demonstrate the consistency of the pattern of stress during the first and second training companies. This involved a 2 x 2 x 6 "Groups x Companies x Days" split-plot design with repeated measures on both "Companies" and "Days" (32). The "Groups" in this analysis consisted of the 17 men in each of the age-matched halves who completed two training companies. "Days" were limited to the 6 study days for each company.

Each ANOVA procedure was run separately for Stress/Strain, Work Load, and all six MQ scales. The ANOVA procedures show whether the stress indicators vary significantly across the study days. They do not indicate whether the pattern of variation is similar for all indicators. For this reason, Kendall's coefficient of concordance (W) was computed to compare the patterns of variation in daily means for the different stress indicators (33, 34). The sole purpose of this analysis was to establish the extent of agreement among the stress indicators concerning the patterning of stress across days. If there is significant agreement, it is reasonable to speak of <u>the</u> pattern of stress; if there is no agreement, it would be necessary to speak of various patterns of stress for the individual stress indicators.

RESULTS

Stress Variability across Days

The variability of stress across study days was investigated for both the 46 men followed over one company (Table 2) and the 34 men studied for two companies (Table 3). Each stress indicator showed a significant "Days" effect in both analyses. This effect was particularly strong for

[Insert Tables 2 and 3 about here]

the Stress/Strain and Work Load indicators. Post hoc comparison of the first company means indicated that there were two primary levels of stress. Study days I-2, I-3, and I-4 in the training cycle were relatively high stress while the remaining days, including CCS-1 and CCS-2, were low stress. The ordering of days from highest to lowest stress was generally consistent across all the stress indicators. When the mean daily stress levels were rank ordered for each indicator, the resulting coefficient of concordance for all eight indicators was $W = .851$ ($p<.001$). During the second company, the pattern of means was generally consistent with that observed during the first company and the coefficient of concordance for the six study days during the second company was $W = .830$ ($p<.001$). Therefore, study days can be divided into two primary stress levels that are consistently identified by all the stress indicators. The pattern of stress considered across both companies is illustrated in Figure 2.

[Insert Figure 2 about here]

TABLE 2

COMPARISONS OF THE STRESS INDICATORS ACROSS STUDY DAYS DURING COMPANY COMMANDER SCHOOL AND THE FIRST TRAINING COMPANY

	Percent of Variance Accounted for by:		
	Groups	*Days*	*Groups X Days*
Work Load	.6	55.3**	.3
Stress/Strain	.3	38.4**	.6
Activity	.0	3.5	2.2
Anger	.5	12.2**	.6
Depression	.0	9.6*	.5
Fatigue	.4	11.7**	.9
Fear	1.0	12.2**	1.5
Happiness	1.2	11.7**	.5

* $p < .05$
** $p < .01$

NOTE: Results are from the "Groups X Days" ANOVA (see Methods). Conservative degrees of freedom (df = 1, 44) were used to determine significance (cf., 31, p. 123).

TABLE 3

COMPARISONS OF THE STRESS INDICATORS ACROSS THE FIRST AND SECOND COMPANIES

	Percent of Variance Accounted for by:		
	Companies	*Days*	*Companies X Days*
Work Load	.2	52.0**	.5
Stress/Strain	.3	42.5**	.7
Activity	.1	3.4*	.8
Anger	1.1**	12.7**	.5
Depression	.9*	8.4**	1.8
Fatigue	1.3*	13.5**	.7
Fear	4.5**	8.1**	2.6
Happiness	.1	7.9**	.7

* $p < .05$
** $p < .01$

NOTE: Results are from the "Groups X Companies X Days" ANOVA (see Methods). Conservative degrees of freedom (df = 1, 32) were used to determine significance (cf., 31, p. 123). Effects of "Groups" were eliminated from this table because none were significant.

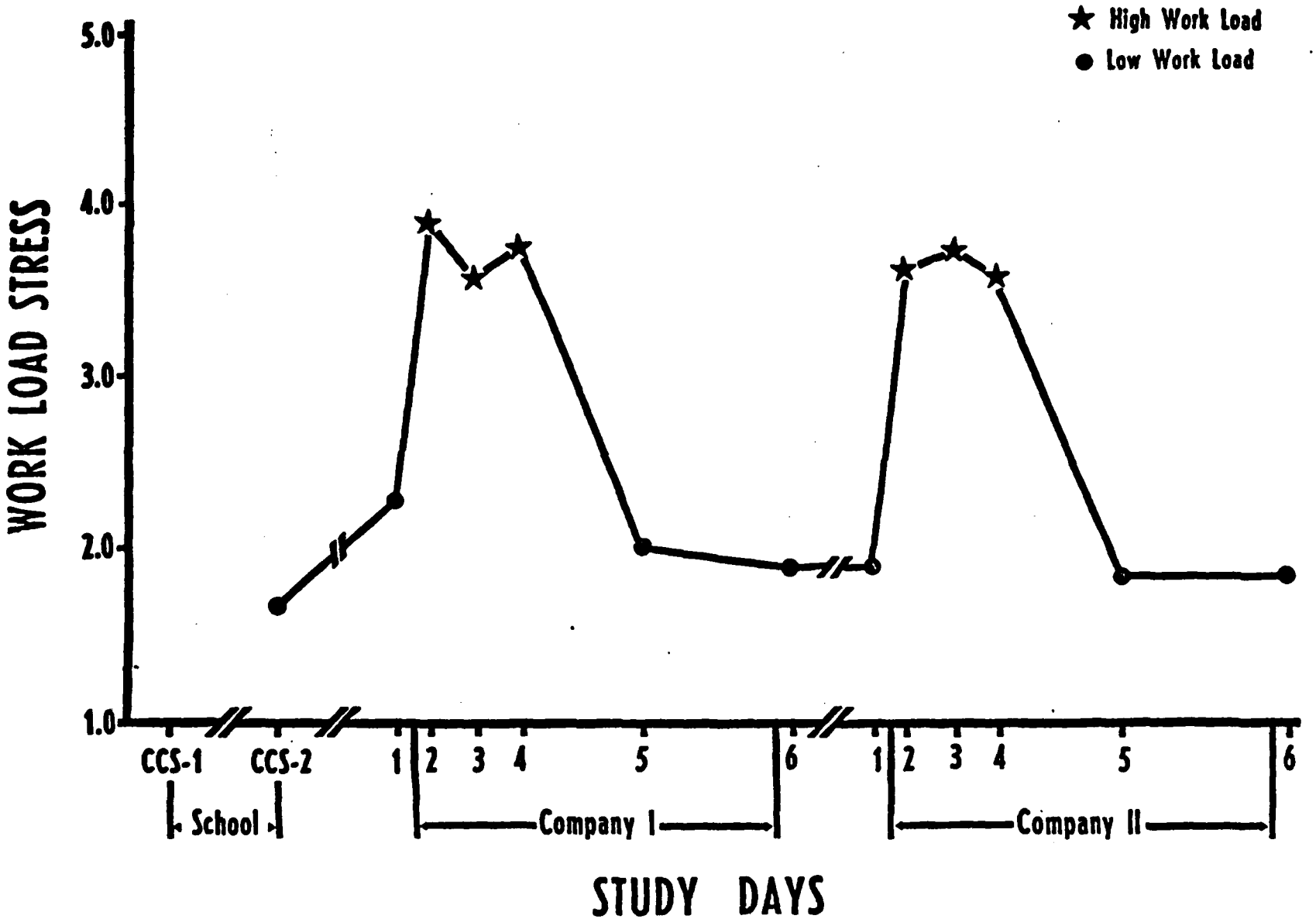

Figure 2. Work load: An example of the pattern of variation in stress across study days.

Stress Variability Across Companies

The "Groups x Companies x Days" ANOVA tested the stability of the pattern of job stress across the two training companies for the 34 men studied twice. As shown in Table 4, the lack of significant effects due to "Companies" indicated that mean levels of Work Load and Stress/Strain did not vary significantly between the two companies. In contrast, negative affect decreased during the second company. There were no significant interactions between companies and days. Thus, the observed differences between companies applied equally to all the training days studied.

[Place Table 4 about here]

DISCUSSION

As pointed out in the introduction, Navy company commanders were selected for this job stress study because they represented ordinary men in a job characterized by intervals of extraordinary stress. Variables selected for study were chosen to extend prior work done in more specialized populations; results from CC should, therefore, have more general application. The study design included both longitudinal assessments of stress indicators and behavioral and biological responses and cross-sectional measurement of psychological defenses and coping behaviors, social supports, and life history variables which could affect persons' stress tolerance.

As this study was designed to focus on the measurement of responses to varying degrees of job stress, it was critical to demonstrate that job stress, in fact, varied across study days. As Mason has pointed out, many investigations simply assume the existence of variation in stress (6). In the present

TABLE 4

MEAN VALUES FOR THE STRESS INDICATORS DURING THE TRAINING COMPANIES (N = 34)

	Company	Study Day[a] 1	2	3	4	5	6	Company Mean
Work Load	I	2.27	3.91	3.56	3.74	2.00	1.88	2.89
	II	1.91	3.62	3.74	3.56	1.83	1.85	2.75
Stress/Strain	I	2.21	3.30	3.45	3.62	1.88	1.85	2.72
	II	1.74	3.48	3.47	3.45	1.80	1.57	2.58
Activity	I	14.27	13.56	14.12	14.18	15.59	14.86	14.43
	II	14.89	13.95	14.38	13.91	14.74	15.42	14.55
Anger	I	6.77	7.79	8.80	8.47	6.71	6.79	7.55
	II	6.48	7.15	7.82	8.18	6.71	6.40	7.12[b]
Depression	I	6.56	7.18	7.62	7.77	6.27	6.33	6.95
	II	6.39	6.62	6.70	7.39	6.56	6.34	6.67[b]
Fatigue	I	5.97	8.12	7.62	7.37	5.97	6.62	6.74
	II	5.83	7.41	6.94	7.04	5.97	5.67	6.49[b]
Fear	I	7.79	8.15	7.65	7.59	6.35	6.47	7.33
	II	6.53	6.86	6.91	7.00	6.47	6.22	6.66[b]
Happiness	I	16.65	15.12	15.74	14.76	17.59	17.76	16.27
	II	16.68	15.65	15.88	15.79	16.71	18.03	16.48

[a]The mean values for each of the eight stress indicators differed significantly across days.
[b]The mean value for Company II is significantly ($p < .05$) less than the mean value for Company I.

study, a number of different variables were measured to provide both environmental and subjective indications of stress. The analyses in this paper have dealt specifically with variation in these stress indicators. Results indicated that CC stress indicators clearly varied across the days studied.

Further analysis showed a pattern of stress over days. This pattern reflected essentially two levels of stress; three days in each company were high stress days and three were low stress days. As high stress days came in a block, the result was an A-B-A-B-A quasi-experimental design (see Figure 2).

The emergence of this pattern of stress provided a major advantage for testing our hypotheses. This advantage was the good internal validity associated with introducing the quasi-experimental manipulation (i.e., the high stress period) twice (35). This provided a chance to verify stress effects and allowed us to investigate the hypothesis that adaptation to stress would occur. However, the approximation to a laboratory experiment is limited as a number of uncontrolled factors may well confound the high-low stress distinction.

A word is in order about our definitions of stress. Environmental definitions conceive of stresses as forces impinging upon the person, emanating from physical and/or social environmental conditions. "Internal state" definitions of stress point out that such an environmental force approach overlooks individual response differences (36,37). The internal state stress definition results from an interaction between environmental forces and salient attributes of the individual (38). Work Load and Stress/Strain measures in our study have attributes of the environmental forces definition of stress. CC duties are spelled out in detail in the recruit training manual; work expectations are minutely clear and are identical across training companies. Thus, measures reflecting these performance expectations should vary from day to day but be

highly consistent for equivalent days across training companies. In addition, it might well be assumed that all CC have identical role demands. Systematic differences between individuals should, therefore, have little impact. Work Load and Stress/Strain showed distinct variation across days, stability across companies, and exceptional interindividual agreement in ratings. These findings are consistent with using an environmental force definition of stress in this study.

Mood variables, on the other hand, have properties consistent with an internal state definition of stress. Internal state is a function of both the individual and the environment. As such, internal state would be expected to vary when environmental forces are varied. Internal states measures would also tend to show consistent interindividual differences in a sample of persons with varied psychosocial attributes. Any change in either individuals or the environment should produce changes in stress responses. Although the environment was constant, as noted above, it should not be overlooked that the participants in the study were likely to vary in several personal attributes over the course of the study. At the very least, they acquired experience with previously unknown work role demands. As a result, variables reflecting internal state stress might be expected to show changes across companies. Our mood data showed significant proportions of variance accounted for by days of training, individual differences, and the repetition of the training experience. Thus, our mood data were consistent with an internal state definition of stress.

Establishing that stress indicators clearly varied across training days for both environmental force and internal state definitions of stress sets the stage for testing who major groups of hypotheses. First, we will explore the covariation between stress indicators and behavioral and biological responses. Second, the effects of stress tolerance buffers on this covariation will be tested. These analyses will be the subjects of future reports.

Addressing other hypotheses which guided this study, the evidence for decreased negative affect during the second training company is important. This finding indicates that some affectual adaptation occurred with repeated job stress. The next task is to identify the psychosocial correlates of this adaptation. Also, the likelihood exists that similar adaptive trends will be found in our behavioral and biological response measures. Exploration of the mediators of psychobiological adaptation are a major future focus of this Navy Company Commander study, and findings will be presented in future reports.

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Navy company commanders, the senior enlisted men responsible for initial training of recruits, were selected for a longitudinal psychobiological study of occupational stress. These men were not selected for this job by rigid screening; therefore they represented typical men exposed to new, and at times, extreme job stresses. Forty-six company commanders were followed during a six-month period while they completed schooling for this job and successfully trained their first company of recruits. Of these, 34 volunteered to be studied during their second company as well, thereby providing data pertinent

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20. Abstract (continued)

to psychobiological adaptation to stress. The study design included assessments of psychological and physiological variables on two occasions during company commander school and on six separate days during each recruit training cycle. Study days were selected to represent a range of job stress. This report describes the study design and the biographical, personality, stress, and strain measures employed. Strains included behavioral and physiological variables which presumably link stress to illness. Analyses confirmed that stress varied significantly and systematically during recruit training cycles. This finding provides the background for future reports on behavioral and physiological strains; adaptation to repeated stress; and life history, social support, and personality variables which buffer or exacerbate the effects of job stress.

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