1978

Developing a typology of cardiac patients

Deirdre Peglar Hiatt

Iowa State University

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DEVELOPING A TYPOLOGY OF CARDIAC PATIENTS.

IOWA STATE UNIVERSITY, PH.D., 1978
Developing a typology of cardiac patients

by

Deirdre Peglar Hiatt

A Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of The Requirements for the Degree of DOCTOR OF PHILOSOPHY

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Iowa State University
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1978
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Overview</td>
<td>1</td>
</tr>
<tr>
<td>Cardiac Illness</td>
<td>4</td>
</tr>
<tr>
<td>LITERATURE REVIEW</td>
<td>7</td>
</tr>
<tr>
<td>Factors Differentiating Cardiac Patients from Controls</td>
<td>7</td>
</tr>
<tr>
<td>Factors Among Cardiac Patients</td>
<td>10</td>
</tr>
<tr>
<td>Perception of Health</td>
<td>20</td>
</tr>
<tr>
<td>Death of Cardiac Patients</td>
<td>25</td>
</tr>
<tr>
<td>OBJECTIVES</td>
<td>28</td>
</tr>
<tr>
<td>METHOD</td>
<td>30</td>
</tr>
<tr>
<td>Subjects</td>
<td>30</td>
</tr>
<tr>
<td>Instruments</td>
<td>30</td>
</tr>
<tr>
<td>Procedure</td>
<td>31</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>32</td>
</tr>
<tr>
<td>Variables</td>
<td>32</td>
</tr>
<tr>
<td>Analysis glossary</td>
<td>34</td>
</tr>
<tr>
<td>Replications</td>
<td>36</td>
</tr>
<tr>
<td>Comparison to PH clusters</td>
<td>36</td>
</tr>
<tr>
<td>Death</td>
<td>37</td>
</tr>
<tr>
<td>RESULTS</td>
<td>38</td>
</tr>
<tr>
<td>Cardiac Clusters</td>
<td>38</td>
</tr>
<tr>
<td>Replication</td>
<td>46</td>
</tr>
<tr>
<td>Perception of Health</td>
<td>48</td>
</tr>
<tr>
<td>Death</td>
<td>52</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>60</td>
</tr>
<tr>
<td>Replication</td>
<td>60</td>
</tr>
<tr>
<td>Cluster Characteristics</td>
<td>61</td>
</tr>
<tr>
<td>Perception of Health</td>
<td>70</td>
</tr>
<tr>
<td>Deceased</td>
<td>71</td>
</tr>
<tr>
<td>FINAL COMMENTARY</td>
<td>79</td>
</tr>
<tr>
<td>REFERENCE NOTES</td>
<td>83</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>84</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1. One-way analyses of variance for cardiac clusters .................................................. 39
Table 2. Chi-square analyses for cardiac clusters ................................................................. 39
Table 3. Cardiac cluster summary characterizations .............................................................. 41
Table 4. $D^2$ matrix for relative distances in Replication 1 .................................................. 47
Table 5. Correlations of cardiac cluster profiles in Replication 2 ......................................... 49
Table 6. Cross classification of patients in Cardiac and Perception of Health clusters ............ 50
Table 7. Analyses of variance for cardiac cluster groups on Perception of Health .................. 50
Table 8. Analyses of variance for Deceased vs. Main Group on cardiac variables .................. 53
Table 9. Chi-square analyses for Deceased vs. Main Group on cardiac variables .................. 53
Table 10. Analyses of variance for Deceased and PH cluster groups on cardiac variables ......... 54
Table 11. Chi-square for Deceased and PH cluster groups on cardiac variables ................. 55
Table 12. Analyses of variance for cardiac cluster groups and Deceased on cardiac variables .... 55
Table 13. Chi-square for cardiac cluster groups and Deceased on cardiac variables ............. 56
Table 14. F matrix for Mahalanobis multivariate distance between cardiac clusters and the Deceased .... 59
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Perception of health patterns for PH clusters</td>
<td>24</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Psychological variables for cardiac clusters</td>
<td>42</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Background variables for cardiac clusters</td>
<td>43</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Medical variables for cardiac clusters</td>
<td>44</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Inhospital variables for cardiac clusters</td>
<td>45</td>
</tr>
<tr>
<td>Figure 6</td>
<td>Perception of health patterns for cardiac clusters</td>
<td>51</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Plot of discriminant score 1 vs. discriminant score 2 in discriminant space for the 5 cardiac clusters (Groups 1-5) and the deceased (Group 6).</td>
<td>58</td>
</tr>
</tbody>
</table>
INTRODUCTION

Overview

By its very nature, research in psychosomatic illness should be integrative. The overall goal of such research is the understanding of interrelationships between physical and psychological variables. Unfortunately, this interrelationship is too often viewed in a unidirectional manner. Either the psyche is seen as causing the somatic reaction or the soma as affecting the psyche. Many researchers do not seem to appreciate the constant interplay of both physiological and psychological factors.

The most common approach to psychosomatic disorders is that a person's life experiences cause emotional reactions which in turn lead to physical illness (Mason, 1970). According to this view, a person becomes ill because he has not been able to handle certain life stresses. This approach fails to take into account the ways in which a person's physical state affects his emotions. For example, in studying the impact of feelings of anxiety on development of cardiac problems, it may be important to understand that anxiety was in part a reaction to physical pain.

To understand the total process of psychosomatic illness, analysis must also include the person's reactions to the experience of somatic disease. The view that a psychosomatic disease is a life crisis which can be reacted to in different ways deals with the effect of physiological processes on psychological ones. However, it is also limited in
providing a full explanation because it, too, is unidirectional.

A full understanding of psychosomatic illness cannot come until researchers give up models which imply that either physical processes cause psychological reactions or psychological processes lead to physical reactions. The overall process of development of a psychosomatic illness and its effect on a person can only be understood if it is realized that physical and psychological processes are in constant interplay, affecting each other and producing reactions. "Psychosomatic" cannot be separated into "psyche" and "soma"; both are interrelated and must be analyzed as such.

Psychological research has been increasingly characterized by integrative approaches. One current integrative view is encompassed in the trait by situation interaction. Instead of viewing either personal characteristics or environment as the single cause of behavior, both are seen as interacting. As Vale and Vale (1969) have pointed out, this view necessitates giving up the nature vs. nurture controversy and replacing it with research on how individual differences interact with situational differences. Giving up this unidirectional model also implies viewing as worthwhile both idiographic and nomothetic approaches and using both experimental and correlational statistical techniques (Cronbach, 1957; Kiesler, 1971). Rausch (1965) exemplifies the research approach to personality by situation research in studying behavior of children of differing personality traits in varying situations.

Mahoney (1977) discusses an integration between cognitive and behavioral approaches to psychotherapy. Cognitions are viewed as
mediators between the environment as such and the ways in which the individual interacts with the environment. Mahoney stresses the causal interrelationships of thoughts, feelings, and behavior but encourages trying to untangle the relationships in order to understand them.

It would be useful to carry over these integrative approaches to research on psychosomatic illness. The importance of cognitive mediators is beginning to be appreciated theoretically (Lazarus, 1966) but research efforts should include better understanding of how cognitive events influence and are influenced by external situational and internal physiological states. It would also be useful to analyze how people with differing personality characteristics react to differing types of situations in developing psychosomatic diseases. Too often research tends to assume one type of person in one type of situation developing one kind of disease.

The statistical approaches in psychosomatic research are a reflection of the unidirectional, causal approach. Generally the use of statistics is unsophisticated. Much research is impressionistic: It may be worthwhile as preliminary investigation, but it cannot provide definitive answers. The early work on various "disease personalities" (Mordkoff & Golas, 1968) has not held up under carefully controlled, objective, prospective research.

Objective, controlled research in psychosomatic illness relies primarily on countless t-tests without consideration for the increased probabilities of obtaining chance significance. The occasional use of multiple regression occurs in the context of having a number of
variables predict a particular outcome measure. It again assumes a unidirectional, causal relationship which implies that a psychological or physiological event can be only a result without being a further cause.

An approach to research which does look at interrelationships is the typological one (Dahlstrom, 1972). This approach seeks patterns among variables which can be used to classify individuals into groups. The interrelationships between the variables become clear through understanding the ways in which groups are formed (Sokal, 1974). Knowing what distinctive patterns for physiological and psychological variables exist will aid in developing a comprehensive picture of the psychosomatic process.

Cluster analysis is a statistical technique which can aid in developing such a taxonomy (Blashfield, 1976). It has been used in a variety of studies to develop typologies of alcoholics (Skinner & Jackson, 1974), depressed patients (Paykel, 1971), and general psychiatric patients (Williams, Barton, White, & Won, 1976).

Cardiac Illness

Cardiac illnesses have been investigated by a number of researchers interested in psychosomatic diseases. Research in cardiac problems reflects the tendency to view physiological and psychological processes in a unidimensional, causal way. One research approach looks at cardiac illness as a physical response to life stresses which are psychologically significant (Miles, Waldfogel, Barrabee, & Cobb, 1954; Rahe &
Lind, 1971). The other general model considers a cardiac disease to be a physical event to which an individual reacts psychologically (Croog, Shapiro, & Levine, 1971; Reiser, 1951).

While both approaches have been extremely helpful in understanding how cardiac diseases develop and how they affect those who suffer from them, neither taken alone is totally adequate. Even before a person realizes he has a cardiac illness, he is reacting to physiological events with emotions. A patient's physiological reactions to the emotions caused by hospitalization will generate further psychological responses. Psychological and physiological events influence each other in the entire process of developing a cardiac illness, having an attack, being hospitalized, and adjusting to the realization of the disease. Although the process can be stopped at a given point in order to be examined thoroughly, that point must be understood within the total context for a full appreciation of the psychosomatic illness.

Some attempts have been made to understand cardiac diseases through developing typologies of cardiac patients. However, the typologies which have been developed have serious shortcomings. Too often the empirically-based classification systems rely on a very limited number of variables. The integrative systems are based on subjective impressions without empirical substantiation. The purpose of this study is to develop an integrative preliminary classification of cardiac patients based on objective measures of psychological, physiological, and demographic variables. In developing this typology, the study addresses questions of how cardiac illness develops, how physiological and
psychological variables determine reactions to cardiac illness, and what types of people are most likely to survive cardiac attacks. While this study cannot provide definitive answers to these questions, it suggests directions for future investigation.
Factors Differentiating Cardiac Patients from Controls

Most of the research on cardiac diseases has attempted to distinguish those who develop cardiac problems from those who do not. This research has begun to demonstrate some consistent factors (Croog, Levine, & Lurie, 1968). Three large, well-designed, prospective studies have produced the most meaningful results. The Framingham (Kannel, 1976), Western Collaborative Group (Rosenman, Brand, Sholtz, & Friedman, 1976) and Health Insurance Plan of Greater New York (Shapiro, Weinblatt, Frank, & Sager, 1965) studies have all found increased risk of heart disease with increasing age and cigarette smoking. The more extensive Framingham and Western Collaborative Group (WCG) studies also found factors of higher serum cholesterol level and hypertension to increase the risk of heart disease. Familial history and overweight were predictive factors in the Framingham studies, not in the WCG.

The only large scale prospective study on personality characteristics of those who develop cardiac disease was done by the WCG. They developed the concept of the Type A behavior pattern (Friedman & Rosenman, 1959) which was found more among cardinals than noncardinals. The Type A person is aggressive, highly competitive, and chronically impatient. The WCG multivariate analysis has shown that the Type A factor has an impact on prediction of heart disease in addition to increasing the levels of traditional risk factors (Rosenman et al., 1976).

This Type A personality is somewhat different from the earlier
proposed "coronary type" (Mordkoff & Golas, 1968) which was seen as inhibiting hostile impulses. The earlier studies usually had no controls and were mainly impressionistic, which may account for the differences in findings.

More recent empirical, retrospective studies have found personality differences between cardials and controls similar to the Type A formulations. Van der Valk and Groen (1967) found that those who suffered myocardial infarctions were more devoted to work, had a greater sense of duty and stronger desire for power than controls did. According to Thiel, Parker, and Bruce (1973) those who had myocardial infarctions worked more hours and suffered from anxiety, depression, and loneliness more than controls. Coronary patients worked harder and felt under more stress in a study by Miles et al. (1954). Minc (1965) found cardiac patients more inhibited and rationally controlled. Thus the Type A pattern does seem to hold up in a number of studies as an important factor in differentiating cardiac patients from controls. There is some evidence that this may be true only for certain groups. According to Keith, Lown, and Stare (1965) age is a determinant of the importance of the Type A pattern. They found more Type As among cardiac patients in younger groups but not in older. More research needs to be done to establish the importance of the Type A pattern among different kinds of groups to assess its importance in developing cardiac disease.

The interaction between personality traits and environment has been emphasized. Friedman (1960) has stressed the importance of socioeconomic milieu while Jenkins, Rosenman, and Friedman (1967) emphasized the
impact of situational pressures. This realization of the interrela-
tionship between trait and situation is very important to an integra-
tive knowledge of disease. Further research on how personality charac-
teristics and environment interact would be very useful.

Much recent research has found a relationship between significant
life changes and the development of illness (Pesznecker & McNeil, 1975;
Nelson, Mensh, Hecht, & Schwartz, 1972; Holmes & Masuda, 1974). A study
by Rahe, Bennett, Romo, Haner, and Arthur (1973) found that subjects
who suffered a myocardial infarction had a significantly higher number
of psychologically important life changes in the six months preceding
their attack.

It is clear that certain factors are likely to increase the risk
of cardiac disorder. The evidence for personality characteristics in-
fluencing the development of cardiac disease is impressive. However,
the process by which these factors affect the course of cardiac dis-
ease is still unclear. The narrowness of the unidimensional model
leads to oversimplifying the process by which a cardiac illness develops.
When researchers write about psychological factors leading to cardiac
disease, they do not consider the possibility that physiological differ-
ences among people may make the development of Type A psychological
traits more likely. To more fully understand why certain people have
cardiac diseases and others do not it is necessary to consider the total-
ity of interrelationships among physiological and psychological factors.
Factors Among Cardiac Patients

Although research has begun to produce clear factors related to the development of cardiac disorders, variables differentiating cardiac patients from one another are not as well-defined. Several variables have been studied and a few types of hospitalized patients have been suggested, but no consistent picture has emerged. Most of the research looks at a few variables related to one outcome measure—usually survival or return to work.

In order to understand how the numerous demographic, physiological, and psychological variables interrelate it is necessary to consider them first separately and then as they have been related to one another.

A number of researchers have investigated socioeconomic differences among heart patients. Various occupations have been studied to assess differential risk of developing cardiac problems and reactions to cardiac disorders. Level of education has also been studied as an approximation of SES.

Age is a variable which has frequently been studied. Rosen and Bibring (1966) have used age as the crucial factor in developing a typology of cardiac patients.

Since smoking has been so clearly indicated as a risk factor in developing cardiac disease, it is natural that it would be studied in regard to differences among patients. Alcoholism has been studied less extensively.

A number of studies have been concerned with physiological measures of cardiac damage. The type of cardiac problem suffered has been
considered to be important. For example, angina patients have been compared to those who suffered myocardial infarctions (Dongier, 1974). The patient's history of heart problems has been considered an important variable. Severity of heart damage, while difficult to measure, has also been seen as important in understanding the patient's reaction to cardiac problems.

Psychological variables are usually considered causal when they occur before a given cardiac problem and considered to be reactions when they occur after. Both before a person realizes he has a cardiac disease and after he has been hospitalized psychological and physiological variables are constantly interacting, but the causal model provides a way to begin analyzing those interrelationships. The model most often used in understanding how psychological factors bring about cardiac problems is the stress model (Wardwell & Bahnson, 1964). Stress has been conceptualized in a number of ways in psychosomatic research (Luborsky, Docherty, & Penick, 1973). The life change model (Rahe & Lind, 1971) views stress in terms of changes in a person's life which research efforts have shown to be psychologically significant. In assessing the importance of a given change, average weighting of a number of raters is used. This procedure has the advantage of quantifying stress units, but does not account for individual differences in the meaning of a particular event. As Rahe (1974) has pointed out, each person's past experiences, psychological defenses, physiological reactions, and coping style determine his reaction to a given event.

The other commonly used definition of stress is "the physiological
and psychological reactions to personal and social situations" (Schar, Reeder, & Dirken, 1973). Instead of viewing stress as the events to which a person reacts, it is seen as the individual's reactions to those events. Selye's (1961) General Adaptation Syndrome emphasizes nonspecifically induced changes while Lazarus (1966) emphasizes specific reactions mediated by cognitive appraisal of the situation.

Sagall and Reed (1969) have reviewed the evidence that acute psychological stress produces physiological changes. Augmented stroke volume, increased heart rate, enhanced oxygen consumption, elevated blood pressure, and abnormal EKG have all been found in conjunction with psychologically stressful situations. All these changes, if they had a permanent impact, could lead to cardiac illness. Thus there is a basis for the interaction of physiological and psychological factors. It is important to keep in mind that physiological components of the stress reaction may also influence the psychological reactions. In addition to cognitions producing physiological reactions, perhaps the physiological components can influence further cognitive production. The experience of feeling stressed may produce thoughts which continue to bring about physiological reactions. Perhaps a circular causal model is more satisfactory than a unidirectional one.

Unfortunately the term "stress" is used very loosely in psychosomatic research and is sometimes poorly operationalized. For example, Eastwood and Trevelyan (1971) use the presence of psychiatric disorder to define stress. Mechanic and Volkart (1961) use responses to questions about loneliness and tension. From these definitions it seems that
stress is merely any kind of upset. Such a general concept is not par-
ticularly helpful. The acceptance of a clear model of stress would
benefit the study of psychological and physiological interrelationships.

The most frequent psychological responses to cardiac attack are
anxiety, depression, and denial (Rosen & Bibring, 1966). These re-
sponses have been frequently investigated. Croog et al. (1971) write
that after a cardiac attack an onslaught of anxiety is the common re-
action, followed by depression. Some patients deal with the anxiety by
denial, others by expression of hostility. In this view, anxiety is
experienced by all patients to a high level, but it is dealt with differ-
ently.

Other researchers have found the distinction between trait and
state anxiety (Spielberger, Wadsworth, Auerbach, Dunn & Taulbee, 1973)
to be useful. Shedletsky and Endler (1974) have developed a person by
situation model. An individual's anxiety-proneness interacts with his
perception of degree of threat in a given situation to determine his
current level of anxiety. A person's reaction to a cardiac attack would
depend on his trait anxiety and how threatening the attack was to him.

One method of attempting to cope with the anxiety of a cardiac
attack is through denial. Froese, Vasquez, Cassem, and Hackett (1974)
have defined denial as conscious or unconscious repudiation of all or a
portion of the available meaning of an illness. Denial has been defined
in research as either a general trait as measured by the MMPI (Gilber-
stadt & Sayko, 1967), denial of feelings of anxiety (Hackett & Cassem,
1975), or even denial that one has had a heart attack (Croog et al.,
1971). One concern about the excessive use of denial is that it may lead to refusal to cooperate with the established medical program (Reiser, 1951).

All these demographic, physiological, and psychological measures have been considered in numerous ways in relation to each other and to measures usually considered outcome variables. The interrelationships of the measures will be considered first, then their relationship to postattack return to work. The impact of these measures on survival from cardiac disease will be considered in a later section.

Several studies have found differences between cardiac patients of varying ages. Miller (1965) found that patients under 55 were higher on measures of anxiety, hostility directed inward, and ambivalent hostility. Rodda, Miller, and Bruhn (1971) also found younger patients more anxious and more likely to remain chronically anxious. Rosen and Bibring (1966) found older patients more depressed and younger patients more defiant of medical regimen.

Although many researchers have investigated SES differences in developing heart problems (Miller, 1965; Reeder, Schrama, & Dirken, 1973), few have found differences between patients who have suffered cardiac attacks. Rosen and Bibring (1966) did find that after suffering cardiac attack, patients in white collar occupations suffered more manifest anxiety than those in blue collar occupations. After suffering a second attack, patients in both classes tended to be manifestly anxious.

A study on the effects of smoking on patients who have had
myocardial infarctions (Jenkins, Zyzanski, & Rosenman, 1976) found that smokers are more likely to suffer subsequent myocardial infarctions.

Some differences have been found between people suffering from different types of cardiac problems. Ostfeld, Lebovits, Shekelle, and Paul (1964) found that when compared with patients who had myocardial infarctions, those who suffered from angina pectoris had higher pre-illness Hy and Hs scores on the MMPI. Since this was a prospective study, differences cannot be attributed to the effect of the kind of cardiac problem; perhaps certain kinds of people are more prone to certain diseases.

Denial of either the meaning of an attack or of the attack itself has been investigated more thoroughly than any other psychological reaction. If the denial mechanism is working, those who use it should have lower anxiety levels. A study by Gentry, Foster, and Haney (1972) found that deniers did express less state anxiety over the course of hospitalization. Froese, Hackett, Cassem, and Silverberg (1974) developed a rating scale on the basis of which they classified cardiac patients as either deniers or nondeniers. They found that deniers, who tended to be younger and to spend less time in the hospital, were less anxious and experienced a reduction in anxiety sooner than nondeniers. For the patients in these studies denial does seem to be effective in reducing anxiety.

Croog et al. (1971) found that of 345 men under treatment for myocardial infarction, 20% denied that they had had a heart attack.
Those who denied having an attack were less likely to admit to negative traits on a self-rating scale and more likely to say they would not follow their doctors' advice. It would be valuable to know if, in fact, deniers were less likely to follow the prescribed medical program.

The other personality variable which has been investigated among cardiac patients is the Type A factor described by the Western Collaborative Group. Jenkins et al. (1976) found that Type As who suffered a myocardial infarction were more likely to suffer subsequent MIs than non-Type As.

Many studies have investigated factors related to return to work after cardiac hospitalization. Although most research assumes that returning to work is a desirable outcome, Croog et al. (1968) have pointed out that if emotional stresses at work were in some measure responsible for the original attack, return to that stressful environment may be contributory to further problems. In general, however, return to work is seen as a positive sign that a person has adjusted to his cardiac problem. Return to work has been associated with higher perception of health (Garrity, 1973a) and higher morale (Cay, Vetter, Phillip & Dugard, 1973). Although most cardiac patients released from the hospital are permitted to work, it has been estimated that at least half of them remain inactive (Wishnie, Hackett, & Cassem, 1971). It is therefore important to understand why some patients are unlikely to return to work.

Older patients are less likely to return to work (Weinblatt, 1966). Gressett (1969) found that those with more education are more likely
to return to work.

Research indicates the severity of the attack which led to hospitalization is not related to return to work (Garrity, 1973b; Hay & Turbott, 1970, Gelfand, Lewis, Monheit, Shapiro, Thomson, Levine, & Hagan, 1960). Croog et al. (1968) view severity of the attack as setting limits on the rate of recovery but not final level of activity. Those who have had an attack prior to hospitalization are less likely to resume work (Nagle, Gangola, & Picton-Robinson, 1971).

Psychological factors have also been related to return to work. Nagle et al. (1971) found that those who did not have cardiac damage gave anxiety and depression most often as their reason for not working. Patients rated by psychiatrists as disturbed in the cardiac care unit were less likely to return to work (Cay et al., 1973). Gelfand et al. (1960) described those who did not return to work as passive-dependent in contrast to the workers who were more obsessive-compulsive and realistic. In summary those who do not return to work tend to be older, have less education, have a history of cardiac problems, and have more psychological problems adjusting to the cardiac attack.

Several researchers have developed typologies of cardiac patients. Although these typologies are based on a limited range of variables, they can provide a basis for an integrative typology.

Henrichs and Waters (1972) divided heart surgery patients into groups based on MMPI scores. The types they suggested were depressed, symbiotic, deniers of anxiety, adjusted, and those with significant psychological disturbance. Those classified well-adjusted had a much
better overall response to surgery.

Boyd, Yeager, and McMillan (1973) differentiated two types of patients undergoing surgery. One group reported before surgery that their health was good. They were more active, tended to have an extrapunitive coping style, were more aggressive, and had a better work record following surgery. The other group contained more alcoholics, saw their health as poorer, had a more intrapunitive coping style and relied more on denial.

Rosen and Bibring (1966) found that patients of different ages had qualitatively different types of reactions. Patients in their 30s tended to be overly cheerful, flirtatious, and independent. Those in their 50s were more hostile, withdrawn, and defiant of medical regimen. The patients in their 60s were seen as sweet and easy-going. The authors speculated that patients in their 50s had the hardest time adjusting to their cardiac attack because of its association with problems of the "mid-life crisis."

Miller (1965) has suggested two different types of myocardial infarction. The attack that takes place in an older person is seen as physiological; that in younger patients is more caused by psychological stress. This difference in types is consistent with the finding that the Type A behavior pattern differentiated cardiac patients from controls only for younger men (Keith et al., 1965).

One interesting typology of patients who were candidates for cardiac surgery was, unfortunately, based only on clinical impressions (Kennedy & Bakst, 1966). Six different types were discussed. The
first, with the best prognosis for surviving surgery, had a history of denial of unpleasant aspects of illness, higher perceptions of their own health, and a higher motivation to live than did other groups. A second group was dependent and for them the secondary gains of their illness were of primary importance. They did not do well in surgery. The third group exaggerated the dangers of surgery and experienced increasing sensations of fear and dread. The fourth group had a strong conflict between their desire to be free from disease and terror of giving up their secondary gains. This group had the largest number of deaths following surgery. The fifth group was characterized by a wish to die. Group six contained those considered to have a basic psychiatric illness.

A somewhat similar typology was based on psychiatric interview data (Kimball, 1969). The Adjusted group consisted of those whose functioning before and during hospitalization was intact and reality oriented. These patients expressed moderate anxiety combined with confidence their operation would succeed. Those in the Symbiotic group had adapted to their illness and were dependent on secondary gains. They did not look forward to changing their situation through surgery. The Denying Anxiety group minimized or denied signs of illness and anxious feelings. They seemed suspicious, hyperactive, and rigid, characteristics which were interpreted to be behavioral signs of the anxiety they were refusing to admit. The Depressed group denied anxiety and did not seem to care what happened to them. Age and severity of illness did not differentiate the groups. However, measures of surgery outcome showed
impressive differences. Those in the Adjusted group generally had uncomplicated recoveries; few in the other groups did. Almost 80% of those in the Depressed group died. There are definite implications for the importance of dealing with severe depression when its results seem so toxic.

In studying these psychological, physiological, and demographic variables, some interrelationships do emerge. Most of the typologies are based on patients undergoing cardiac surgery, who may be differently or more severely disabled than patients who are hospitalized for angina or for a myocardial infarction. No research has been done integrating all these variables to provide for a comprehensive understanding of cardiac illness. It is necessary to find a way to make the patterns of these relationships meaningful.

Perception of Health

A measure which has great potential in an integrative approach to studying psychosomatic reactions is the perception of health (Linn, 1976; King, 1962). In fact, the Task Group on Cardiac Rehabilitation of the National Heart and Lung Institute (Weiss, Note 1) emphasized support for research on perception of health measures as those most likely to lead to understanding of the cardiac patients' adjustment process.

Perception of health has been viewed as an integrative measure in several ways. In his research on health status among the elderly, Maddox (1962) has viewed a person's perception of health to be the crucial intervening variable between objective health status and degree of
acceptance of the sick role. Perception of health is correlated with physicians' ratings of health (Maddox & Douglass, 1973; Suchman & Phillips, 1958; Palmore & Luikart, 1972; Friedsam & Martin, 1963). In fact, it is a better predictor of a subject's reactions to stress than the objective ratings of the physician (Spreitzer & Snyder, 1974; Edwards & Klemmack, 1973; Palmore & Luikart, 1972).

Perception of health has been integrative in relating numerous other variables. Tissue (1972) has discussed perception of health as combining aspects of functional capacity and evaluative response. It has also been viewed as an intervening variable between predictors of reactions to stressful events and measures of adjustment (Garrity, 1973a; Weiss, Note 1). Physical, psychosocial, sociocultural, and health care systems variables are viewed as determining a person's perception of his or her health which then determines outcome variables. Empirically, perception of health has been found to be related to several kinds of outcome variables. Suchman and Phillips (1958) found perception of health to be correlated with general activity level and ability to hold a job. In research on cardiac patients Garrity (1973a) found perception of health at six months following hospitalization was positively related to employment. While Garrity implies that greater perception of health causes improved employment, this relationship could not be demonstrated unless the measure were taken earlier than employment. When the measures are taken simultaneously it is certainly a reasonable alternative explanation that a person might feel "If I'm working, I must be in reasonably good health," and so have employment
lead to greater perception of health.

Some studies have found perception of health to be highly correlated with overall evaluation of life satisfaction. Spreitzer and Snyder (1974), Edwards and Klemmack (1973) and Palmore and Luikart (1972) all found perception of health superior as a predictor of life satisfaction to all other measures considered including background, SES, and physician's ratings.

Findings on perception of health scores for groups of different demographic characteristics are somewhat in conflict. Ware, Wright, and Snyder (1974) and Gaitz and Scott (1972) found younger subjects had higher perceptions of health while Maddox (1962) found older subjects had higher perceptions of health. Ware et al. (1974) found whites had higher perceptions of health; Gentry and Haney (1975) found nonwhites higher. Perceptions of health has generally been found to be higher for those with more education, higher IQ, and higher SES (Ware et al., 1974; Suchman & Phillips, 1958; Maddox, 1962). Longitudinal research has found the measure to remain stable over time (Maddox & Douglass, 1974; Tissue, 1972).

Several studies have investigated perception of health among cardiac patients. Boyd et al. (1973) divided surgery patients into two groups on the basis of posthospital employment. At the time surgery was performed, those who subsequently had good work adjustment saw their health as significantly more positive than those with poor subsequent adjustment. Cay et al. (1973) found that while physical diagnosis of severity of attack did not relate to subsequent return to work, those
who perceived their health as poorer were less likely to return to work.

In a distinction similar to trait and state anxiety, subjects have been asked to rate both their general health and current health at the time of hospitalization. Gentry et al. (1972) classified cardiac patients as deniers or nondeniers of anxiety. On the first day of hospitalization, the general perception of health measures for nondeniers were significantly higher than current health ratings. By the fifth day the ratings of current and general health were similar. The deniers had consistently high ratings of both current and general health.

A recent study of male hospitalized cardiac patients assessed perception of health over a period from hospitalization to one-year follow-up to investigate patterns of perception of health (Borgen, Peglar, and Hiatt, Note 2). Using Ward's (1963) hierarchical grouping analysis, four subgroups were identified as shown in Figure 1. The groups were found to differ from each other in a number of ways. Group 1 had better pre- and posthospitalization employment records. There were more alcoholics in Groups 2 and 4. Group 4 patients stayed longer in the coronary care unit. Group 3 patients were more anxious in the cardiac care unit and in intermediate care. The groups were not differentiated on medical or cardiac history, physical course of hospitalization, education, smoking, age, trait anxiety, or use of psychological defenses.

It is clear that these groups differ in significant ways. Their perception of health patterns are strikingly dissimilar and there are substantial group differences on psychological and background variables.
Figure 1. Perception of health patterns for PH clusters
Group 1 with the uniformly high perceptions of health has the best employment record before and after hospitalization. The patients in Group 3 had consistently low ratings of their health with high state anxiety. Group 2 starts with very high perception of general health with gradually declining ratings of current health. In Group 4 the rating of current health in the cardiac care unit is much lower than general health but rises steeply when patients are told they can return home, then dramatically drops and returns slightly in the posthospitalization period.

In examining the data, an interesting discovery was made which seems worth following up. Those patients who died within the first year after they left the hospital had in-hospital perception of health ratings closely resembling Group 4. The present study further compares those who died with those in Group 4 and the total group on a number of demographic, physiological, and psychological variables.

Death of Cardiac Patients

A few researchers have examined the characteristics of cardiac patients who die within a fairly short period following hospitalization. Demographic, psychological, and physiological variables have been considered.

Several studies found that younger patients were more likely to survive than older ones (Pell & D'Alonoso, 1964; Weinblatt, 1966; Beard, Hipp, Robins, Taylor, Ebert & Beran, 1970). Berman and Leon (1973) found that patients who had their first attack in their 50s were more
likely to survive than those whose first attack occurred earlier or later. Weinblatt (1966) found that higher SES patients were more likely to die.

Patients with a history of cardiac problems prior to the present hospitalization are more likely to die (Garrity & Klein, 1975). Those who suffered more severe attacks are also more likely to die during the first year (Master, 1961; Gazes, 1966). Complications during hospitalization are related to death in the first year (Beard et al., 1970).

According to Berman and Leon (1973), nonsmokers are likely to live longer. Shapiro, Weinblatt, Frank, and Sager (1970), however, found no differences in survival between smokers and nonsmokers.

Some psychological factors have also been related to likelihood of dying. In a group of subjects 65 years old and older Suchman and Phillips (1958) found that those who subsequently died had previously rated their health lower than those who survived.

Stress, defined in terms of psychologically significant life change, has been related to cardiac deaths. In studying sudden cardiac deaths, Rahe and Lind (1971) found definite evidence of a build-up in life change intensity during the six months before the fatal attack. Theorell and Rahe (1975) found that in comparison to those who survived after suffering a myocardial infarction (MI), those who died had a significant build-up in life change units peaking one year before death.

Depression during hospitalization was more common among patients who subsequently died than among survivors (Bruhn, Chandler, & Wolf, 1969; Lebovits, Shekelle, Ostfeld, & Paul, 1967). Garrity and Klein
(1975) found that patients who exhibited more behavioral disturbance in the hospital as rated by the nursing staff were more likely to die. Patients with Type A personality characteristics were more likely to die (Bruhn, Paredes, Adsett, & Wolf, 1974).

In classifying patients undergoing cardiac surgery, Kennedy and Bakst (1966) found that no subsequent deaths occurred among those classified Group 1 (moderate denial, high perception of health). The most deaths occurred among Group 4, characterized by strong conflict between desire for freedom from illness and terror of giving up secondary gains.

Some important factors in predicting death among cardiac patients have emerged. Increased age, greater severity of attack, history of cardiac problems, greater life stress, and more depression are variables with greater risk of death following hospitalization.
OBJECTIVES

The purpose of the present study was to provide an integrative approach to the consideration of characteristics of patients hospitalized with cardiac disorders. In order to understand how a number of demographic, physiological, and psychological variables interact, it was decided to attempt to develop a typology of cardiac patients. The statistical approach of cluster analysis was chosen to determine the basis of the typology. The process of determining how certain individuals resemble one another provided an understanding of the interrelationships among the variables.

Comparisons of the results of this clustering approach with results of other integrative studies was an important consideration. Of particular interest was the study on patterns of perception of health (Borgen et al., Note 2). Determining how perception of health variables were related to the others in this study expanded the understanding of the meaning of all the variables.

Determining characteristics of patients who died shortly after hospitalization was another goal of the present study. Analyses comparing the deceased with the subjects in the clustering analyses as a whole and by groups provided important information on characteristics which might be considered to place a patient at risk of dying soon after hospitalization.

An overall goal of this type of exploratory research is to generate further investigation of patterns developed. It is important to
consider how findings of previous research are related to the present findings and how those relationships suggest future research.

Throughout this study, implications for treatment of cardiac patients are considered to be extremely important. Some suggestions for patient care are drawn from the present results and methods for generating further suggestions are discussed.
METHOD

Subjects

Patients in the Cardiac Care Unit (CCU) of the Des Moines, Iowa Veterans Administration Hospital were asked to participate in a research effort. All those who were asked agreed to participate. The subjects were all male veterans ranging in age from 41 to 64; the mean age was 55. All had cardiac abnormalities documented during hospitalization.

The main group of patients in the study consisted of 37 patients for whom scores on all variables were recorded. Supplementary replication analyses also included 17 patients with scores on all variables except perception of health and 14 who were missing only state or trait anxiety scores. Thirteen patients who died within a year of hospitalization made up a final group.

Instruments

The following instruments were used in the course of the research:

Medical records contained information about the present physical status, history of illnesses, and course of hospitalization.

Semistructured interview was developed for the project to obtain background information and assess reactions to hospitalization.

State-Trait Anxiety Inventory was developed by Spielberger et al. (1973) to assess state and trait anxiety. Subjects respond to 20 statements on the trait measure according to how they generally feel. For
each statement the subject indicates he feels that way "Almost never," "Sometimes," "Often," or "Almost always." On the 20 state anxiety statements the subject marks that he feels at this moment "Not at all," "Somewhat," "Moderately so," or "Very much so."

Recent Life Changes Questionnaire (RLCQ) was developed by Rahe (1969) as a self-report of changes in health, work, home, family, social, and personal adjustment. The subject is asked to indicate if a given event occurred within the past six months, seven to twelve months ago, and one to two years ago.

Perception of Health (PH) was developed by Gentry and Haney (1975). Subjects are asked to evaluate their health by circling the number which best describes their estimate. Evaluations can range from 1 (Poor Health) to 10 (Excellent Health). This procedure is used to assess both general and current health status.

Procedure

Patients were approached two or three days after admission to the CCU when their physicians indicated that their condition had stabilized. The research project was explained and their cooperation sought. When they agreed to participate they were asked to complete the State-Trait Anxiety Inventory and PH measures (both general and current). The interviewer then administered the semistructured interview and the RLCQ.

After the patients were transferred to the intermediate care unit (ICU) and given a date of discharge they completed the current forms of the State Anxiety Inventory and PH.
Three months after discharge from the hospital, subjects were mailed follow-up questionnaires and asked to complete and return them. Included were a PH measure and questions about posthospital employment. If subjects did not return the materials, a postcard was sent as a reminder and follow-up phone calls were made if necessary. The same procedure was followed at six months and one year.

Data Analysis

Variables

The analyses in this study consisted of the following demographic, physiological, and psychological variables relevant to cardiac illness:

**Age**—scored in years.

**Socioeconomic status (SES)**—scored as lower middle or lower class on the basis of information on occupation and education according to a system developed by Ihilevich (1968).

**Prehospital employment (PREMP)**—scored as working (including part-time work) or not working.

**Smoking (SMK)**—scored as currently nonsmoking, moderate smoking (a pack or less each day) or heavy smoking (more than a pack each day) on the basis of patient report.

**Alcoholism (ALC)**—scored as alcoholic or not, based on either the patient's classification of himself, a relative's classification, or indication in previous medical records.

**History of MI (PREMI)**—scored as either had a previous documented
MI or not.

**History of hospitalization in CCU** (PRECCU) -- scored as either previously in CCU or not.

**History of serious noncardiac medical illness** (PREMED) -- scored as history of diabetes or pulmonary disease.

**Hypertension** (HYP) -- scored as documented in medical records or not.

**Overweight** (OVW) -- scored as overweight or not on the basis of height-weight ratios according to the ponderal index.

**Complications in hospital** (COMP) -- scored as present in medical records or not.

**Length of stay in Cardiac Intensive Care Unit** (DAYCCU) -- scored as number of days spent.

**Length of stay in hospital** (DAYHOS) -- scored as number of days spent.

**Diagnosis at present hospitalization** (MI) -- scored as having had an MI or not.

**Denial** (DNY) -- scored as present if the patient answered during the interview that he had never felt afraid while he was in the hospital and as not present if he said he had been afraid.

**Trait anxiety** (TRANX) -- each of 20 items was scored according to whether the patient experienced it "Almost never" (1 point) through "Almost always" (4). Thus a score could range from 20 to 80 with higher scores representing higher anxiety levels.

**State anxiety** (STANX) -- each of 20 items was scored according to whether the patient reported experiencing it "Not at all" (1 point) through "Very much so" (4). STANX1 was taken in the
CCU: STANX2 in the intermediate care unit (ICU).

Life Change (RLCQ)--Points were assigned according to previously determined criteria of severity of events so that a higher score indicated more life change. RLCQ1 represented the six months directly preceding hospitalization, RLCQ2 the six months preceding that and RLCQ3 the year before RLCQ1 and RLCQ2.

Employment at one-year follow-up (POSTEMP)--scored as employed (full- or part-time) or not according to patient report.

Perception of Health (PH)--scored according to the point on a 10-point scale which the patient said best represented his health, from Poor Health (1 point) to Excellent Health (10). PH1 was taken as a measure of general health before hospitalization and PH2 as health now--both were asked in the CCU. PH3 was taken in the Intermediate Care Unit; PH4 at three months after hospitalization; PH5 at six months and PH6 at one year following hospitalization.

Analysis glossary

In order to clarify the meaning of certain terms used in the analyses the following list is provided:

Main group-- the 37 patients with complete data on all variables, including Perception of Health. This group was used in the Cardiac and Perception of Health Clusters.

Cardiac Variables--the 22 variables described above excluding Perception of Health measures.
Cardiac Clusters—the cluster analysis based on the patients in the Main Group analyzed on the Cardiac Variables.

Perception of Health (PH) Clusters—the clustering analysis based on the patients in the Main Group analyzed on the six PH measures.

The scores of the 37 patients in the main group were clustered on all the above variables with the exception of PH. The cardiac variables were analyzed according to Ward's (1963) hierarchical grouping method. Given N sets of data, the analysis proceeds by selecting the two sets with the highest value for functional relationships, leaving N-1 sets. The procedure continues until all sets have been combined into one group. The choice of the number of clusters to be used depends on the error score after each successive reduction. Ward's method has been applied in a number of psychological studies (Owens, 1969). In a comparison of four popular hierarchical clustering techniques (Blashfield, 1976), Ward's method was superior in correctly reproducing predetermined classification.

All variables were either continuous or dichotomous. In order that variables with a larger range and variance did not contribute more to the clustering process all variables were standardized before being used in the analyses.

Univariate analyses of the variables in the original data set were run to understand how the clustered groups differed from each other. Analyses of variance were run for the continuous variables and $\chi^2$ for dichotomous. Where significant differences were found, post-hoc tests
determined in which ways the groups were significantly different.

**Replications**

One issue in the development of clusters is a replicability. In order to assess the replicability of the clusters found in this study, three different approaches were taken. The scores of 17 patients who had completed all the instruments used in the above cluster analysis but not the PH measures were combined with the scores of the previous subjects in a cluster analysis by Ward's method. To assess replicability, group membership for those subjects who were run in both analyses were analyzed by $X^2$. If the clustering in both analyses was similar, a significant $X^2$ for group membership would be expected.

Another approach to replication consisted of randomly dividing those patients into two groups and running separate cluster analyses for each group. Relative distances between the groups formed were determined to assess similarity of groups.

Since a fairly large number of patients did not have scores recorded for anxiety measures and since a large number of individuals is desirable for replication, the final replication included all those with scores on all variables excluding anxiety. These 78 patients were divided into two groups which were clustered. The group means were then correlated to determine similarity of the groupings.

**Comparison to PH clusters**

In order to understand the relationship between the groups formed in the earlier study of perception of health and the groups formed by the
present cluster analysis, a $X^2$ was run for group membership.

**Death**

Patients who died after being released from the hospital were considered in several analyses. First, they were compared with the main group of 37 patients taken as a whole by means of analyses of variance and $X^2$. They were also compared with the groups previously formed on the basis of PH scores and in a similar way with groups formed by analysis of cardiac variables. Although it was understood that running so many univariate analyses increased the risk of chance significance findings, the exploratory nature of the study and the possible importance of implications for treatment of cardiac patients and prevention of cardiac deaths justified the large number of analyses.
RESULTS

Cardiac Clusters

The scores on the 22 cardiac variables of the 37 main patients were cluster analyzed according to Ward's (1963) hierarchical method. A five-group solution was determined by use of the error score. The five clusters were compared by means of analysis of variance for continuous variables and $\chi^2$ for dichotomous variables. Table 1 presents the results of the analyses of variance. Although the statistics are biased because cluster analysis capitalizes on group differences, they are useful for understanding the magnitude of these differences. Six variables significantly differentiated the clusters. These were AGE ($F = 2.67, df = 4/32, p < .05$), DAYCCU ($F = 7.99, df = 4/32, p < .001$), TRANX ($F = 12.51, df = 4/32, p < .001$), STANX1 ($F = 4.15, df = 4/32, p < .01$), STANX2 ($F = 5.51, df = 4/32, p < .01$), and RLCQ3 ($F = 8.96, df = 4/32, p < .001$).

Follow-up Duncan's multiple range tests were performed for those analyses of variance which were determined to be significant. These tests indicated that those in group 5 spent more time in the CCU than all other groups. Trait and both measures of state anxiety were higher for groups 4 and 5 than for groups 1, 2, or 3. Life change for the one-year period which preceded hospitalization by 2 years was significantly higher for group 5 than for groups 1 and 2 which in turn were higher than groups 3 and 4. Although the $F$ value for age was significant, no significant differences appeared on the Duncan's multiple range test.

The results for analyses of dichotomous variables are presented in Table 2. According to these $\chi^2$ analyses, there were significant
Table 1. One-way analyses of variance for cardiac clusters

<table>
<thead>
<tr>
<th>Variable</th>
<th>$F^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAYCCU</td>
<td>7.99***</td>
</tr>
<tr>
<td>TRANX</td>
<td>12.51**</td>
</tr>
<tr>
<td>STANX1</td>
<td>4.15**</td>
</tr>
<tr>
<td>STANX2</td>
<td>5.51*</td>
</tr>
<tr>
<td>AGE</td>
<td>2.67***</td>
</tr>
<tr>
<td>RLCQ3</td>
<td>8.96***</td>
</tr>
<tr>
<td>RLCQ1</td>
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</tr>
<tr>
<td>RLCQ2</td>
<td>0.89</td>
</tr>
<tr>
<td>SMK</td>
<td>1.23</td>
</tr>
<tr>
<td>DAYHOS</td>
<td>1.84</td>
</tr>
</tbody>
</table>

$^a$df = 4/32 throughout.

*p < .05.

**p < .01.

***p < .001.

Table 2. Chi-square analyses for cardiac clusters

<table>
<thead>
<tr>
<th>Variable</th>
<th>$X^2^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREMED</td>
<td>20.16***</td>
</tr>
<tr>
<td>PREMI</td>
<td>13.72**</td>
</tr>
<tr>
<td>PRECCU</td>
<td>12.27**</td>
</tr>
<tr>
<td>HYP</td>
<td>13.19***</td>
</tr>
<tr>
<td>OWW</td>
<td>31.26***</td>
</tr>
<tr>
<td>ALC</td>
<td>10.54*</td>
</tr>
<tr>
<td>SES</td>
<td>10.48*</td>
</tr>
<tr>
<td>MI</td>
<td>12.41**</td>
</tr>
<tr>
<td>DNY</td>
<td>13.79***</td>
</tr>
<tr>
<td>COMP</td>
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</tr>
<tr>
<td>PREMP</td>
<td>4.40</td>
</tr>
<tr>
<td>POSTEMP</td>
<td>7.04</td>
</tr>
</tbody>
</table>

$^a$df = 4.

*p < .05.

**p < .01.

***p < .001.
differences on a number of variables. Significant differences were found for PREMED ($X^2 = 20.16$, $df = 4$, $p < .001$), PREMI ($X^2 = 13.72$, $df = 4$, $p < .01$), PRECCU ($X^2 = 12.27$, $df = 4$, $p < .01$), HYP ($X^2 = 13.19$, $df = 4$, $p < .01$), OVW ($X^2 = 31.26$, $df = 4$, $p < .001$), ALC ($X^2 = 10.54$, $df = 4$, $p < .05$), SES ($X^2 = 10.48$, $df = 4$, $p < .05$), ML ($X^2 = 12.41$, $df = 4$, $p < .05$), and DNY ($X^2 = 13.79$, $df = 4$, $p < .01$). The number of subjects was too small to undertake follow-up analyses, so cell values for significantly different variables will be reported as all, none, few or most for particular groups. Past medical history was reported by most subjects in groups 2, 4, and 5 and by none in group 1. In groups 3, 4, and 5 none had a previous MI; in group 1 most did. None of the subjects in groups 4 or 5 had been in a CCU before; few in group 3 and most in groups 1 and 2 had been. None in groups 3 or 5 were hypertensive; most in groups 1 and 2 were. In groups 1 and 3 none were overweight, while all in groups 2 and 5 were. There were no alcoholics in group 3; all in group 5 were alcoholics. Subjects in groups 4 and 5 were all lower SES; those in group 1 were mostly middle class. All in group 2 and most in group 3 had MIs at this hospitalization; few in group 4 and none in group 5 had. No patients in group 5 were deniers; all in group 3 and most in groups 1 and 2 were.

In order to describe the individual clusters better, a summary table describing significant differences between variables is shown in Table 3. Since there were no significant differences among the groups for age, smoking, length of stay in the hospital, prehospitalization employment, complications, or life change 1 and 2, these variables are
not included in the table. Work record after hospitalization approached significance \( \chi^2 = 7.04, \ df = 4, \ p < .10 \) and is included in parentheses.

Table 3. Cardiac cluster summary characterizations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group 1 (n=14)</th>
<th>Group 2 (n=7)</th>
<th>Group 3 (n=9)</th>
<th>Group 4 (n=5)</th>
<th>Group 5 (n=2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRANX</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>STANX1</td>
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<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>DNY</td>
<td>Most</td>
<td>Most</td>
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<td>None</td>
</tr>
<tr>
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<td>High</td>
</tr>
<tr>
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<td>Most</td>
<td>Mixed</td>
<td>Mixed</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>PBECCU</td>
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<td>Most</td>
<td>Few</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
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<td>Some</td>
<td>Some</td>
<td>None</td>
<td>Some</td>
<td>All</td>
</tr>
<tr>
<td>PREMED</td>
<td>None</td>
<td>Most</td>
<td>Few</td>
<td>Most</td>
<td>All</td>
</tr>
<tr>
<td>HYP</td>
<td>Most</td>
<td>Most</td>
<td>None</td>
<td>Some</td>
<td>None</td>
</tr>
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<td>None</td>
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<td>Some</td>
<td>All</td>
</tr>
<tr>
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<td>Most</td>
<td>Few</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>MI</td>
<td>Some</td>
<td>All</td>
<td>Most</td>
<td>Few</td>
<td>None</td>
</tr>
<tr>
<td>DAYCCU</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>(POSTEMP)</td>
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<td>(Most)</td>
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<td>(None)</td>
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</tbody>
</table>

Another useful way to examine differences is to look at groups of variables. Some are based on similarity of variables; others have been found by previous research to go together. Figure 2 shows the means of the five clusters on the following variables: the three anxiety variables, denial, and Life Change 3—the "psychological" variables. Figure 3 contains "background" variables: age, SES, alcoholism, posthospitalization employment (the latter approaches significance). Figure 4 shows medical history variables: serious medical illness, previous MI, previous presence in a CCU, hypertension, and overweight. Figure 5
Figure 2. Psychological variables for cardiac clusters
Figure 3. Background variables for cardiac clusters
Figure 4. Medical variables for cardiac clusters.
Figure 5. Inhospital variables for cardiac clusters
contains the two significant variables related to present hospitalization: presence of MI and days in the CCU. In all cases, for the quantitative variables higher numbers represent higher scores (higher anxiety, more life change, older, more days in the CCU). For nonquantitative variables, an attempt was made to indicate that lower values were "better" although that is not easy to determine in all cases. Lower values represent not being alcoholic, hypertensive, or overweight, not having cardiac or other medical history, not having a present MI, and being employed.

Replication

Since there are no generally accepted methods of replication for cluster analysis, several different analyses were performed to assess the cardiac clustering procedure. One cluster analysis was run including subjects who had scores on all the cardiac variables but were not included in the original analysis because they did not have scores for all the perception of health measures. These subjects were added to those in the main group, resulting in an analysis of 54 subjects. Then group membership of the 37 subjects in the main analysis was compared with their membership within the analysis of 54 subjects. \( \chi^2 \) was found to be significant (\( \chi^2 = 71.25, \text{df} = 20, p < .0001 \)). Although the significance is positively biased by the fact that the 37 main patients were a high proportion of the total of 54, the result may indicate that the subjects were clustered similarly.

In another attempt at replication, the 54 patients in the above
analysis were randomly assigned to one of two groups. Separate cluster analyses were performed on each group. By the use of the computed error, four-group solutions were selected for each analysis. The means of the eight groups on the 22 variables were then calculated. A matrix of Euclidean distance ($d^2$) values showing relative distance among the eight groups was calculated, as presented in Table 4. Groups 1, 2, 3, and 4 were produced by one cluster analysis; groups 5, 6, 7, and 8 by the other.

Table 4. $D^2$ matrix for relative distances in Replication 1

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<tbody>
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<td>5</td>
<td>2589</td>
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<td>2346</td>
<td>2156</td>
<td>1732</td>
<td>4392</td>
<td>1910</td>
<td>2485</td>
<td>1868</td>
<td>--</td>
</tr>
</tbody>
</table>

If the clusters were formed in approximately the same ways, it would be expected that groups 1, 2, 3, and 4 would be less like each other than they would be like groups 5, 6, 7, and 8 and vice versa. If groups
resemble each other, $d^2$ would be smaller. The smallest $d^2$ values in this matrix are between groups 7 and 3, 6 and 3, and 7 and 1. The large $d^2$ for group 4 with groups 5, 6, 7, and 8 are somewhat less meaningful since group 4 consists of only two subjects.

A final replication was run with a similar division into two groups. Since it was important to use as many subjects as possible, all those with scores on all cardiac variables excluding trait and state anxiety were used, and the anxiety scores were excluded from the analysis. Thus 78 subjects were randomly divided into two groups. Computed error indicated a four-group solution for each analysis. For each of the eight groups a mean was calculated on the cardiac variables excluding anxiety. The mean profiles for the groups were then correlated to assess the relationship between the two clustering routines. The correlations are shown in Table 5. The highest positive correlations should occur between clusters of different groups (1, 2, 3, 4 vs. 5, 6, 7, 8) as compared with clusters within the same group. The significant positive correlations that do occur between groups 1 and 8 and 2 and 5 provide some evidence that the clustering routines are similar.

Perception of Health

In order to investigate the relationship between membership in perception of health clusters determined by previous research and the cardiac clusters of this study, a $X^2$ for group membership was obtained. Each patient's cluster membership was classified according to PH group and according to cardiac group. If the two different ways of clustering
Table 5. Correlations of cardiac cluster profiles in Replication 2

<table>
<thead>
<tr>
<th>Group</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<td>--</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>-.50</td>
<td>.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>-.03</td>
<td>-.15</td>
<td>-.26</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>-.10</td>
<td>.49</td>
<td>.20</td>
<td>.01</td>
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<td>-.33</td>
<td>.20</td>
<td>.10</td>
<td>-.28</td>
<td>-.26</td>
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<tr>
<td>7</td>
<td>-.38</td>
<td>.11</td>
<td>.18</td>
<td>-.15</td>
<td>-.11</td>
<td>-.34</td>
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<td></td>
</tr>
<tr>
<td>8</td>
<td>.66</td>
<td>-.52</td>
<td>-.64</td>
<td>.19</td>
<td>-.45</td>
<td>-.30</td>
<td>-.31</td>
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</tr>
</tbody>
</table>

were similar, a significant $\chi^2$ should be found. The group memberships are reported in Table 6. $\chi^2$ was not significant ($\chi^2 = 15.27, \text{df} = 12$), indicating that membership in a PH group was not related to membership in a cardiac cluster.

The means for each of the six PH measures were calculated for the five cardiac clusters. In addition, the PH values were calculated for all subjects not included in the cardiac cluster analysis; at each point the mean PH value was calculated from all subjects who had completed that measure. The means are plotted in Figure 6. Analyses of variance determined that the differences between the means were not significant,
Table 6. Cross classification of patients in Cardiac and Perception of Health clusters

<table>
<thead>
<tr>
<th>Cardiac cluster</th>
<th>PH cluster</th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
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<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
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<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>7</td>
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</tr>
<tr>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>12</td>
<td>7</td>
<td>9</td>
<td>37</td>
</tr>
</tbody>
</table>

Table 7. Analyses of variance for cardiac cluster groups on Perception of Health

<table>
<thead>
<tr>
<th>Variable</th>
<th>$F^{a,b}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH 1</td>
<td>1.60</td>
</tr>
<tr>
<td>PH 2</td>
<td>1.47</td>
</tr>
<tr>
<td>PH 3</td>
<td>1.47</td>
</tr>
<tr>
<td>PH 4</td>
<td>.99</td>
</tr>
<tr>
<td>PH 5</td>
<td>.58</td>
</tr>
<tr>
<td>PH 6</td>
<td>.20</td>
</tr>
</tbody>
</table>

$^a df = 4/32$ throughout.

$^b$ All values nonsignificant.
Figure 6. Perception of health patterns for cardiac clusters
as shown in Table 7.

Death

A series of special analyses focused on thirteen subjects who died within one year after leaving the hospital. Five had scores on all cardiac variables; the others had scores for all except anxiety variables. The means for each of the variables were calculated and compared with the total group, with the perception of health cluster groups, and with the cardiac cluster groups.

When those who died were compared with the main group of 37 subjects, several significant differences were found. The results are summarized in Tables 8 and 9 for analyses of variance and $\chi^2$ respectively. Those who died were more likely to have suffered an MI in the past ($\chi^2 = 8.42$, $df = 1$, $p < .01$) and have been in a CCU before ($\chi^2 = 3.82$, $df = 1$, $p < .05$). They smoked more ($F = 5.95$, $df = 1/48$, $p < .05$). Those who died had higher life change for the six months previous to hospitalization ($F = 5.89$, $df = 1/48$, $p < .05$) and the six months before that ($F = 5.12$, $df = 1/48$, $p < .05$). Differences between those who died and the rest of the subjects were not significant for any other variables.

Those who died were compared with the four groups determined previously by clustering PH scores. Analysis of variance results are presented in Table 10. Those analyses of variance which were significant were followed up by Duncan's multiple range tests. It was determined that those who died and those in group 4 spent more time in the CCU ($F = 2.87$, $df = 4/46$, $p < .05$). Like group 3, they had higher state
Table 8. Analyses of variance for Deceased vs. Main Group on cardiac variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>F</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMK</td>
<td>5.95</td>
<td>1/48</td>
</tr>
<tr>
<td>RLCQ1</td>
<td>5.89</td>
<td>1/48</td>
</tr>
<tr>
<td>RLCQ2</td>
<td>5.12</td>
<td>1/48</td>
</tr>
<tr>
<td>RLCQ3</td>
<td>.61</td>
<td>1/48</td>
</tr>
<tr>
<td>DAYHOS</td>
<td>1.22</td>
<td>1/48</td>
</tr>
<tr>
<td>DAYCCU</td>
<td>.55</td>
<td>1/48</td>
</tr>
<tr>
<td>AGE</td>
<td>.13</td>
<td>1/48</td>
</tr>
<tr>
<td>TRANX</td>
<td>2.52</td>
<td>1/40</td>
</tr>
<tr>
<td>STANX1</td>
<td>.37</td>
<td>1/40</td>
</tr>
<tr>
<td>STANX2</td>
<td>.39</td>
<td>1/40</td>
</tr>
</tbody>
</table>

*P < .05.

Table 9. Chi-square analyses for Deceased vs. Main Group on cardiac variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>χ²&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREMI</td>
<td>8.42&lt;sup&gt;**&lt;/sup&gt;</td>
</tr>
<tr>
<td>PRECCU</td>
<td>3.82</td>
</tr>
<tr>
<td>COMP</td>
<td>.02</td>
</tr>
<tr>
<td>PREMED</td>
<td>1.03</td>
</tr>
<tr>
<td>HYP</td>
<td>.62</td>
</tr>
<tr>
<td>OWW</td>
<td>.21</td>
</tr>
<tr>
<td>DNY</td>
<td>3.13</td>
</tr>
<tr>
<td>ALC</td>
<td>2.18</td>
</tr>
<tr>
<td>PREMP</td>
<td>2.79</td>
</tr>
<tr>
<td>SES</td>
<td>.09</td>
</tr>
<tr>
<td>MI</td>
<td>.21</td>
</tr>
</tbody>
</table>

<sup>a</sup>df = 1.

*P < .05.

**P < .01.
Table 10. Analyses of variance for Deceased and PH cluster groups on cardiac variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>F</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAYCCU</td>
<td>2.87*</td>
<td>4/46</td>
</tr>
<tr>
<td>STANX1</td>
<td>2.81*</td>
<td>4/37</td>
</tr>
<tr>
<td>STANX2</td>
<td>2.37</td>
<td>4/37</td>
</tr>
<tr>
<td>RLCQ1</td>
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<td>4/46</td>
</tr>
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<td>RLCQ2</td>
<td>1.36</td>
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</tr>
<tr>
<td>RLCQ3</td>
<td>1.09</td>
<td>4/46</td>
</tr>
<tr>
<td>SMK</td>
<td>2.21</td>
<td>4/46</td>
</tr>
<tr>
<td>DAYHOS</td>
<td>1.96</td>
<td>4/46</td>
</tr>
<tr>
<td>AGE</td>
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<td>4/46</td>
</tr>
<tr>
<td>TRANX</td>
<td>.76</td>
<td>4/37</td>
</tr>
</tbody>
</table>

*p < .05.

anxiety 2 (F = 2.81, df = 4/37, p < .05). Results of $X^2$ analyses are summarized in Table 11. Those who died were the only group in which the majority of subjects had past MIs ($X^2 = 9.11$, df = 4, p < .05). They resembled groups 3 and 4 in having few subjects employed before hospitalization ($X^2 = 15.39$, df = 4, p < .05). Like group 4, half were alcoholics; group 2 had some alcoholics and groups 1 and 3 had none ($X^2 = 11.33$, df = 4, p < .05).

When those who died are compared with the five groups formed by clustering cardiac variables, another set of significant relationships emerge. Analyses of variance are summarized in Table 12; $X^2$ are in Table 13. Duncan's multiple range tests determine that the deceased resembled all but group 5 in having a shorter stay in the CCU (F = 3.46, df = 5/44, p < .01). Those who died were like groups 1, 2, and 4 in
Table 11. Chi-square for Deceased and PH cluster groups on cardiac variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
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<td>9.11*</td>
</tr>
<tr>
<td>PREMP</td>
<td>15.39*</td>
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<tr>
<td>ALC</td>
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<tr>
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<td>PREMED</td>
<td>5.48</td>
</tr>
<tr>
<td>HYP</td>
<td>4.35</td>
</tr>
<tr>
<td>OVW</td>
<td>4.87</td>
</tr>
<tr>
<td>DNY</td>
<td>3.82</td>
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<tr>
<td>PRECCU</td>
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<tr>
<td>SES</td>
<td>1.94</td>
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<tr>
<td>MI</td>
<td>.64</td>
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</tbody>
</table>

$^a$df = 4.

* $p < .05$.

Table 12. Analyses of variance for cardiac cluster groups and Deceased on cardiac variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>$F$</th>
<th>df</th>
</tr>
</thead>
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<td>5/44</td>
</tr>
<tr>
<td>RLCQ3</td>
<td>6.71***</td>
<td>5/44</td>
</tr>
<tr>
<td>TRANX</td>
<td>5.10**</td>
<td>5/36</td>
</tr>
<tr>
<td>STANX1</td>
<td>3.34*</td>
<td>5/36</td>
</tr>
<tr>
<td>STANX2</td>
<td>4.42**</td>
<td>5/36</td>
</tr>
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<td>5/44</td>
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<td>DAYHOS</td>
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<td>5/44</td>
</tr>
<tr>
<td>AGE</td>
<td>2.08</td>
<td>5/44</td>
</tr>
</tbody>
</table>

* $p < .05$.
** $p < .01$.
*** $p < .001$. 
Table 13. Chi-square for cardiac cluster groups and Deceased on cardiac variables

| Variable | \( \chi^2 \)  \\
<table>
<thead>
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<tr>
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<td>PREMI</td>
<td>19.39**</td>
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<tr>
<td>PRECCU</td>
<td>15.43*</td>
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<td>MI</td>
<td>12.88***</td>
</tr>
<tr>
<td>OVW</td>
<td>32.60***</td>
</tr>
<tr>
<td>HYP</td>
<td>14.12**</td>
</tr>
<tr>
<td>ALC</td>
<td>11.42</td>
</tr>
<tr>
<td>COMP</td>
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<tr>
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<tr>
<td>PREMP</td>
<td>9.84</td>
</tr>
<tr>
<td>SES</td>
<td>10.65</td>
</tr>
</tbody>
</table>

\( ^a \text{df} = 5. \)

* \( p < .05. \)

** \( p < .01. \)

*** \( p < .001. \)

having a moderate amount of life change in the year two years previous to hospitalization (\( F = 6.71, \text{df} = 5/44, p < .001. \)). With groups 4 and 5 they had higher trait anxiety (\( F = 5.10, \text{df} = 5/36, p < .01 \)) and state anxiety 1 (\( F = 3.34, \text{df} = 5/36, p < .05 \)) and state anxiety 2 (\( F = 4.22, \text{df} = 5/36, p < .01 \)). \( \chi^2 \) data reveal that those who died resembled groups 1, 3, and 4 in having few subjects with noncardiac medical history (\( \chi^2 = 22.92, \text{df} = 5, p < .001. \)). Like group 1 they had a majority who had suffered past MIs (\( \chi^2 = 19.39, \text{df} = 5, p < .01. \)). Those who died resembled groups 1 and 2 in having a majority with a past history of care in a CCU (\( \chi^2 = 15.43, \text{df} = 5, p < .01. \)). They were similar to
groups 1, 2, and 3 in having a majority diagnosed as suffering from an MI at the present hospitalization \( (X^2 = 12.88, df = 5, p < .05) \). While groups 1 and 3 had no overweight subjects and groups 2 and 5 were all overweight, group 4 and those who died had some overweight subjects \( (X^2 = 32.60, df = 5, p < .001) \). Groups 3 and 5 had no hypertensive subjects; groups 1 and 2 had a majority; group 4 and the deceased had some \( (X^2 = 14.12, df = 5, p < .01) \). Like groups 1 and 5, those who died contained a number of alcoholics \( (X^2 = 11.42, df = 5, p < .05) \).

The discriminant analysis method was used to further investigate the relationship between the patients who died and those clustered on cardiac variables. Figure 7 is the plot of the individuals and the group centroids on discriminant score 1 and discriminant score 2, showing that those who died resembled those in groups 1 and 3, particularly those in group 1.

When all 22 variables were included in the analysis and the six groups were compared by means of pairwise analysis in reduced multivariate space, the matrix in Table 14 resulted. The nonsignificant \( F \) values indicate similar groups, in this case group 1 and the deceased and group 3 and the deceased. Both methods of analysis (Figure 7 and Table 14) indicate that the deceased are most similar to group 1 and have some similarity to group 3.

---

1. This table shows \( F \)-values for the significance of Mahalanobis' multivariate distance between each pair of groups.
* Group centroid.

Figure 7. Plot of discriminant score 1 vs. discriminant score 2 in discriminant space for the 5 cardiac clusters (Groups 1-5) and the deceased (Group 6)
Table 14. $\mathbf{F}$ matrix$^a$ for Mahalanobis multivariate distance between cardiac clusters and the Deceased

<table>
<thead>
<tr>
<th>Group</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<tr>
<td>3</td>
<td></td>
<td>4.33**</td>
<td>5.62**</td>
<td></td>
<td></td>
</tr>
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<tr>
<td>Deceased</td>
<td>1.26</td>
<td>2.63*</td>
<td>2.05</td>
<td>3.48**</td>
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$^a_{df} = 22/15.$

* $p < .05.$

** $p < .01.$
DISCUSSION

In order to investigate thoroughly the implications of the results of this study, this section will be divided into several parts. The issue of replication in cluster analysis will be considered first, since detailed study of the differences between clusters is useless if the clustering method does not demonstrate reproducibility. Then the characterizations of the clusters will be discussed, comparing the findings of this study with previous research and suggesting further research. Implications for treatment of patients hospitalized with cardiac disorders will be presented.

The final section will deal with findings about those who died within a year of hospitalization. Their resemblances to and differences from other groups of patients will be evaluated, bringing out implications for prevention of death soon after release from the hospital.

Replication

Since there is no generally accepted method for assessing reproducibility of clusters, this study used several different approaches. None of them provided conclusive evidence in either direction. The method of assessing cluster membership in a larger group would have been more conclusive if more subjects had been available. Both methods provided some evidence that two randomly determined subgroups clustered in similar ways but the results are far from incontestable. There is no accepted cut-off for degrees of significance or numbers of similar comparisons.
which would lead to a conclusive answer to the question of replicability. The best that can be said is that there are no strong indications that these clustering methods are not similar. The clusters seem replicable enough to justify further analysis.

The ultimate answer can only be given when more cardiac patients are studied on the variables in this study. Then it will be possible to know whether certain values of variables do tend to go together and certain types of patients do react in certain ways. For now this typology must be viewed as tentative and as a starting point for further research.

Cluster Characteristics

In considering how to characterize the five cardiac clusters, first the ways in which certain variables appear to go together will be discussed. Then the clusters will be considered individually and the particular nature of each cluster will be identified. Finally future research possibilities and implications for treatment will be identified.

In studying the five clusters it is noteworthy that the trait and state anxiety measures are all similar within a cluster--groups 1, 2, and 3 are consistently low on trait and state anxiety while groups 4 and 5 are consistently high. It seems reasonable to say that for these patients knowing a person's trait anxiety would make it fairly easy to predict his state anxiety during cardiac hospitalization. Assuming that the trait anxiety measure is not overwhelmingly contaminated by being taken in the hospital, it appears that the trait measure is more important than a person's interpretation of the threat in the situation as
Shedletsky and Endler (1974) have proposed. To answer this question more fully, prospective research would be necessary. Trait anxiety would be measured before hospitalization and compared with state anxiety in the hospital. If the measures of trait and state anxieties were not highly correlated it would be useful to look for intervening variables to explain the relationships.

The anxiety levels are related to expression of denial. Those patients with lower anxiety tend to be those who deny being afraid in the hospital. This relationship may be interpreted in several different ways. It may be, as Gentry et al. (1972) have stated, that deniers are less likely to experience anxiety because the denial is effective in reducing anxiety. It may also be that anxiety measures and denial measures are simply different ways of expressing the same feeling and that the common denominator is willingness to express emotion. This confusion over the meaning of denial in this study is compounded by confusion in the literature. Denial sometimes refers to refusing to admit having suffered an MI and sometimes to failure to admit anxiety. In order to determine the utility of denial in cardiac illness it is important that researchers are clear on the meaning of the term. When, as in this study, denial refers to refusal to admit anxiety, it is important to determine whether it implies a defense mechanism or just a response style. Perhaps other types of measures of anxiety such as measures of physiological response would be useful. Whichever interpretation is correct, level of general anxiety and denial of fear in the hospital are related in characterizing clusters in this analysis. Assuming that trait anxiety
measured in the hospital does reflect a general emotional reaction, it seems that those who generally are not anxious do not admit to experiencing fear in the hospital.

In considering cardiac history and present diagnosis, several patterns emerge. Not surprisingly, those who have had previous MIs have been in a CCU before. However, present diagnosis separates patients into several groups. Groups 2 and 3 contain mainly patients suffering from their first MIs, however those in Group 2 had been previously hospitalized for other cardiac problems. Groups 4 and 5 were in the CCU for the first time and were not presently suffering from an MI. Group 1 was less consistent—most had previous MIs but only some of those suffered from an MI at this hospitalization.

In general, the non-MIs seem to experience greater anxiety in the hospital. It is possible to speculate on a number of reasons for this finding. Perhaps having a specific attack is less anxiety-provoking than having continual cardiac problems; perhaps general trait anxiety patients are more likely to experience angina, the most common non-MI complaint. In order to make investigating this possibility more worthwhile it would be necessary to find out if in fact patients suffering from first MIs are less anxious than those without MIs and to separate prehospital trait anxiety from in-hospital anxiety.

The relationships of other variables are more complicated and best considered by studying the clusters individually. Group 1 consists mostly of patients with specifically cardiac disorders. While they have no history of overweight or serious medical illness, they do have
previous MIs. Their defenses seem to be working fairly well as re-
lected in their use of denial and lower anxiety. Although they are
mostly middle class, few worked following hospitalization.

In Group 2 most were experiencing their first MIs, although most
had been in a CCU before for some other cardiac disorder. Some were
alcoholics. They had other medical problems, including hypertension and
overweight. They were not especially anxious while being in the hos-
pital, perhaps since they were used to being ill and being in a CCU. In
view of their medical histories it is not surprising that few worked
after release from the hospital.

Group 3 patients seem to be in the best condition on a number of
variables. All of them were experiencing a first MI and for most it was
the first CCU hospitalization. Few had other complicating medical condi-
tions and none were alcoholics. Their defenses worked sufficiently well
for them to experience little anxiety and they coped well enough to return
to work following hospitalization. They also tended to have a generally
high perception of health pattern.

Group 4 patients were experiencing their first CCU hospitalization,
but few suffered from an MI. Most had other medical problems; some
were hypertensive or overweight. In spite of the fact that they had
continuous high anxiety in the hospital, most of them returned to work
after hospitalization.

Group 5 consisted of only two patients who clustered together by
themselves in any analysis which included both of them. They obtained
identical scores on all the dichotomous variables and scored in
similar directions on continuous variables. Since there were only two of them it is difficult to know if they represent a consistent type of patient or if it is just a coincidence that they appeared in this study. If they represent a type of patient it would be characterized by first CCU admission for non-MI cardiac problem in overweight alcoholics with medical problems, staying for an extended period in the CCU experiencing high anxiety and no denial, and not working on release from the hospital.

The return to work factor has been a very important one in research on cardiac patients. The finding of Nagle et al. (1971) that those who return to work are less likely to have had previous MIs is given some support by the fact that those in Groups 3 and 4 (where the majority did return to work) were less likely to have had a previous MI. None of the patients in Group 3 were alcoholics, consistent with the group in a study by Boyd et al. (1973) who had high perception of health, few alcoholics, and did return to work.

The findings that the patients in Group 3 who tend to have higher PH values do tend to return to work is consistent with research showing that higher perception of health is related to higher likelihood of return to work (Garrity, 1973a; Boyd et al., 1973). However, those in Group 4 (although not characterized by high perception of health) tend to return to work.

Findings on anxiety and return to work are also equivocal. Those in Group 3 had low anxiety consistent with findings of Nagle et al. (1971), but those in Group 4 had high anxiety. In general the Group 3
profile is consistent with that of the type of patients who have been previously shown to return to work; that of Group 4 is not so clear. Further research is needed to clarify the importance of factors like anxiety and perception of health. Perhaps there are several possible patterns related to return to work. Perhaps another variable may nullify the importance of anxiety or perception of health in certain cases. For example, few of the patients in Group 4 suffered from an MI; perhaps anxiety and PH are not as important in those cases. Another possibility is that the pattern of Group 4 will not hold up in further research. The pattern of subjects in Group 3 of low anxiety, high perception of health, and return to work is more likely to be replicable because it is consistent with previous research, however it needs to be demonstrated again before it can be established.

Several variables do not replicate patterns found in previous research. A number of previous studies found age to be an important factor distinguishing types of patients (Rodda et al., 1971; Rosen & Bibring, 1966). This study, however, did not find such differences. Perhaps this is because of a restricted range of ages. This study did not include many men who would fit Miller's (1965) category of the younger, stress-caused MI. In order to more fully understand the importance of the age variable, a larger number of younger men should be studied. Evidence of the interaction between SES and previous hospitalization (Rosen & Bibring, 1966) was not evident in the present study, perhaps because there were not enough middle-class patients who had not been hospitalized previously.
Although none of these patterns of variables and clusters of patients can be considered to establish a typology, some interesting hypotheses for further investigation can be generated. Based on this study and previous research, one particular pattern does seem to emerge which may be characterized as First MI Copers. These patients are hospitalized for the first time in a CCU with an MI, have few other medical problems, are not alcoholics, perceive their health as consistently good, experience low levels of trait and state anxiety, and use denial. This type of pattern may be assumed to be a positive one, especially since these patients are the ones who tend to return to work after hospitalization.

In terms of treatment, it may be useful to reassure patients with similar patterns that many people with histories similar to theirs have made good recovery. The general coping aspect of the pattern and the resulting positive outcome may have some other implications for treatment. While it seems obvious that a medical staff would not wish to raise anxiety levels, the usefulness of denial and high perception of health may not be so obvious. Nursing staffs sometimes believe that there is something wrong with refusing to admit to either being afraid of being in the hospital or being afraid of dying and may encourage patients to "admit" their feelings. The general idea that ventilation of feelings is positive (if not essential) should be questioned, particularly for patients in unstable physical condition. There is some research evidence (Weiss, Note 1) that encouraging denial strategies lowers stress levels as measured by excretion of a smaller amount of
17-hydroxycorticosteroids. At times it may be necessary to reassure the staff that denial can be a positive form of coping and discourage pushing patients to express feelings. A study reported by Gentry et al. (1972) demonstrated that encouragement of ventilation of feeling reduced stress in nondeniers, but increased stress in deniers. It would seem that denial is an important strategy for those who are using it and there may be great risks involved in attempting to change that strategy.

The relationship of perception of health and satisfactory recovery is well-established. Its implication for treatment may be that patients should not be pushed too much into a sick role and that restrictions following hospitalization should not be put in such a way as to encourage invalidism. Patients who persist in seeing themselves as generally healthy people should be encouraged to do so while noting that there are specific things they can do to keep themselves healthy.

The implications of other patterns are not as clear as those of Cardiac Cluster Group 3. If Group 4 represents another possible strategy which allows for positive recovery, it would need to be demonstrated by further research. Since the sample is so small and there is no previous research which would lead to viewing high anxiety in a patient with a first CCU hospitalization as coping, speculation about treatment is less likely to be productive. However, it may be that high anxiety is not as maladaptive in patients who do not have cardiac histories or present MIs and so may not be as important to control. This attitude could only be supported if backed by further research.

Groups 1 and 2 represent patterns which seem to lead to poorer
recovery. History of cardiac problems and hospitalization were common to both, and those in Group 2 had additional medical problems. Perhaps for them, especially those in Group 2 who were alcoholics, hypertense and overweight, working after hospitalization is not a reasonable expectation. In those cases patients should be helped to make the best possible adjustment. In almost all the literature on outcome of cardiac hospitalization, if patients do not either die or return to work there is no specified outcome. For a person who is not working the use of time is a very important consideration. Helping these patients who do not tend to have high perceptions of health to see themselves as functional may decrease the problem of invalidism (Garrity, 1975). In the hospital it would be useful to know that patients with cardiac histories may assume that they will not be able to work so that a thorough determination of the correctness of this assumption can be made.

If the pattern represented by the two patients in Group 5 can be substantiated by further research, there is a type of first CCU non-MI admission which should be carefully watched. These would be alcoholics who are overweight and have other serious medical problems and seem not to adjust well in the hospital. They do not use denial, have high anxiety, and spend a long time in the CCU. Until it can be established that these two patients really represent a type of patient no generalizations about their treatment would be worthwhile.

Some patterns relating to type of cardiac disorder, cardiac history, coping in the hospital, and return to work have emerged from this study. With further work these types can be more firmly established
and refined to assist in predicting outcome and tailoring treatment methods.

Perception of Health

The study found no clear-cut cardiac patterns associated with perception of health, but the tendencies that were apparent encourage further investigation into PH patterns. The finding that subjects in Cardiac Group 3 tended to have higher values for perception of health is consistent with previous research findings, as discussed in the previous section. Perhaps a larger sample would find significant differences between groups clustered along dimensions similar to those in the Cardiac Clusters.

There were no significant relationships between membership in a PH Cluster and membership in a Cardiac Cluster. This was somewhat disappointing in terms of developing an overall typology of cardiac patients. It would certainly be desirable to be able to combine two different ways of categorizing patients into an overall scheme. There is some evidence that this can be done, especially with the pattern discussed for Cardiac Group 3, but relationships of other Cardiac Clusters to PH patterns are still unclear. One possible source of unclarity is the small number of subjects in each cluster. It is obviously important to repeat similar analyses using more subjects to obtain a definitive answer.

Since perception of health is such an important variable in health research, it should be incorporated into any typology of cardiac patients. Another approach would be forming clusters on the basis of a number of
variables including PH measures. The pattern analysis approach has been found to give interesting results and should be analyzed for more cardiac subjects and for other populations. With further research, perception of health can become important in understanding relationships among other physiological and psychological variables.

Deceased

Since the entire group used in the main cluster analysis contained only 37 subjects, the most meaningful comparisons about death in this study can probably be drawn between those who died following hospitalization and the entire group. The increased frequency among the deceased of history of CCU hospitalization and previous MIs seems quite understandable and is entirely in accord with previous findings (Garrity & Klein, 1975). Presumably those types of patients would enter the hospital in worse physical condition and be more deteriorated physically on leaving the hospital, making death more likely.

The finding that rate of smoking is related to death is in accord with the findings of Berman and Leon (1973). Smoking is a generally accepted causal factor in development of cardiac disease and it is reasonable that it would further exacerbate a person's physical condition, making recovery harder. Smoking can also be seen as a reaction to stress or as indicating a high tension level, both of which would make recovery more difficult.

The findings on the relationship of prehospitalization life change to death after hospitalization are provocative. The study indicated
that increased life change in both six-month periods preceding hospitalization is related to increased risk of dying, similar to findings of Rahe and Lind (1971) and Theorell and Rahe (1975). However, life change in the year two years previous to hospitalization was not related to death. Exactly which kinds of life change are more likely to be related to death or by what mechanism the relationship is manifested is unknown. Perhaps excessive changes are stressful to the person, leading to a physiological imbalance which could make recovery from hospitalization more difficult. Perhaps the significant life changes are those which lead to less stable environments for patients to return to, making for a more stressful and less successful recovery. In order to investigate these questions more research into the nature of stress physiologically and into the nature of its psychological impact is needed. It would also be worthwhile to find out if particular kinds of changes are more potentially damaging to chances of survival.

Another set of analyses investigated the relationships between the deceased and patients clustered according to perception of health variables. Previous research (Borgen et al., Note 2) had found that the pattern of PH scores for subjects who died and that of Group 4 was very similar. However, the findings of the present study indicate that this pattern very closely resembles the overall mean pattern computed from the scores of the 60 patients with partially completed measures. Thus the pattern of a large drop between general perception of health and current perception of health in the CCU followed by a sharp rise in ICU is not a pattern which can be viewed as one of risk. Perhaps instead
the distinctive patterns of Groups 1, 2, and 3 indicate particular non-risk configurations. Although this study does not reveal a pattern to point to as one which should be regarded as dangerous, it does lead to questions about why subjects with other patterns are less likely to die.

Survival among those with the uniformly high perception of health pattern of Group 1 does resemble previous research findings. In general high perception of health is related to survival (Kennedy & Bakst, 1966; Suchman & Phillips, 1958). Since Group 1 is not actually different on measures of physical condition from the other groups, the higher perception of health may represent general psychological well-being which may aid in physiological resistance to stress. The high PH in the hospital may represent denial of illness, which has been found to be effective in aiding recovery from cardiac attack (Kennedy & Bakst, 1966).

The generally low PH pattern of Group 3 and the declining pattern of Group 2 have no parallels in previous research. It is possible that because these patients see their health as poor when they leave the hospital, they are more likely to follow the medical regime and so take better care of themselves. Further research into the relationship of perception of health and following the advice of physicians could help clarify this possibility.

In comparisons on cardiac variables in which there were significant differences among the perception of health groups, those who died did not resemble those in Group 1 in any way. They were like Group 2 only in that both groups contained some alcoholics. They resembled both Groups 3 and 4 in containing alcoholics and in having no one employed
before hospitalization. In addition they resembled Group 3 in having high State Anxiety 2 and resembled Group 4 in having a longer stay in the CCU. Thus overall those who died resembled most Groups 3 and 4 who had either a consistently low PH pattern or a pattern like that of those who died. The resemblance to Group 4 is present on factors other than perception of health.

Although the above factors are not identical to those which differentiated those who died from the total group, they are important in determining which patients are at risk. Alcoholism seems to increase the risk of dying soon after hospitalization. Alcoholics may well be in worse physical condition and as such be less likely to survive. They also may have depleted psychological resources which would make stresses harder to deal with and recovery more difficult. Lack of employment before hospitalization may be related to greater risk of death because the reasons for unemployment may reflect emotional or physical problems which would interfere with recovery. Longer stay in the CCU may indicate more serious physical problems or difficulty in mobilizing psychological resources to assist in physiological recovery.

Higher anxiety in the ICU also seems to lead to increased risk of dying. Again the relationship could be physiologically and/or psychologically mediated. High anxiety levels may be physiologically harmful to cardiac recovery. They could also be a reflection of general confusion and inability to decide how to react to the stressful situation.

Since the Cardiac Clusters are formed by picking up differences on the cardiac variables, comparisons among the groups are of
questionable statistical meaning. However, they may give some useful leads for further investigation. The discriminant analysis procedures indicated that those who died were most like those in Group 1. There are also the most resemblances in analyses of variance and chi-square analyses between them. The deceased resembled Group 1 in having a moderately short stay in the CCU, a moderate amount of Life Change two years before hospitalization, few serious noncardiac medical illnesses, a majority suffering past MIs and CCU care, most suffering present MIs, and many alcoholics. Like Group 2 they were characterized by a shorter stay in the CCU, moderate RLCQ3, past CCU care and present MIs. They resembled Group 3 in having shorter stays in the CCU, few with serious medical illnesses, and having present MIs. Like Group 4 they had shorter stays in the CCU, moderate RLCQ3, higher trait and state anxieties, few serious illnesses, some overweight, and some hypertensive patients. They resembled Group 5 in having high anxiety scores and in containing a number of alcoholics.

Many of these factors clearly characterizing the deceased are those which have been found in earlier analyses: past MIs and CCU history, alcoholism, and anxiety. Overweight and hypertension do not seem to be distinguishing factors since the deceased group was moderate on these variables (some patients were overweight or hypertense and some were not). Surprisingly, noncardiac serious medical illness was not a risk factor—in fact, among the deceased few suffered from these illnesses. Since longer stay in CCU and high RLCQ3 distinguished only Group 5 with two subjects, these variables are of less importance to consider. Suffering
from an MI at the present hospitalization is the only significant variable which appears as a risk factor solely in this set of analyses.

Patterns of important risk variables do emerge when the deceased are compared in several ways to other groups of patients. Several variables occur in more than one analysis and so can be more conclusively considered to be risk factors. Cardiac history factors of past MI and CCU history appear several times. Alcoholism and high anxiety scores also appear to be risk factors. Characteristics which appear in only one analysis are less clear as risk factors but are still important to consider. These include RLCQ1 and 2, smoking, not being employed before hospitalization, and having a present MI. Length of stay in the CCU was the only factor with contradictory results—in one analysis longer stay in CCU characterized the deceased, in another it characterized only another group. Therefore it cannot be said to definitely be a risk factor.

The findings of probable risk factors have important implications for treatment of patients hospitalized with cardiac disorders. The staff should realize that patients who have had a history of cardiac problems, particularly past MIs, are at risk. It may be important to insist more strongly that these patients follow the physician's recommendations for diet, exercise, and medication. The recommendation to decrease or preferably quit smoking should be made especially strongly given the evidence that smokers are more likely to die soon after release from the hospital.

Alcoholics should be considered with special concern for both their
physiological and psychological states. Changes in physiological condition because of excessive drinking should be noted and patients made aware of how continued drinking can be harmful. It is likely that changing the alcoholic pattern can only be accomplished if more basic examination is made of the patients' life style and reasons for dealing with stresses by using alcohol.

The way in which patients handle stressful situations is especially important to examine given the relationship between life stress before hospitalization and death after release from the hospital. Living situations which might make recovery more difficult should be investigated and improved if possible. For example, settling an unstable financial situation could mean less pressure for a patient.

Perhaps the focus of concern should not be so much on eliminating stress as on the methods for dealing with stresses that do occur. One issue of current concern is modification of the Type A behavior pattern of dealing with life stress. Recent research has indicated that Type As are more likely to die soon after hospitalization (Bruhn et al., 1974). If these pressured ways of coping are changed perhaps patients would not be as likely to die. There is some evidence that the Type A reaction pattern can be modified. Suinn (1974) designed a program of anxiety management through behavioral rehearsal using relaxation and imagery of adaptive behaviors. There is evidence that the program was successful in changing behavior and in decreasing cholesterol level. Similar approaches may help to decrease the risk of dying among Type A patients, although thorough research is necessary to decide on its effectiveness.
Another group of patients which might seem to be at risk are those who are highly anxious. The nursing staff could be taught to recognize patients who are particularly anxious and make attempts to calm them. With some patients providing detailed information on their condition can be very reassuring; for others the attitude of the staff is particularly important. Building a relationship with a particular staff member through a calm, sympathetic attitude has been recommended as useful in reducing anxiety (Reiser, 1951).

Another possible implication of the risk of high anxiety is that a certain amount of denial may be useful. As discussed earlier, the naive position that patients are better off when they openly express all their feelings is not necessarily correct. Perhaps the staff is better advised to allow patients some denial of anxiety.

With knowledge of the kinds of patients most likely to be at risk for dying soon after being released from the hospital perhaps the staff can learn to direct recovery recommendations better. Not all suggestions for improved patient care involve common sense solutions, and further research may provide more answers which will help prevent cardiac fatalities.
FINAL COMMENTARY

Consideration of the type of research reflected in this study raises a number of important issues. The frustrations of having to do live, uncontrolled studies with small numbers of subjects must be weighed against the rewards of applicability, generation of hypotheses, and direct clinical intervention. After doing any such research it is important to assess how the frustrations balanced the rewards so that future research may be more useful.

As has been pointed out previously in the present study, generalization of results was made more difficult because of the small number of subjects. Some analyses came close to having results reach significance and may have done so with more subjects. Clusters consisting of only two people are certainly a tenuous base for generalization. A related issue is doing so many different analyses on a small number of patients. Certainly the problem of chance significance findings is increased.

With such a small number of subjects, replicability becomes an important issue. Since all the subjects must be used in the analysis, it is not possible to hold out half the subjects as a replication check. These difficulties are compounded in cluster analysis by the fact that there are no generally accepted procedures for assessing replicability. A few possibilities have been suggested in the present study but none are completely satisfactory.

The lack of control in doing research on actual patients in an
institution is another problem. One of the main problems in this study was that different patients were assigned to different physicians who varied in some of their medical practices. Thus factors such as length of stay in the hospital varied according to considerations outside the patient's actual conditions. Physicians also varied according to when during the course of hospitalization they judged patients' conditions were stable enough to permit testing. Psychologists also were not able to test patients at precisely the same physiological or psychological time during the course of hospitalization.

Since this study was in some ways retrospective, questions of causality are difficult to answer. This problem is particularly apparent in terms of the trait anxiety measure. Since trait anxiety did seem strongly related to state anxiety there is some question about whether patients could actually answer in terms of how they "generally" feel. It would be desirable to take measures before patients entered the hospital, but extremely difficult logistically.

Some of the advantages of doing this type of research are fairly obvious. Only by doing research on real patients can we assess how real people react to being hospitalized with a cardiac disorder. It would be impossible to simulate the many physiological and psychological changes in a laboratory. Therefore the results obtained will be more applicable to actual populations and the implications drawn will be more likely to be correct. For example, this study supported earlier findings that denial can be useful in coping with cardiac illness. This finding has led in this hospital to psychological interventions which
did not attempt to strongly challenge patients' denial. The nursing staff has been encouraged to see denial as potentially useful. A group therapy program for cardiac patients in the ICU has steered away from encouraging free expression of strong feelings partly in reaction to the research findings and partly because of experiencing such expression to be physiologically too stressful.

Doing research on real patients also encourages a more holistic approach. Considering physiological and psychological systems in actual patients makes it difficult to say that one system causes reactions in the other; the integration of both seems more obvious when a real patient coping with his reactions to hospitalization is being considered.

Other kinds of benefits of this kind of research may not be so obvious. The impact on a system of doing research within that system can be extremely important. If psychological research is not well-done it can hinder or destroy relationships with the medical staff; if it is done well, being sensitive to the needs of the medical staff, research can be extremely important in establishing psychology as an important service. During the course of the present study, psychologists came to be regarded as team members attending cardiac rounds and becoming acquainted with nursing staff in CCU and ICU. The summaries of research results on individual patients demonstrated to the medical staff that psychologists had useful information to impart. During the course of the project, psychologists have been called in to evaluate patients and to do supportive therapy. In general psychologists have been able to show themselves to be useful members of a treatment team.
Participating in research can also have important effects on patients. All those who were asked to volunteer for the study did so and a number were impressed by being asked to take part in a scientific project. They took the research seriously because they felt the results could be important to them and to future patients. This attitude was useful in making the results of the research more accurate. It also enhanced the self-image of the patients which can be at a very low point during hospitalization.

The problems of small sample size and lack of control are always present in real life research settings such as the one in the present study. This research continues to be done in part because this is the only way it can be done. The problems will continue to be there but the results in terms of greater understanding and improved patient care certainly justify doing live research in institutional setting.

This research project has proved useful in expanding knowledge into risk factors for death from cardiac disorders, coping mechanisms within the hospital, and the relationship between different types of disorders, psychological mechanisms, and outcome variables. A number of suggestions for future investigation have been made. The project has also concretely improved patient care for those patients who participated in it and established psychological services as useful and effective in the setting in which it was conducted.
REFERENCE NOTES


REFERENCES


Garrity, T. F. Vocational adjustment after first myocardial infarction; comparative assessment of several variables suggested in the literature. *Social Science and Medicine*, 1973, 7, 705-717. (a)

Garrity, T. F. Social involvement and activeness as predictors of morale six months after first myocardial infarction. *Social Science and Medicine*, 1973, 7, 199-207. (b)


