Following the pioneering work of Selye, many researchers have been pursuing the link between environmental demands, typical reactions to those demands, and the results or consequences of those reactions. In the simplest possible terms, it is proposed that when certain types of individuals are faced with environmental demands, they react in a way that increases their vulnerability to cardiovascular and gastrointestinal disease and malfunction. They get ulcers, have strokes, and generally degenerate. In this reading, we consider various types of reactions to stress and their possible consequences. In particular, Glass and his colleagues warn of the consequences of Type A behavior patterns.

■ READING 39 ■

Stress, Type A Behavior, and Coronary Disease

David C. Glass, Richard Contrada, and Barry Snow

Epidemiologists trace the beginnings of the heart disease problem in the United States at least to the turn of the century. Since then, mortality rates due to cardiovascular disease have increased dramatically. Between 1940 and 1950, for example, the rate for white males, ages 35 to 64, increased by 23 percent (Borhani, 1966). Although recent data from 1968 to 1972 suggest a decline in coronary mortality in American men, the disease still remains the major cause of death in the United States. A large percent of the cases is classified as "premature" deaths, since they occur during the middle years, ages 35 to 50.

CORONARY HEART DISEASE

Coronary heart disease (CHD) refers to a set of clinical disorders that results from damage to the coronary arteries supplying the heart; this damage is called atherosclerosis or coronary artery disease. There are several major forms of clinical CHD. In angina pectoris, the individual experiences paroxysmal attacks of chest pain, which are the result of failure of the coronary arteries to deliver an adequate supply of blood to the heart. Although angina can be painful, it may persist for years in stable form without significant damage to heart tissue. However, angina pectoris is a serious disease. Affected persons have been known to die suddenly, or they may develop an acute myocardial infarction (MI).

MI, commonly termed *heart attack*, represents necrosis or death of a part of the heart due to a prolonged state of inadequate blood supply. The pathophysiological processes underlying this event remain unclear. Many cases of MI are associated with the presence of thrombosis (clot formation) in one or more of the coronary arteries. However, whether coronary thrombosis plays a precipitating or a secondary role in MI has been debated in recent years. In addition, several studies indicate that the presence of coronary thrombosis is a rare event in

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cases of sudden death due to cardiac arrhythmias. This has led some investigators to argue that MI and sudden cardiac death are two forms of myocardial necrosis with distinct pathophysiological mechanisms (Eliot, 1979). Other forms of clinical coronary heart disease include congestive heart failure and disturbances in the electrical activity of the heart.

FACTORS ENHANCING RISK FOR CHD

Data collected in various epidemiological studies suggest that the following factors are associated with increased risk of CHD: (*a*) aging, (*b*) sex (being male), (*c*) elevated levels of serum cholesterol and related low-density lipoproteins, (*d*) hypertension, (*e*) heavy cigarette smoking, (*f*) diabetes mellitus, (*g*) parental history of heart disease, (*h*) obesity, (*i*) physical inactivity, and (*j*) specific anomolies on the electrocardiogram (Kennel, McGee, & Gordon, 1976).

Although identification of these risk factors represents a significant advance in understanding CHD, some investigators question the predictive importance of such variables as dietary fats and physical inactivity in precipitating a later coronary event (Friedman, 1969). Moreover, the precise mechanisms whereby still other risk factors (e.g., elevated blood pressure) lead to CHD remain unclear. Even if these mechanisms were precisely understood, a search for additional causes of CHD would be indicated, since even the best combination of risk factors fails to identify most new cases of the disease. Accordingly, researchers are now considering the role of social and psychological factors in the etiology and pathogenesis of coronary disease (Jenkins, 1971, 1976, 1978).

Clinicians have long pointed out the hard-driving, competitive, time-urgent, and aggressive qualities of coronary patients (Osler, 1892). Nevertheless, when the growing pandemic of CHD in the 1930s and 1940s gave rise to a series of prospective studies of CHD risk factors, psychosocial factors were largely ignored in favor of biomedical variables. The role of psychological variables in the disease process was neglected for a variety of reasons. Unlike physical variables, which can usually be defined and measured with a good deal of precision, psychological factors frequently elude efforts at conceptualization and quantification. Indeed, reviews of the literature published as late as 1968 concluded that most personality traits could not distinguish between healthy and disease groups with any degree of reliability (Mordkoff & Parsons, 1968). Faced with the limited success of the trait approach, Friedman and Rosenman developed an interactionist perspective to the study of psychosocial risk factors (Rosenman & Friedman, 1974; Friedman & Rosenman, 1974). In their opinion, the increased rate of heart disease in modern times is associated with the stresses and challenges of an increasingly industrialized society. These pressures give rise to a complex set of behaviors, which Friedman and Rosenman define as the Type A coronary-prone behavior pattern.

TYPE A BEHAVIOR PATTERN

Type A behavior may be defined as "an action-emotion complex that can be observed in any person who is aggressively involved in a chronic, incessant struggle to achieve more and more in less and less time, and, if required, to do so against the opposing efforts of other things or persons" (Friedman & Rosenman, 1974). A series of laboratory studies by Glass and associates has provided empirical documentation for the competitive, achievement-striving, time-urgent, and hostile components of Type A behavior pattern (Glass, 1977). For example, Type A individuals strive harder to succeed than Type B, as is reflected in their attempts to solve a greater number of arithmetic problems irrespective of the presence or absence of a deadline. Another study showed that compared to Type B individuals, Type A individuals work at a level closer to the limits of their endurance on a treadmill test, while simultaneously admitting to less fatigue. Still other studies indicated that Type A individuals perceive time as passing more slowly

than it actually does and experience greater difficulty with tasks that require delayed responses. As for the hostility component, two experiments showed that in contrast to Type B, Type A individuals deliver higher levels of electric shock to a confederate who has previously harassed them.

It is generally agreed that the Type A concept does not refer to the stressful conditions that elicit these behaviors, to the responses themselves, or to some hypothetical personality trait that produces them. Pattern A refers to a set of overt behaviors that occur in susceptible individuals given appropriately eliciting conditions. This interactionist approach—focusing on the interplay between the situation and the individual—is reflected in the traditional techniques used to assess the Type A behavior pattern.

MEASUREMENT OF PATTERN A

There are two major methods for assessing Type A behavior. The first, the structured interview, was developed by Rosenman and Friedman (Rosenman, 1978). In this method, the subject is asked a series of questions dealing with the intensity and quality of his competitive drive, time urgency, and hostility. Although the content of the subject's answers is considered important in making a behavior pattern diagnosis, the trained interviewer gives more attention to the manner and tone of the subject's responses. The questions are asked in a brisk manner, with emphasis on key words and phrases. The interviewer will occasionally challenge the subject by interrupting a response in midsentence. Type A individuals typically become impatient at these interruptions and try to override the interviewer. Frequent use of explosive vocal intonations, as well as rapid and accelerated speech, intermittent (and perhaps impatient) sighing, and rhythmic motor responses are also apparent in the Type A individual. Assessments based on the interview are typically made on a four-point scale, where A1 and A2 represent, respectively, the fully developed and the incompletely developed Type A pattern. B represents the relative absence of Type A characteristics, and X represents an intermediate mixture of both behavior patterns. Assessments of recorded interviews by two independent raters reveal agreement rates ranging from 75 to 90 percent in various studies. Moreover, 80 percent of the interviewed subjects in one study showed the same classification over periods of 12 to 20 months (Rosenman, 1978).

Jenkins et al. have developed an alternative to the structured interview known as the Jenkins Activity Survey for Health Prediction (JAS) (Jenkins, Zyzanski, & Rosenman, 1979). This self-administered questionnaire requires that the subject respond to a group of items that reflect the content of the interview. A typical question is: "How would your wife (or closest friend) rate you?" The reply, "Definitely hard driving and competitive," is a Pattern A response, and "Definitely relaxed and easygoing" is a Pattern B response. Another question is: "Do you ever set deadlines or quotas for yourself at work or at home?" Where "Yes, once a week or more often" is a Pattern A response, "No" or "Yes, but only occasionally" are Pattern B responses. Although the self-administered JAS questionnaire has the advantage of providing an objective score on the A-B continuum, this score agrees only moderately with A-B classification based on the interview (i.e., 73 percent). It should be noted, however, that the agreement rate goes up to 90 percent if only the extremes of the A-B distribution ($\pm$ 1 standard deviation) are considered. The JAS has a test-retest reliability, which ranges from .60 to .70 across one- to four-year intervals (Jenkins, Zyzanski, & Rosenman, 1979).

ASSOCIATION OF PATTERN A WITH CHD

The strongest available evidence for an association between Type A behavior and CHD comes from a prospective, double-blind study known as the Western Collaborative Group Study (Rosenman, Friedman, Straus, et al., 1964). A sample of approximately 3,000 men,

ages 39 to 59, was identified and independently examined for behavior patterns and medical and demographic factors. Rosenman et al. reported that about 1,500 men were judged at intake to be Type A. An eight-and-one-half-year follow-up study showed that more than twice the rate of CHD occurred in these men compared to those who had originally been judged as Type B (Rosenman, Brand, Jenkins, et al., 1975). Further analysis of these data revealed that the traditional risk factors (e.g., elevated serum cholesterol and smoking cigarettes) could not account for the differential rate of CHD among Type A and B cases. This finding suggests that Pattern A does not exert its major pathogenic influence through the other risk factors for CHD.

Still other research, using coronary arteriography, has documented a greater degree of coronary occlusion among Type A compared to Type B patients (Blumenthal, Williams, Kong, et al., 1978). It would appear, then, that Pattern A behavior is related to clinical manifestations of coronary heart disease, as well as to the underlying atherosclerotic disease process.

PATTERN A AS A PSYCHOLOGICAL CONSTRUCT

A large proportion of the population is typically classified as Type A, but there is a relatively low incidence of CHD among Type A individuals (albeit significantly greater than in the Type B population). Therefore, the causal mechanisms underlying CHD may not be distributed evenly throughout the Type A group. It is possible that some facets of Pattern A behavior have little or no association with CHD, since they appear in all A individuals rather than in only those who show increased risk. This line of thought underscores the importance of understanding the psychological mechanisms that produce and sustain Type A behavior.

There are at least three approaches to identifying such mechanisms. Consider the work of Glass and associates, who suggest that Type A behavior is elicited in susceptible individuals by uncontrollable, stressful situations (Glass, 1977). Psychological stress may be defined as the internal state of the individual when he is faced with threats of psychic and/or physical harm (Lazarus, 1966). An uncontrollable stressor would be a condition that an individual believes he cannot influence or alter. A controllable stressor, by contrast, implies a perception on the part of the individual that he can escape or avoid the event. Pattern A behavior is conceptualized by Glass as a characteristic style of coping with environmental stressors that threaten the individual's sense of control. Compared with the Type B group, Type A individuals are expected to strive harder initially to assert and maintain control over uncontrollable events (hyperreactivity). However, continued exposure to uncontrollable stress must end in failure and frustration. Type A individuals are believed to react to this eventuality by giving up efforts at control more quickly and intensely than their Type B counterparts (hyporeactivity). Experimental studies have provided some support to these hypothesized Type A reactions.

Another approach to identifying the psychological mechanisms underlying Pattern A behavior is found in the work of Scherwitz et al. (Scherwitz, Berton, & Leventhal, 1978). They suggest that the descriptors of Type A behavior (achievement striving, competition, time urgency, and hostility) require an involvement in the self and usually a comparison with a standard. In the case of achievement, for example, the self is where it wants to be, whereas in competition the self is compared with another. Scherwitz et al. argue that the construct of self-involvement is thus useful in explaining why Type A behaviors arise. Experimental data suggest that self-involvement is, indeed, correlated with cardiovascular variables that might be routes to CHD.

Still a third approach to conceptualization is found in an article by Matthews et al., which showed that only two factors in the Pattern A complex, competitive drive (including hostility) and impatience, were associated with the subsequent occurrence of CHD (Matthews,

Glass, Rosenman, & Bortner, 1977). Dembroski et al. have developed a component scoring system for the structured interview based on these findings (Dembroski, MacDougall, Shields, et al., 1978). The same components that were the best predictors of CHD were also the best predictors of experimentally induced cardiovascular elevations.

PHYSIOLOGICAL MECHANISMS

Researchers have been concerned with the physiological mechanisms that might mediate the association between Pattern A and CHD. The suggested mechanisms include elevated cardiovascular activity (e.g., blood pressure), acceleration of the rate of damage to the coronary arteries over time, facilitation of platelet aggregation leading to thrombus (clot) formation, induction of myocardial lesions, and initiation of cardiac arrhythmias. In some quarters, it is believed that these effects are influenced by enhanced activity of the sympathetic nervous system and consequent discharge of catecholamines such as epinephrine and norepinephrine (Eliot, 1979). Indeed, research has shown greater urinary norepinephrine excretion during the work day and plasma norepinephrine responses to competition and stress among Type A compared with Type B men (Rosenman & Friedman, 1974). More recent research indicates greater elevations in plasma epinephrine among Type A than among Type B individuals when both types were exposed to a hostile competitor (Glass, Krakoff, Contrada, et al., in press). Increases in systolic blood pressure and heart rate accompanied the epinephrine changes. Such cardiovascular activity has been reported by other investigators to be characteristic of the Type A group (Dembroski, MacDougall, Shields, et al., 1978).

Glass has proposed the following integration of these physiological results with his conception of Type A behavior as a style for coping with uncontrollable stressors (Glass, 1977). Evidence exists showing that stress influences the rise and fall of catecholamines and related cardiovascular activity. More specifically, active coping with a stressor may heighten these responses, whereas a decline in efforts to master a stressful event has been linked to a decline in catecholamine activity. Moreover, some investigators have suggested that the rise and fall of catecholamines and associated shifts between sympathetic and parasympathetic activity may be the mechanisms underlying sudden cardiac death (Glass, 1977; Engel, 1970).

One should recall that the Type A group initially exhibits enhanced efforts to master uncontrollable stressors followed by greater signs of giving up after prolonged exposure to such stimulation. Glass's argument is that this alternation of active coping and giving up, accompanied by the potentially damaging physiological processes outlined above, is experienced more frequently and intensely by Type A than by Type B individuals. To the extent that coronary disease is influenced by a cycle of hyperreactivity and hyporeactivity, the greater likelihood of the disease occurring in Type A individuals might be explained in terms of the cumulative effects of the excessive rise and fall in catecholamines released by the repeated interplay of Pattern A and uncontrollable stress. Research is currently being conducted to test this line of thought (Glass, Krakoff, Contrada, et al., in press).

INTERVENTION

A long-range goal for Pattern A research is to generate programs of intervention that will reduce coronary heart disease. Efforts in this area have so far accomplished little more than suggesting approaches which warrant further investigation.

Three interrelated considerations must be made in the design of intervention studies, the first being the choice of a target of intervention. Likely candidates include social and environmental factors that promote and sustain Type A behavior, psychological processes that interact with environmental factors in eliciting potentially pathogenic behaviors, and Type A behavior itself.

A second consideration that is related to the first is the nature of the treatment process. Social and environmental targets call for intervention at an organizational level. One possibility is to alter the conditions that seem to produce uncontrollable stressful experiences. For example, work efficiency and time management might be improved so that the number of hassles and deadlines occurring in an individual's day-to-day work environment is reduced.

Psychotherapeutic approaches may prove effective in altering psychological processes that give rise to Pattern A behavior. For example, modification of the way in which Type A individuals perceive and appraise uncontrollable events might be accomplished through the use of rational approaches to treatment (Roskies, Spevack, Surkis, et al., 1978). Programs of behavior modification might also be used with the aim of reinforcing Type B behavior while reducing the incidence and intensity of Type A behavior (Friedman & Rosenman, 1974). Relevant physiological processes have been the target of some behavior modification programs, in which subjects were trained to recognize and control their somatic reactions in stressful situations (Roskies, Spevack, Surkis, et al., 1978). Pharmacological methods have also received attention in efforts to alter Type A behavior, including the use of agents called beta blockers (e.g., propranolol), which inhibit the production of catecholamines.

A third consideration in designing an intervention program is the choice of criterion measures. Since a reduction in CHD is perhaps the most important criterion, considerable research on the pathophysiological processes associated with Type A behavior is the first order of business. In this connection, it should be noted again that most Type A individuals do not develop coronary heart disease. It becomes necessary, therefore, to identify the components of Pattern A that lead to physiological processes that may be routes to CHD. Once these components are identified, intervention programs could focus their attention exclusively on the CHD-relevant aspects of Type A behavior. Indeed, many facets of the behavior pattern may be socially desirable and adaptive for individuals in this society.

CONCLUSION

It seems clear that the past decade or two has provided systematic documentation for the observations of clinical cardiologists concerning coronary-prone behavior (Dembroski, Weiss, Shields, et al., 1978). It is apparent, however, that additional research remains to be done. Complexities abound at each level of analysis, including the psychological variables that account for Type A behavior, the situations that elicit the behavior, and the physiological processes whereby Pattern A leads to CHD. One must also consider the enormity of the task of integrating these factors with the traditional biomedical risk factors. Although an attempt has been made to provide an overview of the knowledge that now exists, the current state of affairs may be more aptly compared with the fitting of one small piece into a large puzzle. It is hoped that the shadings and minute detail on this small puzzle piece will lead to the eventual completion of the picture.