

1968

Psychological variables and recovery rate in infectious mononucleosis.

Avrene Laura Brandt
University of Massachusetts Amherst

Follow this and additional works at: <https://scholarworks.umass.edu/theses>

Brandt, Avrene Laura, "Psychological variables and recovery rate in infectious mononucleosis." (1968).
Masters Theses 1911 - February 2014. 1348.
<https://doi.org/10.7275/6870877>

This thesis is brought to you for free and open access by ScholarWorks@UMass Amherst. It has been accepted for inclusion in Masters Theses 1911 - February 2014 by an authorized administrator of ScholarWorks@UMass Amherst. For more information, please contact scholarworks@library.umass.edu.

UMASS/AMHERST



312066013800327



PSYCHOLOGICAL VARIABLES AND RECOVERY
RATE IN INFECTIOUS MONONUCLEOSIS

Avrene L. Brandt

Thesis Submitted in Partial Fulfillment of the
Requirements for the Degree of Master of Science

University of Massachusetts

Amherst

July, 1968

TABLE OF CONTENTS

	Page
INTRODUCTION	1
The Effects of Stress	3
Life Crisis and Disease Onset	7
Cognitive Factors and Ego Strength.	11
Measurement of Physical Recovery.	15
Aims and Hypotheses	17
METHOD	20
Subjects.	20
Measures.	20
Procedure	23
RESULTS.	24
Experimental and Control Groups	24
Psychological Variables and Recovery Rate	25
Incidental Results.	26
DISCUSSION	29
Control Group	29
Implications of a Correlational Study	29
Psychological Variables and Recovery Rate	31
Incidental Findings	33
IMPLICATIONS FOR FUTURE RESEARCH	35
Prospective vs. Retrospective Study	35
Control Group	36
The Measures.	37
Ego Control and Reactions to Infectious Mononucleosis	39
SUMMARY.	42
REFERENCES	44
APPENDICES	
A. Table 1. Parallels and Convergences Between Psychological and Physiological Stress Theory . .	48
B. Revised Holmes SRE Questionnaire.	50
C. Subscales of Barron Ego Strength Scale.	59
D. Cover Letter.	61

TABLE OF CONTENTS (Continued)

	Page
E. Table 2. Means, Standard Deviations, and <u>t</u> Tests for Mononucleosis and Control Groups on Independent Variables.	62
F. Table 3. Means, Standard Deviations, and <u>t</u> Tests for Mononucleosis Patients with Three or More SGPT Tests and Mononucleosis Patients with Less than Three SGPT Tests on Independent Variables	63
G. Table 4. Intercorrelation Matrix for all Variables	64
H. Table 5. Matrix of Correlations for Ego Strength Measures	65

ACKNOWLEDGMENTS

The author gratefully acknowledges the assistance of Drs. Larry C. Kerpelman, Claude C. Neet and Henry B. Biller in the preparation and completion of this manuscript.

Special gratitude is extended to Dr. Larry C. Kerpelman, who served as thesis advisor, for his helpful criticisms and advice in the organization of the thesis.

The author also expresses sincere appreciation to Mr. Leo Hall for his suggestions and encouragement throughout the study.

Finally, the author thanks Dr. Dean A. Allen for his aid in the formulation of the study, and Dr. Robert W. Gage, the medical staff at the University Health Service and the students who served as subjects for their cooperation and participation in this research project.

INTRODUCTION

A review of the literature relating personality variables to psychosomatic illness reveals an abundance of studies reporting trait or trait constellations which predispose an individual to specific psychosomatic disorders. Reference is often made to the "ulcer personality" or the "asthma personality." Less frequently is the question asked, "What are the personality variables which promote and facilitate recovery from these disorders?" Numerous studies have demonstrated remission of physical symptoms following psychotherapy (e.g., Nodine & Moyer, 1962), the implications being that certain psychological processes were effective in ameliorating a distressing physical condition. Furthermore, it has been demonstrated repeatedly that certain psychological states can result in measureable physiological changes in the body (Anderson, 1966; Imboden, Canter & Cluff, 1961a; Persky, 1958). It can therefore be argued that recovery from, as well as contraction of, illness is likely to depend on the influence of psychological variables.

The present study is concerned with personality factors which may influence the recovery rate of college students who have contracted infectious mononucleosis, a common cause of college infirmary visits. "Infectious mononucleosis is an acute or subacute disease of young people, usually characterized by irregular fever, sore throat, lymph node enlargement, abnormal liver function, occasionally with jaundice,

a characteristic blood picture, and the presence of a heterophil antibody in the serum. Although the etiology is unknown, it has long been suspected of being a virus disease [Rivers & Horsfall, 1959, p. 790]."

In a study of infectious mononucleosis in a college population, Evans (1961) noted several characteristics of the disease: 1) Infectious mononucleosis is more often found in younger classmen (freshmen and sophomores) with peaks of occurrence in October and March. 2) The myxovirus causing infectious mononucleosis is most probably transmitted through oral contact or by way of fomites. 3) Diagnosis of infectious mononucleosis can be a complicated matter. Often a misdiagnosis of mononucleosis is given when the individual is really ill with tonsillitis, upper respiratory infection, or fever.

Thus far there is no specific treatment for infectious mononucleosis. Dalrymple (1967) advocates the use of oral adrenal corticosteroids and reports significant symptomatic relief, while Seifert (1967) recommends a more conservative treatment consisting of bedrest and aspirins. To further complicate the problem, Prout (1967), another authority on the treatment of mononucleosis, analyzed Dalrymple's data and did not find that the corticosteroids had had any significant effect on recovery.

Recovery rate in illness cannot be completely determined by merely knowing the physiological state of the individual. As has been observable in cases of ulcer remission (Nodine

& Moyer, 1962) and reduction of asthma attacks (Groen, 1964), recovery involved a complex interaction of factors, including the dynamics of the patient's personality and life situation. An individual's response to the stress of disease is often affected by his cognitive resources for coping with the stress. How he perceives his plight, how much control he feels he has in dealing with the situation, and the degree to which he mobilizes his resources all play a part in determining the intensity and duration of his illness.

The Effect of Stress

The word "stress" has had varying application in the fields of physiology, psychology, sociology, etc. In this study "stress" refers to "extremes of disturbance of biological and psychological functioning brought about by unusually threatening, damaging or demanding life conditions [Lazarus, 1966, p. 3]." The degree of stress experienced by different individuals in the same situation varies as a function of such personality dimensions as ego strength, intellectual resources, and competence in dealing with the stress.

Lazarus (1966) presents a systematic theory of psychological stress and the ensuing coping process. The first element in this process is the appraisal of threat. The individual's appraisal of threat depends on his cognitive appreciation of certain cues in the environment. Whether

the cues are interpreted as signifying threat or not is based on two types of situational factors: 1) "factors in the stimulus configuration such as the comparative power of the harm-producing stimulus and the individual's counter-harm resources, the imminence of the harmful confrontation, and the degree of ambiguity in the significance of the stimulus cue; 2) 'factors within the psychological structure of the individual including motive strength and pattern, general beliefs about transactions with the environment, intellectual resources, education and knowledge [Lazarus, 1966, p. 25]."

If the individual interprets the situation as threatening, certain coping processes are initiated. These processes depend on a more specific level of cognitive functioning which Lazarus calls "secondary appraisal." The factors which are considered in this appraisal are degree of threat, the stimulus configuration, and the individual's psychological structure. Important aspects of the psychological structure include ego strength, defense mechanisms and the individual's pattern of motives. In terms of these variables, how the individual sees himself (does he feel masterful or helpless?), what his defenses are (does he realistically evaluate the situation or deceive himself and deny reality?), and what he sees as stressful and what courses of action he will take to reduce the stress, determine how well he will cope.

Applying the above theory of psychological stress and coping to physiological stress and coping, Lazarus suggested a possible mechanism, involving the adrenal cortex, by which the body reacts to stress. He stated that as a result of secondary appraisal one or several coping behaviors are initiated by the organism. These behaviors may be of an affective, motor, or physiological nature. Lazarus noted a relevant physiological reaction which underlies the coping process. He noted that recent research had shown that the appraisal of threat is accompanied by an immediate elevation in certain hormone levels and in particular the secretion of adrenocortical hormone. That this hormone is secreted in response to cognitive processes has been shown by several researchers. For example, Shannon (in Lazarus, 1966), in a study of dental patients, found that the mere anticipation of harm led to an elevated adrenocortical hydroxycorticosteroid (ACTH) response. He further found that the more complicated the anticipated dental surgery, the greater the output of ACTH. Persky (1958) reported a rise of adrenocortical steroid levels associated with the emotional states involved in stress. It is important to note that Persky reported that the pituitary-adrenocorticoid system only responds to the stimuli which signal stress when the stimuli are meaningful to the organism. The relationship of the pituitary and adrenal cortex has been demonstrated by Anderson (1966) who found that during

physiological stress an ACTH-releasing hormone is secreted by the anterior pituitary gland. "This neurohormone presumably enters the general circulation by way of the portal vessels of the anterior pituitary gland [Anderson, 1966, p. 378]."

Extensive research similar to that discussed above is an outgrowth of Selye's (1956) formulation of the general adaptation syndrome (G.A.S.). The G.A.S. is activated in response to stress--defined by Selye as "the sum of all the nonspecific effects of factors (normal activity, disease-producers, drugs, etc.) which can act upon the body [Selye, 1956, p. 42]."

The syndrome is characterized by three stages. The first stage, called the alarm reaction, is an initial countershock reaction to the noxious agent, characterized by a release of ACTH from the anterior pituitary gland. The ACTH then activates the cortex of the adrenal gland, which secretes anti- and pro-inflammatory corticoids. In the resistance, or second stage, there is a concentration of defense against the noxious agent with a consequent decrease of resistance to other stimuli. If the stress is prolonged, the individual's ability to adapt decreases, and the exhaustion stage occurs. As adaptation decreases, there is a return of the symptoms found in the initial "shock phase," and death may follow. The general adaptation syndrome is an ongoing process which is evidenced in accordance with the amount of stress experienced. Typically the organism is

not aware of the adaptation process, as daily stresses are relatively minor.

Although Selye's formulation is primarily applicable in the case of physiological stress, Lazarus (1966) draws certain important parallels between physiological and psychological stress. 1) Both require some initial appraisal of danger. In the case of physiological stress, the danger is recognized as a noxious stimulus, while in psychological stress, it is called threat. Again threat requires a cognitive appraisal. 2) In order for adaptation to occur there is a need for a central regulating system of signals and reactions. In physiological stress a neurochemical process is the regulator, in psychological stress, it is a cognitive process.

As demonstrated in many studies (Persky, 1958; Shannon, 1966) psychological stress can lead to physiological reactions, and the cognitive appraisal of threat can initiate certain specific physiological processes such as adrenal cortical secretions. For the reader who wishes to further investigate the relationship between psychological and physiological processes in stress, reference is made to Table 1, Appendix A. This table elaborates on the points of convergence between psychological and physiological stress.

Life Crisis and Disease Onset

Perhaps one of the most interesting demonstrations of the relationship between stress and physiological changes is

the recent work of Holmes on life crisis and disease onset (Rahe & Holmes, 1966a; Rahe & Holmes, 1966b; Holmes & Rahe, 1966). Holmes, unlike Lazarus, considers positively as well as negatively experienced situations and extends his treatment of stress to include a wide variety of events requiring adjustment. His treatment of stress also differs from that of Selye in that the former concentrated on adjustment to long-term stress in contrast to Selye's more frequent reference to immediate stress. Holmes' concept, however, is considered to be an extension of the Selye concept also in that Holmes defined his total stress measures in terms of an accumulation of many immediate stress situations. The stressful events elicit organismic reactions and call for adjustment and adaptation on the part of the organism. A more general statement about stress which ties the Selye and Holmes concepts together is offered by Ruff and Korchin (in Appley and Trumbull, 1967). They state "Stress occurs when an organism is forced into strenuous effort to maintain essential functions at a required level [p. 297]" despite an additional load. The organism must use some adaptive behavior in order to compensate and restore equilibrium.

In his study of disease onset and life stress Holmes (1966) reported a highly significant relationship between the time of disease onset and the recency of certain social changes requiring readjustment in the individual's life

situation. He constructed a questionnaire consisting of a list of life events which have the common factor of requiring some type of coping or adaptive behavior on the part of the individual. Not all of the events are negative or undesirable, but all require some type of change in the individual's state of adjustment. The amount of readjustment required of an individual in any given period of time is recorded in terms of life change units (LCUs). The total life change is a sum of weighted life events which the individual has encountered in a specified period of time. For example if, in a given year, an individual changed schools (value of 26 LCUS) and has gotten married (value of 50 LCUs), his totalled life change units would be 76. Values of life events range from 11 to 100. A recent life crisis is defined as a total LCU of 150 or more in one year. Using this definition in a prospective study in which the subjective reports on life crisis preceded the observation of health changes, it was noted that 93% of the health changes found in his subjects were associated with a life crisis (Rahe & Holmes, 1966a). Health changes included acute illnesses, onset or exacerbation of chronic diseases, and large weight changes. The association was found with a significantly greater than chance occurrence. In addition, Holmes found a linear relationship among all subjects between the magnitude of the life crisis in the preceding year and one-half and the percentage of disease. "For subjects

with scores between 150 and 199 LCU, 37% had an associated health change. This association rose to 51% for subjects with scores between 200 and 299 LCU and to 79% for those with scores greater than 300 LCU [Rahe & Holmes, 1966a, p. 2]."

A similar relationship between illness and life stress was found by Hinkle (1958). He reported a close relationship between the occurrence of illness and reactions to various life situations. Using two groups of subjects, one with a high frequency of illness and the other with a low frequency, Hinkle observed that the important variable influencing susceptibility to illness was how the individual perceived his life experiences. High and low groups did not differ from each other in terms of physical hardships, geographical dislocation, interpersonal difficulties, etc. Rather, the difference between the high and low frequency groups was that the former viewed their lives as demanding and unsatisfactory and perceived themselves as being unloved and rejected, whereas the latter found life interesting and satisfying and felt secure and capable of overcoming obstacles. Hinkle suggested two hypotheses to account for the differences in frequency of illness. First, the high frequency group may have come to view life as unsatisfactory as a result of a constitutional factor which interferes with the capacity to adapt and results in increased susceptibility to illness. Second, the repeated physiological

changes accompanying attempts to adapt to perceived threats may make the individual more susceptible to illness. The latter hypothesis lends support to the position that an individual's reaction to and perception of life situations may affect the way he later copes with stress and, in this case, resists illness.

Holmes (1966a) suggested an etiologic mechanism to explain how psychophysiologic reactions can result in health change. According to Holmes (1966a) and others (Grace, 1952; Wolf, 1955) the process of adjustment is accompanied by the activation of several of the body systems including the endocrine, cardiovascular, musculo-skeletal, and autonomic nervous system. The greater the adjustment and consequently, the greater the amount of energy needed for adjustment, the greater the activation of these organ systems. This increased amount of systemic activation leads to some bodily dysfunction, with a resulting increased vulnerability to external noxious agents. As a result of higher stress and a need for significant readjustment, the body loses some of its adaptive capabilities and becomes more vulnerable in the face of illness.

Cognitive Factors and Ego Strength

In addition to the influence of prior stress on the course of illness, the individual's psychological resources affect how well he copes with his illness. It was noted above that coping processes may involve physiological

reactions to psychological stress (such as the release of ACTH) and that there are psychological reactions to physiological stress in the form of cognitive appreciation of the impending danger to the organism. The importance of cognitive appraisal of stress has been noted in the case of reaction to the stress of illness (Lazarus, 1966). (A realistic and accurate perception of the situation would facilitate more positive action toward resisting the disease.)

The ability to accurately test reality is dependent on strong and adaptive ego functioning. In his description of bodily reaction to stress, Selye (1956) stated that resistance to the acceptance of reality, combined with a delusion of invulnerability, can lead to a lag in performance which hinders the adaptive behavior necessary in combating stress.

A relevant study of duration of illness and ego strength (Greenfield, Recessler & Crosley, 1959) reported a negative correlation between duration of infectious mononucleosis and ego strength. The criteria for the onset of mononucleosis were a total white blood count of no more than 10,000 per cubic millimeter, a lymphocyte count greater than 60%, and the presence of atypical lymphocytes or a positive heterophile test in the presence of leucopenia. Termination of illness was defined as total white blood count of less than 10,000 per cubic millimeter, a total lymphocyte count of less than 60%, and no atypical lymphocytes. The Barron Ego Strength Scale of the MMPI was administered six months

after recovery. Greenfield reported a significant ($p < .05$) difference on the Barron scale between means of long-term and short-term recoverers. He theorized that "recovery from illness is an essential adaptive function of the ego. . . . Persons with relatively less ego strength cannot discriminatively perceive and respond to various physiological stimuli occasioned by the illness; their adaptive capacity is impaired by inaccurate perception [Greenfield, 1959, p. 127]." Greenfield's results appear rather straightforward. The looseness of his criteria, however, make his findings difficult to interpret. The present study proposes to more clearly define these criteria by using clinical findings and laboratory measurements more specific to infectious mononucleosis.

Several of the researchers cited here (Greenfield, 1961; Holmes, 1966; Seyle, 1956) appear to be relating dimensions of the ego-strength concept to reaction to illness, notably the ability to perceive and cope with reality. According to Welsh and Dahlstrom (1956), a strong ego, as measured by the Barron Ego Strength Scale of the MMPI, correlates with physiological stability, accurate perception of reality, ability to cope with environmental pressures, and general good health. "Low ego strength implies deficits in self-restraint, environmental mastery or cognitive awareness that limit a person's ability to deal with stresses, unfamiliar problems or hardships [Dahlstrom & Welsh, 1962, p. 356]."

Another important aspect of ego strength is the feeling of adequacy and control. These characteristics can be measured on the Rotter Internal-External Control Scale (Rotter, 1965). This scale differentiates between individuals who perceive things which happen to them as the result of their own behavior (Internalizers) versus those who attribute these events to outside forces, such as fate or chance (Externalizers). The internalizer attempts to control the situation and plans his course of action carefully while the externalizer proceeds on "hunches" (Liverant & Scodel, 1960).

Using the Rotter Internal-External Control Scale, Seeman and Evans (1962) studied patients in a tuberculosis hospital and found statistical support for the general hypothesis that those patients whose scores placed them at the internal control end of the scale would be more informed about their own condition, would know more about tuberculosis in general, and would be regarded as better patients by the ward personnel. It is speculated that this finding might be relevant for mononucleosis patients in that the more informed and "better" patient would be expected to recover more quickly. The internalizer would be expected to be more in control and more able to appraise the situation realistically, and these factors may facilitate recovery.

Measurement of Physical Recovery

Greenfield's study (1959) of psychological variables and infectious mononucleosis is not representative of those relating psychological variables and response to illness. Typically, when researchers have reported a relationship between psychological factors and recovery from diseases not commonly regarded as psychosomatic, they speak in terms of symptomatic, not physiological, recovery (Imboden, et al., 1961a; Imboden, Canter & Cluff, 1961b; Mechanic, 1961; Brodman, Mittelman, Wechsler, Weider & Wolff, 1947). The results of these studies indicate that in such diseases as influenza, acute respiratory infections, and brucellosis symptomatic recovery is slower in those patients having a propensity for depressive, anxious or hypochondrical behavior. When speaking of physiological recovery, however, it is more difficult to specify relevant psychological variables.

In addition to the problem of specifying the relationship between psychological and physiological process, objective measurement of physical recovery is often a difficult procedure. It becomes increasingly difficult when the disease under consideration is as complicated as infectious mononucleosis in terms of both diagnosis and routine treatment. The most accurate statements about mononucleosis are made on the basis of laboratory tests such as that used to measure the patient's level of serum glutamic-pyruvic

acid transaminase (SGPT). Serum glutamic-pyruvic transaminase has been found to be elevated in the majority of patients with infectious mononucleosis and is believed to represent liver involvement in infectious mononucleosis (Gelb, 1962; Hall, 1968). Rennie and Wroblewski (1957) have found that "serial alterations of SGPT during the course of infectious mononucleosis not only correlate with the laboratory reflections of hepatic involvement but also appear to parallel the nonspecific symptoms associated with the disease [p. 551]." Thus, not only does the level of SGPT indicate amount of liver damage, but also it seems to parallel the patient's general state of physical well being. The relevant physiological processes underlying the production of SGPT are two-fold. First, SGPT level indicates liver damage because as the liver cells disintegrate they secrete an enzyme which is measured as SGPT. Second, some additional SGPT results from the turnover of leukocytes found in infectious mononucleosis. The end product of the leukocyte disintegration is measured as SGPT.

In a study of SGPT and infectious mononucleosis, Wroblewski (1958) stated that the rise and fall of SGPT is related to recovery. When complications occur, it is reflected in a secondary superimposed rise in SGPT activity. Among the reasons offered by Hall (1958) for using the SGPT as a parameter in mononucleosis was "the fact that this enzyme probably reflects liver involvement more accurately than other techniques commonly used to study

patients with this disease [Hall, 1968, p. 21]." Although SGPT levels may be elevated in diseases other than mononucleosis, Hall further reported that patients suspected of having mononucleosis but found serologically negative did not demonstrate elevated SGPT levels. The fact that non-mononucleosis patients with similar symptoms demonstrate normal SGPT levels testifies to the validity and applicability of the SGPT measure.

Aims and Hypotheses

The present study is concerned with the relationship between stress, ego strength, control, and recovery rate in infectious mononucleosis. Infectious mononucleosis is generally not considered to be psychosomatic in nature. In this study, however, recovery in mononucleosis is the dependent variable, with the hypothesis being that psychological factors are operative in all physical disease and can affect the course of disease. The interactions between the psychological and physiological are indeed complex, presumably involving such brain structures as the hypothalamus, pituitary gland, thalamus, etc. and characterized by numerous interrelationships between the central and autonomic nervous systems and endocrine system (Gellhorn & Loofbourrow, 1963). It is not within the province of this study to postulate what the various interconnections might be. Rather the present study proceeds on the implicit assumption that such connections between psychological and physiological functioning do exist.

The relationship between variables associated with the coping process and recovery in infectious mononucleosis was investigated in this study. It was hypothesized that the relationship between life stress and reduced capability to resist illness also holds for the capacity for dealing with and combating illness once it is contracted. Holmes (1966) stated that "'stressful' life events, by evoking psychophysiologic reactions played an important part in the natural history of many diseases [Holmes & Rahe, 1966, p. 2]." Thus the degree of stress experienced and amount of readjustment called for may be important factors in determining how quickly a person recovers once he has contracted an illness.

Ego strength and ego control were also included in this study as measures related to the ability to cope with illness. As noted by Welsh and Dahlstrom (1956), a strong ego is related to physiological stability and accurate reality testing. It is thus considered an important aspect of coping with illness. A measure of ego control was also related to recovery in infectious mononucleosis as ego control implies realistic perception and a command of the situation.

The specific hypotheses of the study were:

- 1) A relationship between recent life crisis (stress) and recovery rate in infectious mononucleosis was expected. (The greater the stress, the slower the recovery.)

- 2) A relationship between ego strength and recovery rate in infectious mononucleosis was expected.
(The stronger the ego, the better the recovery.)
- 3) A relationship between amount of control felt and recovery in infectious mononucleosis was expected.
(Internalizers were expected to recover better.)
- 4) The possibility of an effect of the sex variable was also investigated.

Because there is little empirical data on this specific topic, this research was essentially exploratory in nature. Consequently interactions among the variables (such as life stress, ego strength, and sex) were not dealt with.

METHOD

Subjects

Experimental. Ninety-six college students at the University of Massachusetts who were diagnosed as having infectious mononucleosis and were treated at the University Health Service during the 1966-67 school year were contacted by mail and asked to participate in the study. The criteria for a definitive diagnosis of mononucleosis were those used by the University of Massachusetts Health Service. Subjects had to have a positive heterophile of 1:224 or greater; lymphocytosis of 50% or greater; and a physician's evaluation of mononucleosis based on the following clinical findings (one or more)--sore throat, lymphadenopathy, fever, splenomegaly, malaise. Of the 96 students contacted, 66 agreed to participate in the study.

Controls. Roommates served as controls for the mononucleosis students in that they were likely to be similar to the mononucleosis subject in socio-economic background, general intelligence, environmental conditions and so forth. The significant way in which the groups differed was that controls had not contracted mononucleosis.

Measures

Recovery rate was determined using serial measurements of the patients' levels of SGPT. The rate was established as follows: the percentage reduction of SGPT secretion

from the highest level recorded to the last SGPT measure taken on the patient was calculated. This percentage was then divided by the number of days from the highest SGPT test to the last SGPT measure. A rate of recovery was used, instead of duration of illness in terms of number of days needed for the complete remission of symptoms or the return of normal SGPT levels, for primarily two reasons. For one, students often returned to the infirmary when they had been well for several days and secondly, some students failed to return even though they were not completely well. Consequently the exact date of recovery could not be determined. The relative progress made in a period of time, however, could be measured and calculated as a rate. The number of SGPT measures per patient ranged from 3 to 6 with a mean of 3.3

Thus:

$$\text{Recovery rate} = \frac{\% \text{ reduction in SGPT level from highest to last measure}}{\text{number of days between highest and last SGPT measure}}$$

The Holmes SRE questionnaire was adapted for a college population. (See Appendix B for the revised instrument.) An independent group of 80 undergraduates was asked to evaluate and weigh the intensity of life change events on the new questionnaire. This was done in order to eliminate some of the irrelevant questions on the Holmes questionnaire and change others so that they were more applicable. Items numbered 13, 22, 23, 26, 27, 34, 40, and 41 were changed from the original. A Spearman Rho between the Holmes and revised

questionnaire weightings resulted in a ρ of .96, indicating high agreement of the revised questionnaire. The stress measure used in this study was obtained by totaling the life change units for the year preceding the six-month time period which included the onset of mononucleosis.

The Barron Ego Strength Scale of the MMPI was given. This is a 68 item, true-false scale on which subjects received a total ego strength score and three sub-scores. The three additional scores were taken from Barron's grouping of the items "according to the kinds of psychological homogeneities which . . . are involved in the item content [Barron, in Welsh and Dahlstrom, 1956, p. 227]." The 3 groups of items used relate to 1) physical functioning and physiological stability, 2) sense of reality, and 3) personal adequacy, ability to cope (see Appendix C for item groupings). As an addendum to this questionnaire, students were asked to rate, on a 7 point scale, how active they were normally versus how active they were when ill with mononucleosis. This question was included to control for the possible confounding effect of amount of activity during illness on recovery rate.

Consistent with the idea of importance of feelings of adequacy, environmental mastery, and ego control, the Rotter I-E Control Scale was administered. This is a 29-item forced choice questionnaire which classifies the subject as either an internalizer or externalizer. Internalizers receive low

scores and externalizers high scores. Subjects are expected to react differently to their illness depending on whether they perceived themselves as in control of life situations (internalizer) or perceived their life situations as determined by fate or chance (externalizer).

Procedure

Approximately six months after recovery from mononucleosis the above three measures were mailed with a covering letter (see Appendix D) to each of the students in the experimental group. An approximate six month time wait was used in order to eliminate the possible effects of being ill on how patients responded to the questionnaire. The fact that illness is often accompanied by depression (Brodman, 1947; Imboden et al., 1961b) and that individuals do not function up to capacity when ill was considered to have bearing on how they would answer the questionnaires. All questionnaires were also mailed at the same time as a matter of procedural convenience. It was also necessary to wait until the end of the school year to see if enough students had contracted mononucleosis to make the study feasible. As soon as each student returned the questionnaire, a second set of questionnaires was sent with the instruction that his/her roommate also fill out and mail back the questionnaire.

RESULTS

Experimental and Control Groups

Sixty-six of the 96 experimental subjects contacted returned their questionnaires. Of these 66, none had had any other known illness concomitant with mononucleosis. The experimental group was reduced in size due to the elimination of all subjects having an insufficient number of laboratory tests (the required minimum number of SGPT tests was 3), and to insufficient completion of the 3 questionnaires. The final number of experimental subjects was 30 (15 males and 15 females). Twenty-five roommates (7 males and 8 females) of mononucleosis subjects returned the questionnaire, giving a control group N of 25.

As there was no date of onset of mononucleosis for the control group, a measure of degree of stress for the year preceding onset of mononucleosis could not be calculated for them. Therefore, an approximate "mean mononucleosis date" was established for the experimental group and the amount of stress for the preceding year for the control group was calculated from this date. The difference of means on this measure, as can be seen from Table 2 (Appendix E) was not significant. Comparison of mean scores on the psychological variables between the experimental and control groups revealed no significant differences (see Table 2, Appendix E). A comparison of mean scores on the psychological variables for mononucleosis patients with less than 3 and 3 or more SGPT tests also revealed no significant differences (see Table 3, Appendix F).

Psychological Variables and Recovery Rate

To test the hypothesis that there is a relationship between recent life stress and recovery rate in infectious mononucleosis, Pearson and partial correlations were computed. Both Pearson ($-.36$), (see Table 4, Appendix C) and partial correlations ($-.38$) between amount of stress and recovery rate in infectious mononucleosis were significantly different from zero ($p < .05$). Partial correlations were performed in order to obtain an estimate of what the relationship between the two variables under study would be if the effect of all other variables in the study were eliminated. They are used here as clarifiers rather than for confirmation of a relationship between variables. These correlations indicate that the lower the amount of stress experienced in the year preceding the onset of mononucleosis, the faster the recovery in mononucleosis.

Intercorrelations between the four ego strength measures (the total Barron Ego Strength Scale and 3 subscores) revealed moderate internal consistency of these measures (see Table 5, Appendix H). Mononucleosis subjects received four Ego Strength Scores which were correlated with recovery rate. The Pearson product-moment correlations (r_s) between these measures (seen in Table 4, Appendix G), tested the hypothesis that there is a relationship between ego strength and rate of recovery in mononucleosis. All but the relationship between recovery rate and ability to cope were not significant.

The hypothesis that internalizers with infectious mononucleosis would recover better than externalizers was not confirmed. A Pearson r for the relationship between recovery rate and scores on the Rotter I-E Control Scale was $+.20$ ($df = 28$) which was not significant. This positive correlation increased to $+.43$ ($p < .05$) when the effect of all other variables was partialled out. These correlations are in the opposite direction of that predicted and indicated that those students scoring high on the Externalizer end of the continuum recovered at a faster rate than those receiving scores which classified them as Internalizers.

Incidental Results

To measure the possible confounding effect of initial severity of illness on recovery, a Pearson r was computed between recovery rate and the first (highest) SGPT level used. The correlation of $+.24$ ($df = 28$) was not significant, indicating that initial severity did not effect changes in SGPT level. The possible effect of administration of corticosteroids on recovery was also investigated with a point biserial correlation. This, as expected, was not significant ($r_{pbi} = .11$, $df = 28$), as corticosteroids provide only symptomatic relief and therefore would not affect SGPT levels.

The change in amount of activity from the students' normal level to activity level during mononucleosis was

determined by calculating the difference on a 7-point activity level scale. This measure was included in order to control for the possible confounding effect of the student's level of activity on recovery rate. An r of $-.21$ between activity level and recovery rate ($df = 28$) was not significant. When all other variables were partialled out, however, the resulting r was $-.39$, significant at the $p < .10$ level. Thus, it appeared that, students whose activity level during mononucleosis more closely approximated their normal activity level also recovered at a faster rate.

A t test of the sex differences in recovery rate resulted in a t of 2.05 ($p < .05$), indicating that males tended to recover significantly faster than females. It is also very interesting to note that a point biserial correlation between sex and ego strength was significant ($r_{pbi} = .38$, $p < .05$), and the point biserial for sex and ability to cope was also significant ($r_{pbi} = .70$, $p < .001$).

The multiple R for the nine predictor variables and the criterion (recovery rate) was $.53$ ($df = 20$), which was not significant. A multiple correlation based on only the five most related variables (ability to cope, amount of stress, degree of externalization, activity level, and initial severity) and the criterion was $.59$ ($df = 24$). This was significantly different from zero ($p < .05$). The discrepancy between the R of $.53$ and the R of $.59$ is

accounted for by the fact that the additional four variables (reality testing, total ego strength score, sex and physical functioning), included in the R of .53, contributed relatively more error variance than predicted variance. Thus the contribution of these variables in terms of predictive ability was negligible, while the additional error variance brought in was large enough to reduce the strength of the multiple correlation. In considering the predictive ability of the independent variables it therefore is reasonable to look only at the percent of variance accounted for by each of the five most related variances. These percentages were as follows: a) ability to cope = 11%, b) amount of stress = 7%, c) degree of externalization = 5%, d) activity level = 6%, and e) initial severity = 6% (total accounted for variance = 35%). The other four variables, as mentioned, did not increase the amount of accounted for variance.

DISCUSSION

Control Group

In trying to draw conclusions about the factors related to contracting infectious mononucleosis, the control group in this study was not very helpful. There were no significant differences between control and experimental groups on any of the independent variables. It may be that the variables measured are not specifically related to the contraction of mononucleosis. In the establishment of the control group, it was assumed that all things were equal for the two groups except that the experimental group had had mononucleosis. Both groups were considered to have experienced the same general amount of physical illness and emotional disturbance. It is possible, though, that control subjects experienced the high stress, had low coping ability, etc., corresponding to their experimental counterpart, but they reacted differently. For example, they may have contracted a different disease or series of less serious illnesses, or they may have experienced emotional difficulties. This is difficult to determine. It can only be said that the experimental group reacted to a certain set of conditions by contracting infectious mononucleosis.

Implications of a Correlational Study

In interpreting the results of the study it is initially necessary to understand what the significant correlations

mean. The implication of a significant correlation is that a certain amount of prediction of one variable can be made knowing a score on another variable. The correlation does not imply a casual relationship. For example, in the case of amount of stress and recovery rate, this study postulated that the amount of stress experienced in the year preceding mononucleosis would have an effect on recovery rate. Correlational techniques, however, do not allow this statement to be made. They do allow for the statement to be made that the two variables are found to exist in a predictable relationship. The correlation squared, or coefficient of determination, is the percent variance in the predicted variable (in this study, recovery rate) which is determined, or accounted for, by the variance in the predictor (i.e., amount of stress, ego strength, sex). It is typically difficult to report more than this when attempting to relate psychological and physiological functions. As Adler states, "We can speak about psychological factors in somatic processes which undoubtedly exist but . . . It is not the psyche which influences the soma or vice versa; it is the individual who has a soma and a psyche, who can think and feel and act, biologically and socially. All these functions are at the disposal of one individual, as he moves toward his goals [Adler, in Stein, 1961, p. 78]." What then, is the purpose of a correlational study when one wants to deal with the effect of certain variables on recovery in illness? If it

cannot be said that a certain variable has an effect on recovery, why is it important to note that they are correlated? The justification for the use of correlations in this study lies in the fact that infectious mononucleosis is a difficult disease to predict, both in terms of contraction and treatment. If certain variables can be designated which occur in a predictable relationship with recovery rate (i.e., amount of recent stress and ability to cope with stress), then slow or fast recoverers may be identified at the onset of mononucleosis. Thus a student who is found to have a low ability to cope with stress and a high amount of recent stress can be expected to recover slowly. With this knowledge, adjustments in treatment can be made to facilitate recovery. Additional drugs may be prescribed, bed rest called for, or a reduction of the student's course load suggested. The psychological measures used to identify the slow recoverer would hopefully be easy to administer and to some patients be less painful than repeated laboratory tests. They may also contribute important information about how the student will react to his illness.

Psychological Variables and Recovery Rate

Both the simple and partial correlations between stress for the preceding year and recovery rate were significant. These findings were in the predicted direction. They are interpreted as demonstrating that those students found to have had more stress in the year preceding the onset of

mononucleosis can be expected to recover more slowly than students having had fewer and less intense stress situations.

All ego strength and recovery rate correlations, with the exception of ability to cope, were nonsignificant but in the predicted direction. The failure to obtain significance may be due to the small sample size or to the possibility that these measures are not strongly related to recovery. The correlation between ability to cope and recovery rate was significant in the expected direction. It can, therefore, be stated that the ability to cope is related to recovery rate in infectious mononucleosis, and that those students who demonstrate better ability to cope on the Barron Ego Strength subscale may be expected to recover faster.

The results of the correlation between the Rotter I-E Control Scale and recovery rate are difficult to explain. The tendency (especially indicated by the partial r) for externalizers to be faster recoverers is opposite that predicted. As noted earlier, a partial correlation does not reflect what the data say but what the data might say, if all other variables in the study were held constant. It does, however, appear that externalizers recover faster. This may be due to the fact that they are better patients and follow doctors' orders better, thus taking better care of themselves while ill. In a retrospective study it is not possible to determine which students were "good" patients and which were not. The fact that externalizers appeared

to do better may also be related to mononucleosis being a relatively short-term illness. The internalizer may take his illness lightly and not mobilize his resources as he would if confronted with a more serious illness, while the externalizer may be taking better care of himself.

Incidental Findings

The control measure of initial severity of SGPT reaction did not correlate significantly with recovery rate. Intuitively it seems reasonable to expect that a patient's initial degree of illness will be related to how long it takes to recover. It is important to note that the dependent variable in this study is not the absolute time it took to recover from mononucleosis but is, in fact, a rate of recovery. As such it is not a measure of duration of illness in terms of number of days but measures the efficiency of a process. It is therefore conceivable that initial severity of illness may not have been significantly related to this process.

Although the simple correlation between activity level during illness and recovery rate was not significant, the partial correlation reached a low level of significance. The partial r , as an indicator of what relationships may exist between activity level and recovery rate, suggests that the closer the patients' activity levels approximated their normal activity level, the faster they were recovering. This cannot be taken as an indication of an effect of activity on recovery, as it is more probable that those students who were recovering faster were feeling better and

therefore felt less like resting and more able to maintain their normal activity levels.

The relationship between the sex variable, recovery rate, ability to cope, and ego strength merits attention. The t test between male and female mean recovery rate revealed a significant difference, with males appearing to be faster recoverers. Ability to cope and ego strength were also significantly related to sex ($p < .001$ and $p < .05$) respectively, and ability to cope was significantly related to recovery rate ($p < .05$). It was, therefore, concluded that the relationship between sex and recovery rate is influenced by sex differences in ego strength and the ability to cope.

Regarding the general predictive ability of the variables used in the study, the total 35% accounted for variance is not high. It is therefore important to look at the variables used to see which ones do offer the most in the way of predictive ability. It is apparent from the results that ability to cope and amount of stress are most predictive in determining recovery rate, with degree of externalization, activity level, and initial severity related to lesser degrees. The results of the study then indicate that the first two variables mentioned would be most useful in predicting recovery rate. It is suggested that these two variables be used in future studies relating psychological variables and recovery in infectious mononucleosis.

IMPLICATIONS FOR FUTURE RESEARCH

Prospective vs. Retrospective Study

In a retrospective study, such as this one, in which personality measures are taken after the experimental condition has occurred, the question is often raised as to whether the scores obtained were affected by the experimental condition. In this study such questions would be, Was the student's ego strength or ability to cope altered by his having mononucleosis, and Was his perception of how much stress he had had preceding mononucleosis influenced by his reaction to being ill? To circumvent this problem it is suggested that stable psychological measures be selected as independent variables so that it can be said that these scores on these measures did not change as a function of illness. It is also often possible to get a picture of a student's pre-illness level of functioning from past records, such as standard achievement tests and routine personality inventories given by the school. Ideally, the relationship between psychological variables and recovery rate should be investigated in a prospective study. As an example of this, psychological data could be collected in a large sample of college students, i.e., all incoming freshmen. Then slow and fast recoverers could be compared with regard to their scores of the personality inventories. This procedure would also allow for more efficient comparison to be made on personality inventories between students who had

contracted mononucleosis and those who had not.

Control Group

The control, as well as the experimental group, would have been more helpful had there been a larger number of subjects. As used in the present study, the control group was not a true control for the dependent variable. In effect, it was a comparison group used to establish psychological differences between students who had and who had not contracted infectious mononucleosis. As such, this control group was not used in relation to the dependent variable, recovery rate in infectious mononucleosis.

Typically, the difference between experimental and control groups is that the former is exposed to a specific experimental condition or treatment, while the latter is not. Performance differences between the groups are considered to be a result of the effect of the treatment. In this study, performance (the dependent variable) was recovery rate in infectious mononucleosis. To be measured on the dependent variable subjects have to have had mononucleosis. In other words, in order to perform subjects had to be ill with mononucleosis. Students who had not had this disease, therefore, could not serve as controls as there would be no measure for them on the dependent variable. Furthermore, students with similar diseases could not be controls, because even the slight differences found in similar diseases lead to too much variability in recovery. The control

group suggested for future research in this area, therefore, would have to come from within the mononucleosis group itself. It is suggested that subjects be divided into three discrete recovery rate groups--slow, moderate, and rapid recoverers with the moderate recovery rate group serving as the control. Performance of both slow and fast recoverers could then be compared with moderate recoverers and related to how these groups scored on the psychological variables.

The Measures

SGPT. SGPT levels appear to be a good laboratory measure of recovery rate which might, in future studies of this kind, be used more effectively. Arrangements could be made to have students report into the infirmary on a regular basis for SGPT tests until their SGPT returned to a normal level. With more tests being made at more regular intervals, a more accurate charting of the course of mononucleosis would be possible. A rate of recovery is still considered the most accurate dependent variable because absolute duration of illness in terms of days is difficult to determine. Students initially come into the infirmary at various stages of mononucleosis. Some have been ill for many days and others have just taken ill. The exact onset of illness would be nearly impossible to determine in most cases. Even using a more accurate measure, such as a rate of recovery, certain considerations must be made. Influencing factors such as number of days of bedrest and number of classes

missed, changes in course load and changes in grade point average, and variations in treatment should be noted so that statistical corrections can be made for their effect on the dependent variable.

Holmes Questionnaire. In addition to its apparent face validity, the revised Holmes questionnaire proved effective in that it was significantly related to recovery rate. Perhaps the main problem encountered with this questionnaire is the students' accuracy of memory of events and the times at which they occurred. To control for this, a large number of students, such as the incoming freshman class, could be instructed to make note of the events which are listed in the questionnaire, as they occur throughout the year. The questionnaire of students who contracted mononucleosis could then be studied with relation to the dependent variable. This is still somewhat impractical, however, as students cannot be expected to keep accurate records of their life events.

As mentioned above, the stress measure is significantly related to recovery rate. This relationship, which was assumed to be linear, may be confounded by the phenomenon of 'learning to cope' with stress. It may be that the correlation between stress and recovery rate is more significant than that obtained. It is postulated that individuals with a history of stressful life events learn how to deal with these events and are more effective when later

confronted with a stress situation, such as being ill with infectious mononucleosis. Particularly when the previous stressful events involved physical illness, the individual is more familiar with illness and may not feel as debilitated as the individual to whom illness is a new experience. The latter individual may become frightened and immobilized in this situation. In addition to being less immobilized when ill, the person with more experience with illness has the benefit of practice in taking care of himself when ill. The importance of the phenomenon of 'learning to cope' is, however, thought to be related to the amount of stress the individual has encountered. It is suggested that at low levels of stress, the individual's previous experiences with stressful situations are more helpful than when the higher extremes of stress are reached. At the point at which the amount of stress becomes overwhelming, previous experience coping with stress or illness might not make a difference in terms of how well the individual recovers. Future studies might investigate what role this factor plays and under what circumstances it has an appreciable effect.

Ego Control and Reactions to Mononucleosis

The fact that externalizers were found to recover significantly faster than internalizers led to a consideration of specific students' reactions to illness. The internalizer, who is better informed and expected to be more involved in his illness, perhaps recovers more slowly because he is too

involved and too concerned. He may become so worried that he is actually immobilized, rather than more in control, when ill. Individual reactions to being ill vary and may affect how the individual prepares to cope. Some students view mononucleosis negatively and consider being ill a humiliating experience. They may feel that mononucleosis is a disease which is typical of students who study a lot and therefore would not like being identified with the group. They may be embarrassed by the campus beliefs that mononucleosis is contracted through sexual contact. Some students become upset at the thought of missing school and falling behind in their work. On the other hand, for some students there are definitely positive aspects to having mononucleosis. Resting, following doctor's orders and being taken care of can fulfill dependency needs. Furthermore, being physically ill may relieve the student of certain responsibilities. He may not be expected to complete school-work and may be able to avoid stressful social interactions. Positive and negative reactions can both aid and interfere with recovery. The individual who perceives physical illness as a humiliating situation may strive to get well or may feel inadequate and be overwhelmed by his illness. The individual who does not take responsibility for himself may more readily follow orders and be more relaxed and therefore recover faster, or he may make an effort to remain sick. As can be seen, there are numerous factors to be

considered in investigating reactions to illness. Future efforts should be made to control for the effect of these various factors so that a clearer representation of the relationship between psychological variables and recovery in mononucleosis can be found.

SUMMARY

Thirty University of Massachusetts students who had been treated for infectious mononucleosis at the University Health Service participated in a study to determine the relevance of psychological variables to recovery rate in infectious mononucleosis. Approximately six months after recovery, these students and roommate controls filled out the revised Holmes Schedule of Recent Events Questionnaire (a measure of recent stress), Barron Ego Strength Scale, and Rotter Internal-External Control Scale. In addition, the experimental group was asked to report on their activity level while ill with mononucleosis. A rate of recovery for the experimental group was calculated using serial measurements of serum glutamic pyruvic transaminase (SGPT) in the blood.

The measures used did not differentiate between students who had contracted mononucleosis and control students. A significant correlation ($p < .05$) between amount of stress in the year preceding onset of mononucleosis (as measured by the Holmes questionnaire) and recovery rate was found. The Barron Ego Strength Scale did not differentiate between slow and fast recoverers, although high scores on an 'ability to cope' scale (a subscale of the Barron Ego Strength Scale) correlated significantly ($p < .05$) with recovery rate as predicted. Contrary to prediction, students scoring on the Externalizer end of the continuum on

the Rotter I-E Scale were faster recoverers than those receiving scores classifying them as Internalizers. Initial severity of illness, as determined by the highest SGPI level recorded, was not found to be associated with recovery rate. The control measure of activity level during illness was found to be positively correlated with recovery rate. This correlation was interpreted as indicating that those students who were recovering faster and feeling better could more easily maintain their normal activity level. The significant sex differences in recovery rate ($p < .05$), with males recovering faster than females, were interpreted as being a function of males' significantly higher ego strength scores and their significantly better ability to cope with stress ($p < .001$).

The study indicated that the Holmes stress questionnaire and the 'ability to cope' subscale of the Barron Ego Strength Scale were the best predictors of recovery rate in infectious mononucleosis. One of the implications of the study was that more accurate predictions of expected duration of illness could be of aid in determining how the patient is treated.

REFERENCES

- Adler, A. In Stein, M. (ed.) Contemporary psychotherapies. New York: The Free Press, 1961.
- ✓ Anderson, E. Adrenocorticotropin-releasing hormone in peripheral blood: Increase during stress. Science, 1966, 152, 378-379.
- Barron, F. An ego strength scale which predicts response to psychotherapy. In Welsh, A. S. and Dahlstrom, W. G. Basic readings on the MMPI in psychology and medicine. Minneapolis: University of Minnesota Press, 1956.
- Brodman, K., Mittelman, D., Wechsler, D., Weider, A., and Wolff, H. G. The relation of personality disturbance to duration of convalescence from acute respiratory infections. Psychosomatic Medicine, 1947, 9, 37-44.
- Dahlstrom, W. G. and Welsh, G. S. An MMPI handbook. Minneapolis: University of Minnesota Press, 1962.
- ✓ Dalrymple, W. The treatment of infectious mononucleosis with adrenal corticosteroids. Paper presented at the International Mononucleosis Symposium. Washington, D.C., 1967.
- ✓ Evans, A. S. Infectious mononucleosis in University of Wisconsin students: Report of a five-year investigation. American Journal of Hygiene, 1961, 71, 342-362.
- Gelb, D., West, M., and Zimmerman, H. Serum enzymes in disease IX: Analysis of factors responsible for elevated values in infectious mononucleosis. American Journal of Medicine, 1962, 33, 249-261.
- Gellhorn, E. and Loofbourrow, A. N. Emotions and emotional disorder. New York: Harper and Row, 1963.
- Grace, W. J. and Graham, D. T. Relationship of specific attitudes and emotions to certain bodily diseases. Psychosomatic Medicine, 1958, 14, 243.
- Greenfield, N., Roessler, R., and Crosley, A. Ego strength and length of recovery from infectious mononucleosis. Journal of Nervous and Mental Disease, 1959, 128, 125-129.
- Groen, J. J. Psychosomatic research. New York: MacMillan Company, 1964.

Guilford, J. P. Fundamental statistics in psychology and education. New York: McGraw-Hill Book Company, 1965.

Hall, L. Serum glutamic pyruvic transaminase levels in patients with infectious mononucleosis. Paper accepted for publication by American Journal of Medical Technology, 1968.

✓ Hinkle, L. E., Jr., Christenson, W. N., Kane, F. D., Ostfeld, A., Thetford, W. N., and Wolff, H. G. An investigation of the relation between life experience, personality characteristics, and general susceptibility to illness. Psychosomatic Medicine, 1958, 20, 278.

Holmes, T. H. and Rahe, R. H. Life crisis and disease onset, I. Qualitative and quantitative definition of life events composing the life crisis. Submitted to Psychosomatic Medicine, 1966.

✓ Imboden, J. B., Canter, A., and Cluff, L. E. Convalescence from influenza. Archives of Internal Medicine, 1961, 108, No. 3(a).

Imboden, J. B., Canter, A., and Cluff, L. E. Symptomatic recovery from medical disorders. Journal of the American Medical Association, 1961, 178, 1182-1184(b).

Lazarus, R. Psychological stress and the coping process. New York: McGraw-Hill, 1966.

Liverant, S. and Scodel, M. Internal and external control as determinants of decision-making under conditions of risk. Psychological Reports, 1960, 7, 59-67.

Mechanic, D. and Volkart, E. Stress, illness behavior and sick role. American Sociological Review, 1961, 26, 51-58.

Nodine, J. H. and Moyer, J. H. Psychosomatic medicine: The first Hahnemann symposium. Philadelphia: Lea and Febiger, 1962.

✓ Persky, H. et al. Relation of emotional responses and changes in plasma hydrocortisone level after stressful interview. AMA Archives of Neurology and Psychiatry, 1958, 78, 434-447.

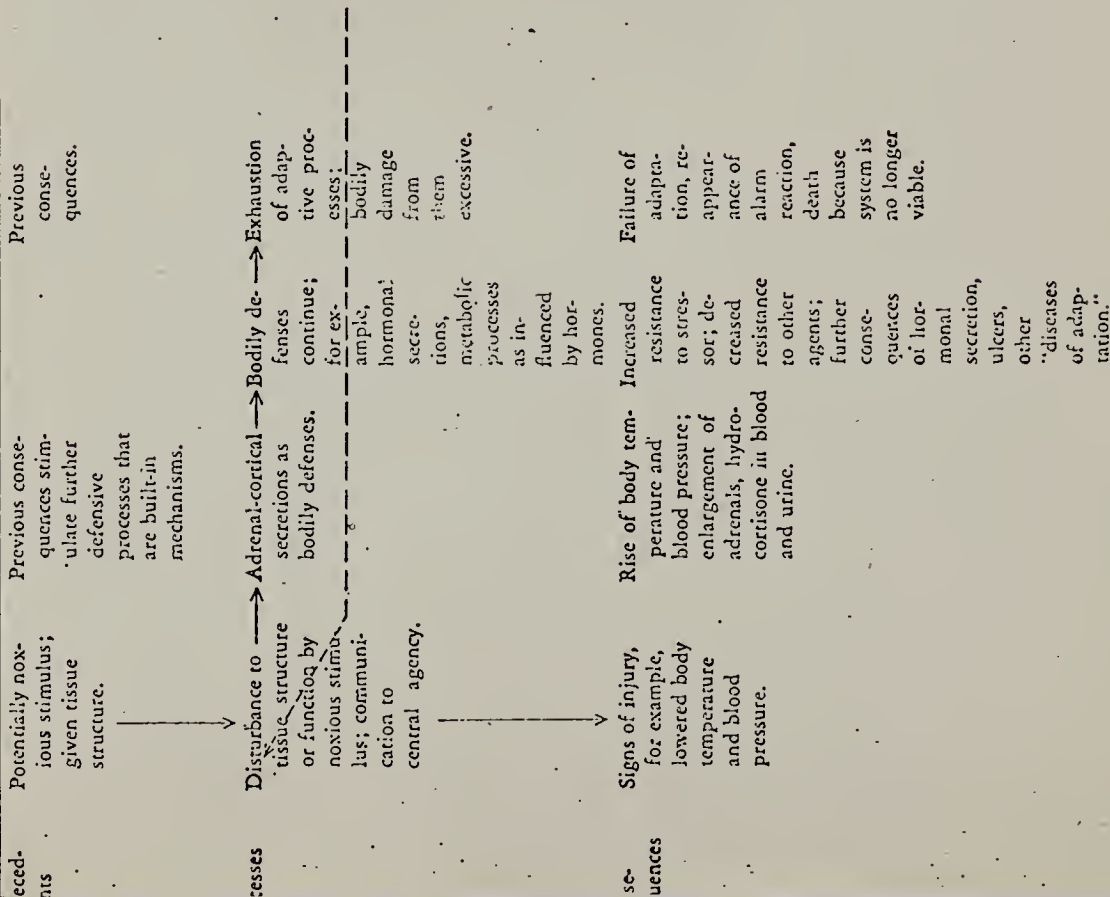
Prout, C. Reviewing Dalrymple (1967), paper presented at International Mononucleosis Symposium, Washington, D.C., 1967.

- Rahe, R. H. and Holmes, T. H. Life crisis and disease onset, II. Qualitative and quantitative definition of the life crisis and its association with health change. Submitted to Psychosomatic Medicine, 1966(a).
- Rahe, R. H. and Holmes, T. H. Life crisis and disease onset, III. A prospective study of life crisis and health changes, 1966(b).
- Rennie, G. E. and Wroblewski, F. The clinical significance of serum transaminase in infectious mononucleosis complicated by hepatitis. New England Journal of Medicine, 1957, 257, 547-553.
- ✓ Rivers, T. and Horsfall, F. Viral and rickettsial infections of man. Pennsylvania: J. B. Lippincott, 1959.
- ✓ Rotter, J. and Mulry, R. Internal vs. external control of reinforcement and decision time. Journal of Personality and Social Psychology, 1965, 2, 598-604.
- Ruff, G. E. and Korchin, S. J. Adaptive stress behavior. In Appley, M. H. and Trumbull, R. (eds.) Psychological stress: Issues in research. New York: Appleton-Century-Crofts, 1967.
- Seeman, M. and Evans, J. W. Alienation and learning in a hospital. American Sociological Review, 1962, 27, 772-782.
- ✓ Seifert, M. The conservative treatment of mononucleosis. Paper presented at International Mononucleosis Symposium. Washington, D.C., 1967.
- ✓ Selye, H. The stress of life. New York: McGraw-Hill, 1956.
- Shannon, I. L. In Lazarus, R. Psychological stress and the coping process. New York: McGraw-Hill, 1966.
- Wolf, S., Cardon, P. V., Shepard, E. M., and Wolff, H. G. Life stress and essential hypertension. Baltimore: Williams and Wilkins, Co., 1955.
- ✓ Wroblewski, F. The clinical significance of alterations in transaminase activities of serum and other body fluids. In Sabotha, H. and Steward, C. P. (eds.) Advances in clinical chemistry. New York: Academic Press, 1958, 313-351.

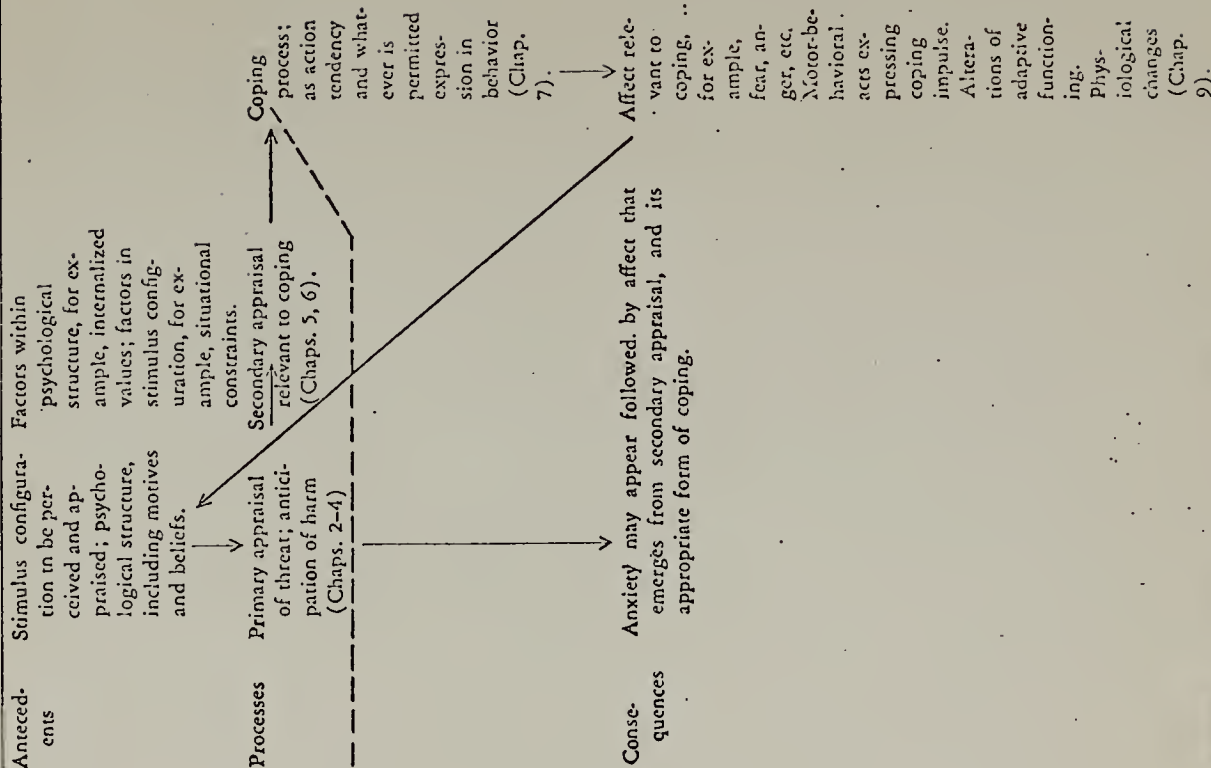
APPENDIX A

Table 1. Parallels and Convergences Between
Psychological and Physiological
Stress Theory

PHYSIOLOGICAL STRESS



PSYCHOLOGICAL STRESS



and arrows show roughly the sequence of events within each level of analysis, physiological or psychological. The dotted arrow indicates a convergence or interaction between

levels, as noted in the text on page 422. Many more interactions between the systems exist, but they could not be illustrated without creating a very confusing pattern of arrows.

APPENDIX B

Revised Holmes SRE Questionnaire

1. Name _____ Address _____
2. Sex: Male _____ Female _____ Age _____ Phone _____ Date _____
3. Race: White _____ Negro _____ Indian _____ Japanese _____ Chinese _____ Other _____
4. Ages at which (give age for each marriage, divorce, etc. if more than one):
 Married _____ Divorced _____ Widowed _____ Separated _____ Check if never married _____
5. Education, number of years _____ Occupation _____
6. In the blanks on the right column enter the number from the left column which corresponds to the length of time at the designated residence.
 (1) Less than 1 month _____
 (2) 1 to 3 months _____ Present residence
 (3) 4 to 6 months _____ Last residence
 (4) 7 to 11 months _____
 (5) 1 to 2 years _____ Next to last residence
 (6) 3 to 5 years _____
 (7) 6 years or more _____ Earliest remembered residence
7. In the blanks on the right column enter the number from the left column which corresponds to the type of housing at the designated residence.
 (1) Own home, or buying _____
 (2) Other detached dwelling _____ Present residence
 (3) Duplex or triplex _____ Last residence
 (4) Hotel-apartment _____
 (5) Boarder (roomer) _____ Next to last residence
 (6) Housekeeping room _____ Earliest remembered residence
 (7) Other _____
8. Where more of life was spent: rural area _____ towns under 5,000 _____
 larger towns _____
9. Where born: rural area _____ town under 5,000 _____ larger town _____
 Country of birth: of self _____
 Of your father _____ Of your mother _____
 Of your father's mother _____ Of your mother's mother _____
 Of your father's father _____ Of your mother's father _____
10. How many: older brothers _____ Deaths of brothers or sisters (give
 younger brothers _____ your age and his or her age) _____
 older sisters _____
 younger sisters _____
11. What was your age when your mother died?
 Age _____ Mother is still living _____
12. What was your age when your father died?
 Age _____ Father is still living _____

INSTRUCTIONS FOR THE REST OF THE QUESTIONS

Every question will have a list of years like this:

Jan. June 1965-1965	July Dec. 1965-1965	Jan. June 1966-1966	July Dec. 1966-1966	Jan. June 1967-1967
------------------------	------------------------	------------------------	------------------------	------------------------

Think back and decide if the question applied to you in any of these years. If so, mark an X under any year when it applied.

Each question has a space for you to say if it did not apply. If you are sure it does not characterize your life during any of these years then mark an X where it says: "Does not apply_____."

If you are doubtful at all, then make up your mind it does apply. In other words, you would not be in doubt if you had no reason to be. So answer as well as you can.

If you are not sure of the year, don't worry. You will not be more than a year or so off, and the main thing is to spot whether it was a short time ago or quite a while back.

Answer every question. Go back to see if you made any mistakes. Don't be afraid to make corrections.

13. Mark under the years where there has been either a lot more or a lot less trouble with your professors:

Jan. June 1965-1965	July Dec. 1965-1965	Jan. June 1966-1966	July Dec. 1966-1966	Jan. June 1967-1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply_____

14. Mark under the years where your usual sleeping pattern was changed (sleeping a lot more or a lot less, or change in part of day when asleep):

Jan. June 1965-1965	July Dec. 1965-1965	Jan. June 1966-1966	July Dec. 1966-1966	Jan. June 1967-1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply_____

15. Mark under the years where your eating habits were changed (either a lot more or a lot less eating, or very different meal hours or surroundings):

Jan. June 1965-1965	July Dec. 1965-1965	Jan. June 1966-1966	July Dec. 1966-1966	Jan. June 1967-1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply_____

16. Mark under the years that there has been substantial change in your personal habits (your dress, manner, association, etc.):

Jan. June 1965-1965	July Dec. 1965-1965	Jan. June 1966-1966	July Dec. 1966-1966	Jan. June 1967-1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply_____

17. Mark under the years that there has been substantial change in your usual amount and/or type of recreation:

Jan. June 1965-1965	July Dec. 1965-1965	Jan. June 1966-1966	July Dec. 1966-1966	Jan. June 1967-1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply_____

18. Mark under the years that there has been substantial change in your social activities (clubs, dancing, movies, visiting friends, etc.):

Jan. June 1965-1965	July Dec. 1965-1965	Jan. June 1966-1966	July Dec. 1966-1966	Jan. June 1967-1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply_____

19. Mark under the years that there has been a substantial change in your church activity (either a lot more or a lot less, or a change in denomination):

Jan. June 1965-1965	July Dec. 1965-1965	Jan. June 1966-1966	July Dec. 1966-1966	Jan. June 1967-1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply _____

20. Mark under the years that there has been a substantial change in family gettogethers (picnics, holidays, etc.):

Jan. June 1965-1965	July Dec. 1965-1965	Jan. June 1966-1966	July Dec. 1966-1966	Jan. June 1967-1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply _____

21. Mark under the years that you have had either a lot more or a lot less financial problems:

Jan. June 1965-1965	July Dec. 1965-1965	Jan. June 1966-1966	July Dec. 1966-1966	Jan. June 1967-1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply _____

22. Mark under the years that you had either a lot more or a lot less trouble with your parents:

Jan. June 1965-1965	July Dec. 1965-1965	Jan. June 1966-1966	July Dec. 1966-1966	Jan. June 1967-1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply _____

23. Mark under the years that you had either a lot more or a lot less arguments with your roommate (for example, over study hours, personal habits, etc.):

Jan. June 1965-1965	July Dec. 1965-1965	Jan. June 1966-1966	July Dec. 1966-1966	Jan. June 1967-1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply _____

24. Mark under the years that you had either a lot more or a lot less sexual difficulties:

Jan. June 1965 1965	July Dec. 1965 1965	Jan. June 1966 1966	July Dec. 1966 1966	Jan. June 1967 1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply _____

NOTICE: FOR THE REST OF THE QUESTIONS, USE NUMBERS TO ANSWER.
Every question asks you for the number of times in a year that something happened.

25. List the number of times each year that you experienced major illness, injury, or substantial health change (for example, pregnancy, disease, large weight gain or loss, etc.):

Jan. June 1965 1965	July Dec. 1965 1965	Jan. June 1966 1966	July Dec. 1966 1966	Jan. June 1967 1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply _____

26. List the number of times each year that you have lost a close family member (other than parent/spouse) by death:

Jan. June 1965 1965	July Dec. 1965 1965	Jan. June 1966 1966	July Dec. 1966 1966	Jan. June 1967 1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply _____

27. List the number of times each year that you have lost a parent/spouse by death:

Jan. June 1965 1965	July Dec. 1965 1965	Jan. June 1966 1966	July Dec. 1966 1966	Jan. June 1967 1967
------------------------	------------------------	------------------------	------------------------	------------------------

Does not apply _____

28. List the number of times each year that you have lost a close friend by death:

Jan. June	July Dec.	Jan. June	July Dec.	Jan. June
1965-1965	1965-1965	1966-1966	1966-1966	1967-1967

Does not apply _____

29. List the number of times each year that you have gained a new family member (birth of a child, adoption, oldster moving into home, etc.):

Jan. June	July Dec.	Jan. June	July Dec.	Jan. June
1965-1965	1965-1965	1966-1966	1966-1966	1967-1967

Does not apply _____

30. List the number of times each year that there has been a major change in the health or behavior of a family member:

Jan. June	July Dec.	Jan. June	July Dec.	Jan. June
1965-1965	1965-1965	1966-1966	1966-1966	1967-1967

Does not apply _____

31. List the number of times each year that you have changed place of residence:

Jan. June	July Dec.	Jan. June	July Dec.	Jan. June
1965-1965	1965-1965	1966-1966	1966-1966	1967-1967

Does not apply _____

32. List the number of times each year that you have been held in jail or some other detention place:

Jan. June	July Dec.	Jan. June	July Dec.	Jan. June
1965-1965	1965-1965	1966-1966	1966-1966	1967-1967

Does not apply _____

33. List the number of times each year that you have been found guilty of minor infractions of the law (disturbing the peace, traffic tickets, etc.):

Jan. 1965	June 1965	July 1965	Dec. 1965	Jan. 1966	June 1966	July 1966	Dec. 1966	Jan. 1967	June 1967

Does not apply _____

34. List the number of times each year that you have undergone major change in regard to school (failure of courses, improvement in grades

Jan. 1965	June 1965	July 1965	Dec. 1965	Jan. 1966	June 1966	July 1966	Dec. 1966	Jan. 1967	June 1967

Does not apply _____

35. List the number of times each year that you married:

Jan. 1965	June 1965	July 1965	Dec. 1965	Jan. 1966	June 1966	July 1966	Dec. 1966	Jan. 1967	June 1967

Does not apply _____

36. List the number of times each year that you were divorced:

Jan. 1965	June 1965	July 1965	Dec. 1965	Jan. 1966	June 1966	July 1966	Dec. 1966	Jan. 1967	June 1967

Does not apply _____

37. List the number of times each year that there was a lot more or lot less contact with your spouse (for example, marital separation, reconciliation, etc.):

Jan. 1965	June 1965	July 1965	Dec. 1965	Jan. 1966	June 1966	July 1966	Dec. 1966	Jan. 1967	June 1967

Does not apply _____

38. List the number of times each year that you have achieved special successes (championships, awards, scholarships, notable accomplishments, etc.):

Jan. June	July Dec.	Jan. June	July Dec.	Jan. June
1965 1965	1965 1965	1966 1966	1966 1966	1967 1967

Does not apply _____

39. List the number of times each year that there have been unusual changes in working hours or conditions:

Jan. June	July Dec.	Jan. June	July Dec.	Jan. June
1965 1965	1965 1965	1966 1966	1966 1966	1967 1967

Does not apply _____

40. List the number of times each year that you have experienced a change in your responsibilities at school (for example, joining a fraternity/sorority, election to office, termination of office):

Jan. June	July Dec.	Jan. June	July Dec.	Jan. June
1965 1965	1965 1965	1966 1966	1966 1966	1967 1967

Does not apply _____

41. List the number of times each year that you have been expelled:

Jan. June	July Dec.	Jan. June	July Dec.	Jan. June
1965 1965	1965 1965	1966 1966	1966 1966	1967 1967

Does not apply _____

42. List the number of times each year that your living conditions have substantially changed (remodeling, building additions, deterioration of home and/or neighborhood, etc.):

Jan. June	July Dec.	Jan. June	July Dec.	Jan. June
1965 1965	1965 1965	1966 1966	1966 1966	1967 1967

Does not apply _____

43. List the number of times each year that you have taken a vacation:

Jan. - June	July - Dec.	Jan. - June	July - Dec.	Jan. - June
1965 - 1965	1965 - 1965	1966 - 1966	1966 - 1966	1967 - 1967

Does not apply _____

44. List the number of times each year that you have changed schools:

Jan. - June	July - Dec.	Jan. - June	July - Dec.	Jan. - June
1965 - 1965	1965 - 1965	1966 - 1966	1966 - 1966	1967 - 1967

Does not apply _____

45. List the number of times each year that you have changed to a new line of work:

Jan. - June	July - Dec.	Jan. - June	July - Dec.	Jan. - June
1965 - 1965	1965 - 1965	1966 - 1966	1966 - 1966	1967 - 1967

Does not apply _____

46. List the number of times each year you have either begun or quit formal schooling:

Jan. - June	July - Dec.	Jan. - June	July - Dec.	Jan. - June
1965 - 1965	1965 - 1965	1966 - 1966	1966 - 1966	1967 - 1967

Does not apply _____

APPENDIX C

Subscales of Barron Ego Strength Scale

I. PHYSICAL FUNCTIONING

1. I have a good appetite. (T)
2. I have diarrhea once a month or more. (F)
3. I have a cough most of the time. (F)
4. I seldom worry about my health. (T)
5. My sleep is fitful and disturbed. (F)
6. I am in just as good physical health as most of my friends. (T)
7. During the past few years I have been well most of the time. (T)
8. I have never had a fainting spell. (T)
9. My hands have not become clumsy or awkward. (T)
10. At times I hear so well it bothers me. (F)

II. SENSE OF REALITY

1. At times I have fits of laughing and crying that I cannot control. (F)
2. I have had very peculiar and strange experiences. (F)
3. When I am with people I am bothered by hearing very queer things. (F)
4. Parts of my body often have feelings like burning, tingling, crawling, or like "going to sleep." (F)
5. I have no difficulty in keeping my balance in walking. (T)
6. I have had blank spells in which my activities were interrupted and I did not know what was going on around me. (F)
7. I have strange and peculiar thoughts. (F)
8. My skin seems unusually sensitive to the touch. (F)

III. ABILITY TO COPE

1. I find it hard to keep my mind on a task or job. (F)
2. I am easily downed in an argument. (F)
3. I like collecting flowers or growing house plants. (F)
4. I like to cook. (F)
5. My way of doing things is apt to be misunderstood by others. (F)
6. If I were an artist I would like to draw flowers. (F)
7. When someone says silly or ignorant things about something I know about, I try to set him right. (T)
8. My plans have frequently seemed so full of difficulties that I have had to give them up. (F)

APPENDIX D
Cover Letter

UNIVERSITY HEALTH SERVICES

UNIVERSITY OF MASSACHUSETTS

AMHERST, MASSACHUSETTS 01002

May 9, 1967

Dear

The University Health Services and the Psychology Department are conducting a cooperative research project on mononucleosis in a college population. Your name was one of several of those students who were treated for mononucleosis this past year and we are writing to ask for your cooperation in this study.

As you are probably aware the exact nature of mononucleosis is not clearly understood. You will be making a contribution to our scientific knowledge of the disease through your participation. There will be no physical examination, laboratory test, etc. required. All you need do is complete the three enclosed questionnaires and mail them back in the envelope provided. This should require less than forty-five minutes of your time. Please do not consult with anyone in deciding on your answers. No mention of individual names will be made in the study. Names are needed in order to match up the questionnaires with the laboratory records. No other use will be made of individual records, and results will be reported only as group scores.

Your commitment to this study is very important as it can only be done with University of Massachusetts students who have recently had mononucleosis and a series of laboratory tests. When the study is completed, a summary of the purpose and results will be sent to you. Please fill out the enclosed questionnaire and mail them back to us by May 15th.

Thank you for your cooperation.

Sincerely,

Burton Brunet

Psychology Department

St. B. Hall
Supervisor of Laboratory
Services

APPENDIX E

Table 2

Means, Standard Deviations and t Tests for Mononucleosis and Control Groups on Independent Variables

	Control	Mononucleosis
Rotter I-E Scale	N = 24 ^a X = 9.8 S = 3.7	N = 31 X = 11.1 S = 4.9
	t = 1.08	
Ego Strength (total score)	N = 23 ^b X = 43.8 S = 6.4	N = 31 X = 46.7 S = 6
	t = 1.05	
Physical Functioning	N = 23 ^b X = 9.5 S = 2.1	N = 31 X = 8.9 S = 1.6
	t = 1.25	
Sense of Reality	N = 23 ^b X = 6.6 S = 1.7	N = 31 X = 6.1 S = 1.9
	t = 1.01	
Ability to Cope	N = 23 ^b X = 5.7 S = 2.3	N = 31 X = 6.4 S = 2.3
	t = 1.07	
Stress (Preceding Year)	N = 25 X = 191 S = 109	N = 31 X = 222.6 S = 134
	t = .94	

^aOne subject eliminated due to insufficient data.

^bTwo subjects eliminated due to insufficient data.

APPENDIX F

Table 3

Means, Standard Deviations and t Tests for Mononucleosis
 Patients with Three or More SGPT Tests and Mononucleosis
 Patients with Less than Three SGPT Tests
 on Independent Variables

	Three or More SGPTs	Less than Three SGPTs
Rotter I-E Scale	N = 31 X = 11.1 σ = 4.9	N = 33 X = 9.3 σ = 4.0
	t = 1.20	
Ego Strength (total score)	N = 31 X = 46.7 σ = 6	N = 33 X = 47.4 σ = 6.3
	t = .45	
Physical Functioning	N = 31 X = 8.9 σ = 1.6	N = 33 X = 9.5 σ = 1.4
	t = .16	
Sense of Reality	N = 31 X = 6.1 σ = 1.9	N = 33 X = 6.3 σ = 2.0
	t = .42	
Ability to Cope	N = 31 X = 6.4 σ = 2.3	N = 33 X = 7.5 σ = 1.9
	t = 1.9	
Stress (preceding year)	N = 31 X = 222.6 σ = 134	N = 33 X = 319 σ = 156
	t = .26	

APPENDIX G

Table 4

Intercorrelation Matrix for All Variables

	Recovery Rate	External Control	Ego Strength	Physical Functioning	Reality Testing	Ability to Cope	Activity Change	Stress (Preceding Year)	Initial Severity	Sex
Recovery Rate	1.00	.20	.28	.16	.13	.36*	-.21	-.36*	.24	-.34
External Control		1.00	-.21	-.06	-.06	-.19	.11	.04	-.02	.05
Ego Strength			1.00	.57**	.80**	.54*	-.28	-.24	-.07	-.35
Physical Functioning				1.00	.49**	.11	-.05	-.33	-.04	-.16
Reality Testing					1.00	.44**	-.37**	-.06	-.18	-.30
Ability to Cope						1.00	-.09	-.11	-.01	-.71**
Activity Change							1.00	-.14	.00	-.10
Stress (Preceding Year)								1.00	.02	.12
Initial Severity									1.00	-.08
Sex										1.00

* $p < .05$

** $p < .01$

APPENDIX H

Table 5

Matrix of Correlations for Ego Strength Measures

	Ego Strength (total score)	Physical Function- ing	Sense of Reality	Ability to Cope
Ego Strength (total score)	1.00	.57	.81	.54
Physical Functioning		1.00	.50	.11
Sense of Reality			1.00	.45
Ability to Cope				1.00

Approved as to style and content by:

Larry L. Kupselman
(Chairman of Committee)

Stanley M. Moss
(Head of Department)

Stanley M. Moss
(Member)

Henry B. Biller
(Member)

July 1968
(Month) (Year)

