THE RELATIONSHIP OF TYPE A AND TYPE B
CORONARY BEHAVIOR PATTERNS AND
ACHIEVEMENT STRIVING

by

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1. Graphic display of the interaction among the cell means on the number of problems attempted by Type A and Type B subjects under the No Deadline and Deadline conditions . . . . 39
The purpose of this study was to conduct a systematic replication of the experiment of Burnam, Pennebaker, and Glass (1973) using an adult population and the Jenkins Activity Survey. Additionally, this study attempted to address the issue of whether the previous results would be substantiated when a non-college sample was used.

The subjects consisted of 40 females and 40 males who volunteered to participate in the study. All subjects were given the Jenkins Activity Survey and randomly assigned to Condition I, the No Deadline condition, or Condition II, the Deadline condition. The subjects in the No Deadline condition were given arithmetic problems with no time limit instructions, and subjects in the Deadline condition were given arithmetic problems with instructions which stated a time limit.

The results indicated that college students performed differently than the employed adults used in this study. Unlike the original study, this study using adults did not find a significant main effect for the
Deadline versus No Deadline condition. Although the interaction effects were statistically significant in both studies, the reported interaction effects were not similar.
INTRODUCTION

The notion that there is an important relationship between behavior and emotion and the cardiovascular system is not new and has been perceived through history. It can easily be traced from a historical perspective. Biblical writers associated sorrow and fear with heart pains (Leibowitz, 1970). Harvey, a physician, in the year 1628 wrote: "Every affection of the mind that is attended with either pain or pleasure, hope or fear, is the cause of an agitation whose influence extends to the heart" (Eastwood & Trevelyan, 1971, p. 289). In 1897, Oslet wrote: "I believe that the high pressure at which men live and the habit of working the machine to its maximum capacity are responsible for (arterial degeneration) rather than excesses in eating and drinking" (Oslet, 1897, p. 25). Coronary heart disease has been present in society, but only recently has it become an acute problem.

The widespread beginnings of coronary heart disease in the United States began in the early 1920s (Anderson, 1973). Since that, death due to coronary heart disease increased 23% from 1940 to 1950 (Borhani, 1966) and continued to increase until the late 1960s. Although there has been a significant decline in mortality rates from coronary heart disease during the last few years, a news article reports the disease still remains the major source of death in the United States ("The Killer," 1975). For the year 1975, the National Heart, Lung and Blood Institute estimated that 1.3 million Americans would experience coronary heart disease; 675,000 would die; and 175,000 of those who died would be under the age of 65 ("Coronary Deaths," 1975).
Another way of viewing the coronary heart disease epidemic is the impact on the economy. Felton and Cole (1963) estimated that all cardiovascular diseases accounted for 12% of the time lost by the "usually working population" in the United States for a total economic loss of about $4,000,000,000 during one fiscal year.

In a bulletin issued by the International Society of Cardiology (1969) concerning coronary heart disease, it was stated that "it will result in coming years in the greatest epidemic mankind has faced unless we are able to reverse the trend by concentrated research into its cause and prevention" (p. 147).

Knowledge of the epidemiology of coronary disease has greatly increased during the past few decades. There are research data which suggest that the individual prone to coronary heart disease can be identified by certain risk factors. These risk factors are listed by the American Heart Association. They include: age, sex, cigarette smoking, elevated systolic blood pressure, serum cholesterol, left ventricular hypertrophy, and diabetes (Insull, 1973). However, the best combination of traditional risk factors still fails to identify most new causes of coronary heart disease (Jenkins, 1971). The presence of two or more of these risk factors is associated with very high risk of coronary heart disease but, even under these conditions, they predict only about half the incidence of the disease (Glass, 1977a). Bruhn, Wolf, and Lynn (1968), in a study in which populations having low rates of coronary heart disease were compared internationally, found certain risk factors like cholesterol high in many populations in which coronary disease was rare.

Because of the limitations of standard risk factors in predicting
coronary heart diseases, a number of researchers have called for broadening the search for contributing causes (Glass, 1977a; Gordon, Garcia-Palmieri, & Dagan, 1974; Jenkins, 1976; Segers, Graulich, & Mertens, 1974) rather than intensifying the study of traditional risk factors like diet. It is in this connection that recent research studies have increased the probability that certain psychological, social, and behavioral conditions do indeed place persons at a higher level of risk of clinically manifested coronary heart disease (Jenkins, 1971).

Among the most promising approaches relating behavior to coronary heart disease risk has been the work of Friedman and Rosenman of the Mount Zion Hospital and Medical Center. In the late 1950s they began studies of a specific manifest behavior type, the coronary-prone behavior pattern or Type A. In their book, *Type A Behavior & Your Heart*, Friedman and Rosenman (1974) describe intense striving for achievement, competitiveness, easily provoked impatience, time urgency, abruptness of gesture and speech, overcommitment to vocation or profession, and excesses of drive and hostility as characteristic of the behavior pattern. In Friedman and Rosenman's classification, individuals at increased risk to coronary heart disease are labeled Type A and those in lower risk Type B.

In recent years, many research centers have found increasing support for the position that higher risk of coronary disease is present in people manifesting the coronary-prone behavior pattern, Type A. The pattern has been associated with: (a) prevalence of coronary disease in otherwise healthy persons, (b) the degree of arteriosclerosis determined by coronary angiography, and (c) risk of reinfarction with persons who
already have the disease (Jenkins, 1971). Jenkins (1971) compiled an extensive review of the literature concerning Type A. He concluded that studies investigating a Type A pattern were more numerous and the consistency of positive findings with this behavior pattern was higher than any other of the psycho-social variables studied.

These studies have largely been concerned with the prevalence and prediction of coronary heart disease. While the Type A pattern has been shown to be an overall good predictor of coronary heart disease, there has never been adequate systematic investigation of the extent of the contribution of each of the factors commonly accepted as part of this pattern. For example, it has not been shown that any of the individual attributes associated with Type A behavior, such as achievement striving, are a necessary part of the pattern.

It was the intent of this research to investigate one of the components of Type A, excessive achievement striving. Our society is built upon a work ethic, and achievement striving is generally viewed as a positive attribute for an individual. Friedman and Rosenman's (1974) position has been that Type A individuals exhibit a positive force identified as achievement striving to an intensity which becomes self-destructive. They discuss Type A people as engaged in a continuous struggle to achieve a maximal number of goals in a minimal amount of time. Type A people are typically always ready to compete with maximal intensity toward any challenge. On the other hand, Type B people may strive for achievement but they lack the intensity of the Type A group. Type B people work at maximal intensity only when a situation necessitates such a response.

Although there is agreement in describing Type A as having an
intense drive to succeed in achievement-related activities (Friedman & Rosenman, 1974), this judgment is based on clinical observations and data collected during the stress interview. The role of behavioral factors needs to be established so that education and advice to patients about behavior can be based on extensive evidence. Glass (1977b) has called for more systematic documentation of this component of the coronary-prone behavior pattern.

If Friedman and Rosenman's assumption of achievement striving as a prime indicator of the coronary-prone pattern is correct, then individuals with this pattern should be expected to work at their maximum capacity even in the absence of a specific deadline for task completion. The non-coronary group, Type B, might be expected to work as hard as its Type A counterpart only when confronted by a concrete deadline condition.

This hypothesis was tested in an experiment by Burnam, Pennebaker, and Glass (1973) using a Deadline versus No Deadline treatment. Subjects were designated as Type A people or Type B people by the student version of the Jenkins Activity Survey (JAS). The same task (arithmetic problems) was assigned to each treatment group. Each treatment was timed for five minutes, but only the Deadline group was told of the limited time. The No Deadline group was told there was no time limit.

There were no differences in the percentage of errors on the arithmetic task. The results indicated a statistically significant difference in the number of problems attempted between the Deadline and the No Deadline condition. In addition, it was found that Type A subjects attempted more problems than the Type B subjects under the No
Deadline condition.

Analysis of variance of the data revealed a significant main effect for the Deadline versus No Deadline treatment, $F(1, 58) = 4.57, p<.05$, and a reliable interaction between this variable and the A-B classification, $F(1, 58) = 3.84, p<.05$). Contrasts using the error-mean-square from the analysis of variance showed that Type A people attempted more problems than Type B people in the No Deadline condition ($Ms = 86.0$ and $71.6, p<.06$), but the difference between Type A and Type B in the Deadline condition was not statistically significant ($Ms = 87.0$ and $94.5, p>.20$). Comparisons between the two experimental treatments indicated Type A performed at a similar level under Deadline and No Deadline conditions ($p>.20$), but Type B attempted more problems under Deadline than No Deadline ($p>.01$).

A working assumption of the Deadline and No Deadline study is that the results can be generalized to a non-student population. If Glass (1977a) and Burnam et al. (1973) are correct in using a college student population in Type A research, we would expect similar results in a replication of the Deadline and No Deadline study conducted with the general population. The Jenkins Activity Survey was normed on an adult population. Most of the work concerning coronary heart disease and Type A and Type B behavior has been done with the general population. It is important to answer the question, "Will research done on a college-age population generalize to the general population?" There has been no replication of Burnam and his associates' work with students in the general population using the non-modified Jenkins Activity Survey.
REVIEW OF LITERATURE

Theoretical Background

Coronary heart disease (CHD) is a clinical disorder produced by lesions of the coronary arteries. The major categories of coronary heart disease are angina pectoris and myocardial infarction (Friedman & Rosenman, 1974).

Angina pectoris means "pain of the chest" (Friedman & Rosenman, 1974). It arises when the heart muscle experiences anoxia from an inadequate blood supply (Friedberg, 1966). Friedberg (1966) defined angina pectoris as a clinical syndrome characterized by attacks of distinctive pain or oppression. Angina is usually precipitated by physical exertion or physical stress. Angina typically does not involve permanent damage to heart tissue (Glass, 1977a).

Myocardial infarction is usually the result of a clot forming in a coronary artery which diminishes the blood supply. The insufficient oxygen supply causes death of some heart tissue (Glass, 1977a). This condition is usually called a heart attack by laymen. It might also be referred to by the terms "coronary," "acute coronary occlusion," or "acute coronary thrombosis." The area involved may be very small or relatively extensive. It is usually located in the left ventricle of the heart. An electrocardiograph and various lab procedures are used to determine the magnitude and location of the myocardial infarction. An acute myocardial infarction sometimes involves the heart's conduction system as well as the heart muscle, resulting in arrhythmia (Friedman & Rosenman, 1974).
Sociological and Psychological Factors as Related to Coronary Heart Disease

A large body of evidence currently exists concerning the social and psychological variables that place certain types of people at a higher risk of coronary heart disease. Syme (1968) indicated in his review that social and psychological factors relating to coronary heart disease have more implications in coronary disease than the role of diet. Jenkins (1971, 1976) has completed a very extensive review of the psycho-social risk factors from 1965 to 1970.

Various occupations, income levels, ethnicity, religion, or marital status have shown no consistent relationship with coronary heart disease. Education has now been found to have an inverse relationship (Hinkle, Whitney, & Lehman, 1968; Rosenman, Brand, Jenkins, Friedman, Straus, & Wurm, 1975). Shekelle (1969) found angina pectoris occurs more frequently in groups with less education.

Social mobility is defined as a movement which places a person in different social worlds. Examples are a change in culture or a major change in occupation. Smith's (1967) review of social mobility's relation to coronary heart disease found the disease to be more frequent in urban, industrial settings; among the socially mobile, migrants, and individuals who had failed in adaptation to cultural change.

Hinkle et al. (1968), in a study using 270,000 Bell System employees, found no relation of mobility to coronary heart disease. This project used a variety of indices of mobility and successful achievement. Williams' (1968) study of frequency of coronary heart disease following a geographic move, change in job, or job pressures found results similar to Hinkle and his associates'.
In a study of an industrial population Shekelle, Ostfeld, and Paul (1969) found that men were at a significantly higher risk of coronary heart disease if either the man or his wife had experienced different status (higher or lower) during childhood. Caffrey (1970) found a disproportionate number of infarctions among monks with a college education and those who came from homes of lower socio-economic levels where parents were less likely to have attended college.

Generally, no clear picture of social mobility and coronary heart disease can be obtained from these studies, particularly since each investigation isolated a highly specific sample from which to generalize.

Job involvement has been found to be associated with coronary disease. Wynn (1967) and Russek (1965) found coronary patients were more likely than controls to work at two or more jobs simultaneously. Coronary heart disease patients were also found to work overtime regularly (Russek, 1965; Wynn, 1967).

In a study of Swedish twins, Liljefors and Rahe (1970) found twins with myocardial infarction histories to have a greater devotion to their work than twins without coronary disease. Van der Valk and Groen (1967) reported myocardial infarction patients to have an exaggerated "success ethic" and to have needs to be aggressive and keep active. These patients were interpreted as "work addicts" who remained hyperactive as a defense against passivity (Kits van Heijningen & Treurniet, 1966). Mac Kinnon (1968) and Sales (1969) both reported similar conclusions in regard to overwork and work overload as risk factors in coronary heart disease. These findings were also supported by Dreyfuss, Shanan, and Sharon (1966); Liljefors and Rahe (1970), and Theorell and Rahe (1972).
The "work overload" observed in Type A individuals does not mean Type B individuals are without ambition. Type B people, according to Friedman and Rosenman (1974), "have a considerable drive but their character is such that work seems to steady them, give confidence and security to them, rather than to goad, irritate and infuriate, as with Type A men" (p. 68).

Friedman and Rosenman (1974) define Type B people as more creative, less hostile, more tactful, and as having a better sense of where to compete than Type A people, therefore making them more desirable for executive positions than Type A people. This notion is supported by other researchers who view the coronary patient as one who strives without joy or success at times. Bruhn, Chandler, and Lynn (1966) found coronary patients to have usually attained less upward mobility than their matched controls in occupation.

Ostfeld, Lebovits, and Shekelle (1964), in a study using the Minnesota Multiphasic Personality Inventory (MMPI), reported that the hypochondriasis scale and the hysteria scale were elevated in men before the development of angina pectoris, but men before myocardial infarction were not different from those without coronary disease on any of the MMPI scales. Lebovits, Shekelle, and Ostfeld (1967) found persons who had coronary heart disease shifted to higher scores on the three neurotic scales of the MMPI: hypochondriasis, depression, and hysteria. Other studies found men with coronary heart disease as having higher MMPI scores on depression and hysteria and also lower scores on the masculine-feminine scale, suggesting strong masculine behavior (Bakker & Levenson, 1967; Brozek, Keys, & Blackburn, 1966).

Bruhn, Chandler, and Wolf (1969), using the MMPI, compared controls
with a group of coronary patients who did not and who did survive for seven years. The entire coronary group had lower defensiveness than controls. Survivors had less adequate defenses than controls. The fatality group was significantly higher than survivors on the depression scale. The patients with angina scored higher than those with infarction on denial, hysteria, depression, and hypochondriasis. Also using the MMPI Ibrahim, Jenkins, and Cassel (1966) found patients with coronary heart disease more frequently manifested a profile of low hostility with higher anxiety and depression.

Using the Cattell 16 Personality Factor Inventory Test, Ostfeld and his colleagues (1964) found subjects who developed coronary heart disease to be more suspecting and jealous and to have greater feelings of inner tension. They were also more independent and self-sufficient. Subjects who later developed angina pectoris were more immature and emotionally unstable than future myocardial patients.

Using Cattell's measure, Bakker and Levenson (1967) reported on 112 patients with coronary heart disease. In comparison to the general population, they had higher levels of conformity, soberness, prudence, social control, and compulsivity. They made no conclusion as to whether these characteristics were typical of coronary heart disease patients or were representative of people who were likely to be referred to a cardiac evaluation clinic.

In a later paper, Bakker (1969) reported some characteristics that distinguished between angina and myocardial infarction patients. Those with angina were less stable, more conforming, less conscientious but more timid, apprehensive, and wrapped up in inner urgencies. More marked differences were found in angina patients with less than a 10th-
grade education and with ages above 45 years. Caffrey (1970) administered the 16 PF scale at a Trappist-Benedictine monastery. The monastery population generally scored at a more healthy level than the population on which the test was normed. Only on apprehension and "being more wrapped in inner urgencies" did coronary monastery patients differ from the normative population.

Using the IPAT Anxiety Scale Goulet, Allard, and Poirier (1968), in a random sample of 1,000 French Canadian males, found a prevalence rate of 31 per 100, with coronary patients scoring much higher on the anxiety scale and also more frequently rating themselves as being under chronic stress. Another study by Medalie, Kahn, and Groen (1968) found patients with coronary heart diseases to be significantly higher than those without coronary heart disease on an eight-item anxiety index.

Bruhn and colleagues (1968), using an anxiety scale developed by Christie, compared coronary heart disease patients and a control group. Their findings indicated the coronary heart disease group to be significantly higher on the anxiety scale. However, the patients did not differ from controls in response to verbal questions dealing with tension and nervousness. Klein and Parsons (1968) obtained self and spouse ratings of 16 patients with coronary heart disease and 16 matched control without coronary heart disease on the Clyde Mood Scale. Patients rated themselves as having greater depression, being more anergic, and having clearer thoughts than did controls. Patients also rated themselves as being more jittery before the infarction. Ratings by wives of both groups were not significantly different, except patients' wives rated them as more anergic than control spouses. Miller (1965) used the Gottschalk scale to evaluate oral responses of
infarction patients in various interview situations. He found patients as having greater anxiety, depression, and feelings of worthlessness.

Drawing from a Veteran's Administration study, Brown (1967) found men with coronary heart disease reported lifetimes with more stress and tension than the control group with healthy hearts. No difference was reported in psychological adjustment or frequency of neurosis. This study is in conflict with Caffrey (1970), previously cited, who found individuals with coronary heart disease to be well adjusted.

Lovell and Verghese (1967) used a sample of Australian men hospitalized for coronary heart disease. They found men who reported pain in the left side of the chest following the acute episode were highest in neuroticism scores. Patients with no residual pain had normal scores. The Eysenck Personality Inventory and the mood and affect portions of the Cornell Medical Index were used as personality measures. Blue collar workers had less anxiety than white collar workers in patients hospitalized for coronary heart disease (Rosen & Bibring, 1966).

Although a clear majority of the papers reviewed here reports positive findings between behavioral variables and coronary heart disease, the limitation in the literature cited here is the retrospective nature of the majority of the research. The personality findings may be a result of the coronary episode rather than a precursor of the disease. The retrospective studies thus place a limitation on findings. Research needs to move from a descriptive nature to the use of behavioral factors in field trials of coronary prevention programs.
Research on Type A Behavior and Coronary Heart Disease

The notion of particular types of behaviors which might place an individual in a position for increased risk of coronary heart disease has been presented by various researchers over the years. Cardiologists Friedman and Rosenman (1959, 1974) have worked to develop a comprehensive description of the coronary-prone pattern.

The pattern is defined as a set of limited predisposition characteristics which interact with appropriate eliciting situations. The distinction between a coronary behavior pattern and a coronary personality are important (Bowers, 1973; Mordkoff & Parsons, 1968; Mischel, 1968) as the coronary personality notion lacks empirical support. The crucial difference between the coronary behavior pattern and the coronary personality lies in the eliciting situations. It is the predisposition to react to certain stimuli that leads to behavioral and psychological responses. This is an essential assumption underlying the coronary-prone behavior pattern (Glass, 1977a). Friedman and Rosenman refer to the necessary stimuli as the "environmental challenge" (p. 68).

For the purposes of this review, the coronary behavior pattern will be labeled as Type A. The non-coronary behavior pattern will be referred to as Type B (Friedman & Rosenman, 1974). Type A will be defined in this review as a behavioral syndrome characterized by intense achievement striving, exaggerated sense of time urgency, and aggressiveness and hostility (Friedman & Rosenman, 1974).

Jenkins (1976), in his literature review, defines the pattern as follows:

For purposes of this review the 'coronary-prone behavior
pattern' is considered to be the overt behavioral syndrome or style of living characterized by extremes of competitiveness, striving for achievement, aggressiveness, (sometimes stringently repressed), haste, impatience, restlessness, hyper-alertness, explosiveness of speech, tenseness of facial musculature and feelings of being under the pressure of time and under the challenge of responsibility. Persons having this pattern are often so deeply committed to their vocation or profession that other aspects of their lives are relatively neglected. Not all aspects of this syndrome or pattern need be present for a person to be classified as possessing it. The pattern is neither a personality trait nor a standard reaction to a challenging situation on a characterologically predisposed person. Different kinds of situations evoke maximal reaction from different persons (p. 988).

Friedman and Rosenman (1974) have conducted a series of studies concerning the role of behavior and coronary heart disease. These investigators (Friedman, 1969) define Type A as a:

... characteristic action emotion complex which is exhibited by those individuals who are engaged in a relatively chronic struggle to obtain an unlimited number of poorly defined things from their environment in the shortest period of time, and if necessary, against the opposing efforts of other things or persons in their same environment (p. 84).

Friedman and Rosenman (1974), in their book Type A Behavior and Your Heart, have stated that in Type A achievement striving, "the number, not the quality of his (Type A) achievements, must constantly increase to satiate an appetite that, unchecked by other restraints, ceaselessly increases" (p. 75). They also view the Type A as in a "frenzy" to gain the esteem of peers and superiors.

Brown and Ritzmann (1967) found competitiveness and a concern for status to be associated with coronary disease in older Veterans' Administration patients. In a study using an Israeli population, Dreyfuss et al. (1966) reported coronary heart disease patients to be those who work aggressively toward achievement.

Glass (1977b) has conducted a variety of studies to document the relationship of achievement striving and Type A. The majority of the
research subjects used were college students. The research found Type A students to attempt more arithmetic problems under both Deadline and No Deadline experimental conditions (Burnam et al., 1973). The studies also found Type A students to have participated and have won more athletic awards while in high school. However, Type B students were reported to be more socially active than Type A students on a scale of "very active" to "not active at all." Type A students also participated in more college extracurricular activities than did Type B students. When asked about "plans after college," 60% of the Type A students planned to "go on to graduate or professional school" (p. 179) while 70% of the Type B students planned to "go to work" (p. 179). These studies seem to suggest that the Type A student is a hard-driving individual with a goal toward success and achievement (Glass, 1977b).

Friedman (1969) described Type A as having a high need for achievement with an attitude that any task can be mastered or overcome with sufficient effort. In order to test this hypothesis concerning achieving Type A people Carver, Coleman, and Glass (1976) designed an experiment which would produce fatigue. Using a Balke treadmill test, Type A students and Type B students were matched according to height, weight, body fat, aerobic capacities, and tobacco use. Type A students reached an oxygen absorption rate of 91.4% of their capacities while Type B students reached a rate equal to only 83.8% of their capacities. Type A students also rated their fatigue as significantly lower than Type B students. The results seem to indicate a greater effort given the treadmill test by Type A students and also indicates the hard-driving Type A students' need for achievement by not acknowledging fatigue. Glass (1977a) wrote: "The acknowledgment of fatigue, on the
other hand, might interfere with successful task mastery--a situation which Type A could not tolerate easily" (p. 48).

The notion that Type A students will conceal fatigue in the efforts of task mastery led Burnam et al. (1973) to compare Type A students and Type B students in another environmental situation. Subjects were exposed to high-frequency sound (3100 hz), which was increased during an experimental session. The level of intensity at which students terminated the sound was the dependent variable. The results showed that Type A students waited significantly longer than Type B students to terminate the unwanted sound. As in the fatigue experiment, Type A subjects appear to directly deny subjective states in order to not degrade task performance.

The research reported by Glass (1977a) appears to provide some behavioral validation of the achievement striving component of Type A. These studies, however, used a college population in data collection. Certainly replication of these findings on an adult population, which is more likely to consist of coronary heart disease patients, is a necessary next step.

The predictive validity and the relationship of the coronary behavior pattern has been shown by several studies over previous years. Many research centers have found increasing support for the position that higher risk of coronary disease is present in people manifesting the coronary-prone behavior pattern, Type A. The pattern has been associated with prevalence of coronary disease in healthy persons, risk of reinfarction with persons who already have the disease, and with atherosclerosis and other physiological risk factors (Jenkins, 1971). It may be assumed from the data that coronary heart disease etiology is
multi-faceted, but Type A appears to be an important link. Caffrey (1968, 1969) studied some 1,500 Trappist and Benedictine monks in 26 different monasteries. The highest prevalence rates of coronary heart disease occurred among those groups of monks having a higher proportion of Type A individuals living in what was characterized as a Type A monastery and eating a high-fat diet. Multivariate analysis showed coronary disease and non-coronary disease monks to differ on two variables: high Type A scores and level of responsibility.

Jenkins (1971) found that 83 coronary patients scored as Type A on the A-B scale of the Jenkins Activity Survey. Kenigsberg, Zyzanski, Jenkins, Wardwell, and Licciardello (1974) compared 48 patients hospitalized for coronary heart disease with 42 patients hospitalized for other diseases. They found that the coronary patients scored in the Type A direction regardless of sex or age.

Probably the largest and best-known study concerning Type A and Type B was initiated by Friedman and Rosenman and is referred to as the Western Collaborative Group Study, or WCGS (Rosenman, Friedman, Straus, Wurm, Jenkins, & Messinger, 1966). The study used 3,524 men ages 39 to 59 years from 10 California companies. Data on medical, socio-economics, diet, smoking, blood pressure, cholesterol, triglycerides and lipoproteins, blood clotting, and coronary behavior pattern classification were taken annually for 8½ years. Men judged to possess Type A were twice as likely to develop coronary heart disease over the 8½ years follow-up (Friedman & Rosenman, 1959; Rosenman, Friedman, Straus, Wurm, Jenkins, & Messinger, 1966). Also, subjects who scored as Type A were five times more likely to have a second myocardial infarction than were Type B subjects. Analysis also showed that a
higher coronary heart disease incidence in Type A people still was maintained when subjects were stratified on risk variables like cholesterol, smoking, and blood pressure.

The relative risks for Type A people and Type B people were 1:87 in the 39-49 age group and 1:98 in the 50-59 age group. This seems to show that Type A acts independently as a precursor for coronary heart disease (Brand, Rosenman, Sholtz, & Friedman, 1976).

The Western Collaborative Group Study was designed as a prospective study. Subjects were classified as Type A or Type B without any prior biologic data and without being seen by a cardiologist. Diagnosis was made by an internist who functioned independently of the study and who had no knowledge of behavior-pattern classification or intake risk factors. After 2½ years, Type A men had 6.5 times the incidence of coronary heart disease than Type B men in the 39-49 year group. The Type A men in the 50-59 year group had 1.9 times the incidence of coronary heart disease. Bivariate analysis showed Type A men to be at a higher risk, regardless of distolic pressure and lipoproteins (Rosenman, Friedman, Straus, Wurm, Jenkins, & Messinger, 1966).

After 4½ years follow-up the Type A men, 39-49 age group, had 2.7 times the risk of Type B, and in the 50-59 age group the incidences were 1.7 times the rate over Type B. Multivariate analysis of the data showed the coronary behavior pattern to be functioning independently of heredity factors, blood pressure, and lipids. Multiple regression using 12 other risk factors did not reduce significance in the 39-49 age group but did put the 50-59 age group slightly below significance levels, with Type A men having 1.4 times the rate of Type B men (Rosenman, Friedman, Straus, Jenkins, Zyzanski, & Wurm, 1970). Type A behavior was also
found to be significantly associated with acute infarctions, angina pectoris, and with clinically unrecognized (silent) infarctions. Rosenman, Friedman, and Jenkins (1967) found a significant number of silent infarctions in the 39-49 age group. Subjects who were found to have sustained a silent infarction scored significantly higher on Type A, hostility, time urgency, and high past achievement than controls. Based on 4½-year follow-up data Jenkins, Rosenman, and Zyzanski (1968) found the behavior pattern and smoking to have strong and independent effects on coronary incidence. In a later study, Type A was found to be the single-strongest predictor of coronary heart disease when compared with serum cholesterol and number of cigarettes smoked daily (Jenkins, Zyzanski, & Rosenman, 1976).

Using the Western Collaborative Group Study Jenkins, Rosenman, and Zyzanski (1974) found, after a four-year follow-up, that those subjects who scored in the extreme upper third of the distribution had 1.3 times the rate of coronary disease as compared to those who were in the lowest third of the distribution. He also found high, middle, and low scores on Type A to be associated with high, middle, and low incidences of coronary heart disease. Using the Western Collaborative Group Study data Rosenman, Friedman, and Jenkins (1966) reported on immunity predictions in coronary disease. They reported that Type A people with normal blood pressure and serum lipids below population means had a modest risk of coronary disease. Type B people with similar physiological data, however, appeared relatively immune.

In a study of 4,108 persons aged 25-64 years at Northwestern University's School of Medicine, Shekelle, Schoenberger, & Stamler (1976) found Type A scores to be positively correlated with prevalence
of myocardial infarction. They also found a positive correlation between the number of cigarettes smoked per day, prevalence of hypercholesterolemia, and Type A.

Keith, Lowen, and Stare (1965) found significance in the Type A direction when they compared coronary patients to those with chronic diseases. Cassel (1966), using Keith's data, also found a significant positive relationship between Type A and coronary heart disease when the population was divided into five-year age brackets. Glass (1977a) compared coronary disease patients with controls and found results similar to Keith's and Cassel's.

Quinlan, Barrow, and Mornuddin (1968) found Type A to be one of several significant risk factors in subjects with coronary heart disease in comparison with non-cases. Type A subjects had 2.3 times the incidence of angina pectoris and 4.3 times the incidence of myocardial infarction.

Two dissertations conducted on coronary patients also found significantly higher rates of Type A (Cohen, 1974; Stokols, 1973) between coronary heart disease patients and non-coronary heart disease patients, both in South Carolina and Hawaii. Zyzanski, Wrzeniewski, and Jenkins (1978) also found significantly higher rates of Type A for coronary patients in Belgium and Poland, suggesting cross-culture validation of Type A and coronary heart disease.

From the data presented here it appears the coronary behavior pattern is directly related to coronary disease. Even when traditional risk factors were controlled, Type A seemed to function as an independent risk factor. The addition of a behavioristic hypothesis is not intended to downplay the impact of physiological risk factors.
Coronary heart disease etiology is a combination of many phenomenon, with many unresolved issues and inconsistencies.

Research on Type A Behavior and Physiology

Blumenthal, Williams, Kong, Thompson, Jenkins, and Rosenman (1975) studied 156 patients who were referred for angiography, a test which measures atherosclerosis in patients. They found Type A individuals to account for 82% of those with at least a 75% narrowing of one artery. Type A also had a significantly greater degree of atherosclerosis, even when age and sex were covaried. A replication found similar results. Subjects with 50% or more arterial obstruction in two or more vessels scored significantly higher on an A-B scale (Zyzanski, Jenkins, Ryan, Flessas, & Everist, 1976). Friedman, Rosenman, and Byers' (1968) autopsy study found an association between Type A and atherosclerotic disposition in coronary arteries.

A possible link between the coronary behavior pattern and catecholamines has been suggested by Frankel (1969). Friedman, Rosenman, and Carroll (1958) found accountants' blood coagulated faster on the April 15 tax deadline. Average clotting time for blood of Type A individuals was significantly faster than blood of the Type B person (Friedman & Rosenman, 1959). The adhesiveness of blood platelets is believed to play a role in the pathogenesis of coronary heart disease; discharge of catecholamines appears to potentiate platelet aggregation (Mustard & Packham, 1969). Secretion of epinephrine appears to be a link, and Type A subjects were found to excrete more epinephrine in a variety of situations of both in blood plasma and urine (Friedman, Byers, Diamant, & Rosenman, 1975; Friedman, St. George, Byers, &
Type A people have also been shown to have higher serum cholesterol levels than Type B people by several research teams. Friedman and Rosenman (1959) and Rosenman and Friedman (1961) showed increased serum cholesterol levels in both males and females who were classified as Type A. Rosenman, Friedman, and Jenkins (1966) found intake cholesterol levels of a significantly higher range for individuals who were Type A, although both groups reported similar dietary habits. Jenkins, Zyzanski, and Rosenman (1973) and Blumenthal et al. (1975) all reported higher levels of cholesterol for the Type A group.

Higher serum lipid levels have also been shown in Type A subjects (Friedman et al., 1968; Sloane, Davidson, Holland, & Payne, 1962). Type A subjects have triglyceride levels which are similar to coronary patients long before coronary heart disease onset (Friedman, Rosenman, & Byers, 1964).

From the physiological data presented here, it appears that Type A people differ physiologically in comparison to Type B people in several traditional risk factors. In viewing the physiological differences in behavioral terms, Type A people seem to have developed a pathogenic lifestyle in an attempt to cope with environmental events. The end result appears to be a risk of health. Although there remain gaps in the research between Type A and established risk factors, Type A may help to explain the pathophysiological mechanisms linking the associated variables.

Measurement of Type A Behavior

Initial formulation of the measurement of Type A was by Friedman
(1969), who identified certain characteristic differences between coronary patients and those with other illnesses. In order to improve specification criteria, the Structured Interview for measuring the behavior pattern was developed (Rosenman, Friedman, Straus, Wurm, Kositchek, Hahn, & Werthessen, 1964). It specified question wording, verbal style used, and specific probes for responses. Judgment criteria are based on content, delivery, and verbal style. The Structured Interview has been shown to have statistical and clinical significance of a prospective and retrospective nature with coronary heart disease (Rosenman et al., 1975; Rosenman et al., 1970; Rosenman, Friedman, Straus, Wurm, Jenkins, & Messinger, 1966).

A number of other attempts to develop a measure for Type A have been made, including a battery performance test developed by Bortner (Bortner & Rosenman, 1967). The performance battery included a total light-free room, a period of dark adaptation, and several experimental psychology procedures. It was found to have statistically significant association with Type A, as judged by the Structured Interview. Other measures which were not shown to be associated with the coronary-prone behavior pattern were Bortner's (1969) short rating scale and voice analysis (Scherwitz, Berton, & Leventhal, 1977; Schucker & Jacobs, 1977).

In an effort to develop a quicker, less expensive procedure for judging Type A behavior Jenkins, Rosenman, and Friedman (1968) developed a self-administered, computer-scored questionnaire entitled "The Jenkins Activity Survey for Health Predictions" (JAS). The Jenkins Activity Survey has been through repeated revisions since the initial 1965 edition in order to increase reliability in replicating the Structured
The first experimental form of the Jenkins Activity Survey was a 64-question version prepared in 1964. Items were derived from the Structured Interview and from clinical observations. This item pool was given to 120 men from the Western Collaborative Group Study (WCGS) who were diagnosed as Type A people or Type B people using the interview technique. Items were considered discriminators if response alternatives were chosen in significantly different proportions by Type A men and Type B men. These remaining items, along with some additions, made up the first published test in 1965 (Jenkins, Rosenman, & Zyzanski, 1965). Using 2,951 subjects from the follow-up Western Collaborative Group Study, items were compared with the Structured Interview and optimally scaled according to Fisher's (1948) method with computational techniques by Bock (1960). When the weighted items significantly discriminated between the two behavior types, the items were retested on 984 men. Items maintaining during cross-validation were assigned regression weights and optimally scaled to yield the best discrimination between Type A and Type B (Jenkins, Zyzanski, & Rosenman, 1971).

After the best discriminating items were selected, the test was given to an independent sample of 419 men. The scores of the entire number of 2,951 were approximately normally distributed. A mean was established at 0.0, with a standard deviation of 10.0. Results showed a 90% agreement between the Structured Interview and individuals who scored one standard deviation in either direction from the mean. For all persons, a 73% agreement between the 1965 Jenkins Activity Survey and the Structured Interview was found (Jenkins, Zyzanski, & Rosenman, 1979).
A second test was published, with additional items taken from further clinical and psychometric data available about Type A. Items found to be inferior psychometrically or too repetitive were dropped. The Jenkins Activity Survey was again given to an equal number of already classified Type A and Type B subjects to determine items which best discriminated between Type A and Type B. The highly discriminating items were cross-validated on a sample of 741 men. Optimal scaling and discriminant functions were also performed. The surviving items were then given to 420 men. A 71% agreement was achieved between the 1966 Jenkins Activity Survey and the Structured Interview (Jenkins et al., 1979).

In 1972, a fourth edition was developed: Form B. The major aim of this edition was to broaden the Jenkins Activity Survey to include women. All gender items were excluded or altered. An example of a typical phrase change was the word "spouse" being substituted for the word "wife" (Jenkins et al., 1974).

The final test, Form C, was modified slightly to facilitate administration and scoring of the Jenkins Activity Survey. The item composition and scoring algorithms of the Jenkins Activity Survey remained intact. The reliability and validity of the scale are the same for the 1969 Form B and Form C (Jenkins et al., 1979).

Reliability for the Jenkins Activity Survey was computed for internal consistency and test-retest. Item reliabilities were computed by using Kendall's Tau b one-year test-retest coefficient. Item reliabilities ranged from .39 to .79. Estimates were also derived from the squared multiple correlation (SMC) coefficients. The SMC computations ranged from .27 to .75. Using these methods, the internal
consistency reliability coefficients were .83 and .85 (Jenkins et al., 1979). The test-retest reliability of the Jenkins Activity Survey from a one- to four-year interval fell between .60 and .70. The test-retest after four- to six-month intervals ranged from .65 to .82 (Jenkins et al., 1979).

Validity for the Jenkins Activity Survey was established initially by comparing the Jenkins Activity Survey with the Structured Interview ratings. Validity also comes from studies which have indicated a significant difference in coronary heart disease incidences and Type A and Type B scores on the Jenkins Activity Survey (Jenkins et al., 1979).

Several studies exist concerning the Jenkins Activity Survey and its ability to discriminate between groups with and without coronary heart disease (Cohen, 1974; Glass, 1977a; Hiland, 1977; Jenkins, Zyzanski, Rosenman, & Cleveland, 1971; Shekelle et al., 1976; Stokols, 1973; Zyzanski et al., 1978). These replications provide consistent cross-validation support data for the validity of the Jenkins Activity Survey in measuring Type A behavior. The replications took place in widely dispersed geographic areas from Hawaii to Poland, suggesting the validity and reliability of the Jenkins Activity Survey of Type A behavior is sufficient to allow for cross-cultural translation. These replications were all of a retrospective nature, and questions concerning bias of selective survival and influence of having coronary heart disease on respondent answers remains questionable. Prospective studies concerning coronary heart disease and the Jenkins Activity Survey might solve this problem and reinforce retrospective findings.

Analysis of 2,750 Jenkins Activity Survey scores from the Western Collaborative Group Study found the Type A scale to distinguish between
the subjects who remained free of coronary heart disease and those subjects who later developed heart disease. Subjects scoring as Type A on the Jenkins Activity Survey had 1.7 times the incidence of coronary heart disease as Type B subjects on the test (Jenkins et al., 1974).

The Jenkins Activity Survey Type A scores have also been found to associate significantly with risk of reinfarction (Jenkins, 1976; Jenkins et al., 1971). Data from the Jenkins (1976) study found Type A scores to be relatively unaffected by whether the Jenkins Activity Survey was taken before or after the initial coronary event. Multiple discriminant function equations also showed Type A scores to be the single-strongest predictor of recurrent coronary heart disease among the more traditional variables tested (cigarettes smoked per day and serum cholesterol levels). Type A scores distinguished even more effectively between the recurrent coronary group and single coronary group than between single coronary and the coronary-free group.

Glass (1977a) recently modified the Jenkins Activity Survey slightly for use with college students. The changes were a matter of semantics. For example, "Do you ever set deadlines or quotas for yourself at work or at home?" was changed by substituting the words "in courses or other things" for "at work or at home." Minimal effort was given to further validity or reliability. Glass (1977a) does report a test-retest reliability of 83 students; nine percent of the population showed a score change after a four-month interval. Glass reported the student test had "proved to be a reliable and valid procedure for classifying subjects in various studies concerning Type A and Type B."
Summary of Literature Review

In conclusion, it has been shown that Type A behavior made a significant contribution to the pathogenesis of coronary heart disease. Evidence for this position was shown in the review where significant relationships were found between coronary heart disease and Type A scores. This relationship maintained even when simultaneous adjustments were made for combinations of traditional risk factors. The findings presented here also indicated the Jenkins Activity Survey for Health Predictions has merit in classification of individuals as either Type A or Type B. The usefulness of the Jenkins Activity Survey has been demonstrated in this review by examination of its development and its reliability and validity. Most important has been the predictive validity of Type A behavior as measured by the Jenkins Activity Survey in both retrospective and prospective studies. The Jenkins Activity Survey appears to be a useful measure for the classification of individuals as Type A or Type B.

It is also important to note the recognition of the multifaceted etiology of coronary heart disease. Type A traditional risk factors and, eventually, other unknown variables will all need to be incorporated for the total etiology of coronary heart disease to emerge.
Coronary heart disease has been related to the Type A behavior pattern. Research to date has not substantiated the exact nature of this pattern. One of the delineating criteria in determining the exact nature of this behavior pattern and its relation to coronary heart disease has been striving for achievement. Burnam et al. (1973) have demonstrated achievement-striving performance might be a predictive variable in this issue. However, the use of college students may not be an adequate population from which to generalize to the general population. The problem, then, is the lack of empirical evidence which substantiates the achievement-striving variable in a population other than college-age subjects.

The purpose of this study was to conduct a systematic replication of the experiment of Burnam et al. (1973) using a working adult population and the Jenkins Activity Survey. Additionally, this study attempted to address the issue of whether the previous results would be substantiated when a non-college sample was used. Standard scores from the Jenkins Activity Survey were used, and all A-B scores were analyzed as Burnam et al. (1973) did for the college population. If this procedure produced similar results, support for the student population in Type A research would be offered. It was essential that findings about Type A be validated on a non-student population.

The basic aim of current research about coronary heart disease is the treatment and prevention of coronary disease. The majority of patients are treated by altering dietary, exercise, and smoking habits.
Little is being done for patients in the way of altering the Type A behavior pattern. Type A is a relatively new theory and requires research in order to document its alleged characteristics and lend credibility to its place in behavioral medicine.

Hypotheses formulated on the basis of the preceding objectives were: Given a standard problem-solving challenge,

(1) There will be no difference in the mean number of problems attempted by Type A and Type B subjects ($\alpha = .05$).

(2) There will be no difference in the mean number of problems attempted by subjects in the Deadline and No Deadline conditions ($\alpha = .05$).

(3) There will be no greater difference in the pattern of cell means (means for condition-by-type interactions) than one would expect looking at the marginal means (the means for condition and type) for the number of problems attempted ($\alpha = .05$).

(4) There will be no difference in the mean percentage of errors made by Type A and Type B subjects ($\alpha = .05$).

(5) There will be no difference in the mean percentage of errors made by subjects in the Deadline and No Deadline conditions ($\alpha = .05$).

(6) There will be no difference in the pattern of cell means (means for condition-by-type combination) than one would expect looking at the marginal means (means for condition and type) for the percentage of errors made ($\alpha = .05$).
PROCEDURES

Population and Sample

The subjects were 40 females and 40 males in Jackson, Wyoming, at least 18 years of age who were currently employed and not attending a university and who volunteered to spend about 30 minutes answering questions. In order to obtain subjects for the study various civic clubs, business and church groups were contacted requesting members to participate. The following statement was read at the various meetings:

We are asking for help in a study of health prediction being conducted through Utah State University. All participation is on a voluntary basis, and you will be asked to answer items on two brief questionnaires which will require about 30 minutes. The questionnaires are number-coded and at no time will your identification be associated with your answers. In order to participate in the study you must be at least 18 years of age, be employed, and not be attending any university currently. If you decide to participate in the project, please call Jolene Adams at 733-0000.

Method

The testing sessions were arranged over a four-week time block so that each subject was tested at the most convenient time for him/her. When the subject arrived at the community room of the Jackson State Bank for the experiment, he/she was taken to a testing room and told: "I would like to thank you for coming to help in the project. I will be giving you a questionnaire to fill out first. Please take your time and answer as honestly as possible. I will answer any questions I can for you."

Subjects were asked to sign the consent form (see Appendix A) and
were then asked to fill out the Jenkins Activity Survey. All tests were number-coded rather than using names for identification of subjects. The Jenkins Activity Survey and the math sheets for each subject had identical numbers. Numbers were assigned in random order as subjects entered the testing room. Even numbers were assigned to Condition I and all odd numbers were assigned to Condition II. After the subjects had completed the Jenkins Activity Survey, the math task was given. Instructions for the math task were presented exactly as in the Burnam et al. (1973) study.

**Condition I (No Deadline Condition)**

Subjects assigned to Condition I were given the sheet of math facts, and the following statement was read: "Please complete these math problems. You will be given about five minutes. Please write only the final answer on the test sheet. Do not skip any problems."

**Condition II (Deadline Condition)**

Subjects assigned to Condition II were given the same sheet of math facts, and the following statement was read: "Please complete these math problems. You have exactly five minutes to do as many as you can. I will be timing you. Please write only the final answer on the test sheet. Do not skip any problems."

Both treatments were timed for five minutes. At the end of the time period the experimenter said "Stop" and collected the test sheets. Each subject was asked not to communicate his/her experience with anyone during the course of the study. Any concerns or anxieties that subjects may have had as a result of the procedure were responded to by the researcher at this time.
**Instrumentation**

The Jenkins Activity Survey was used to measure the coronary-prone behavior pattern, Type A, and the non-coronary behavior pattern, Type B. A more comprehensive description of the Jenkins Activity Survey is contained in the Review of Literature on page seven. This section includes the validity and reliability. The math problems were 240 arithmetic problems such as $6 + 9 - 2 = \_\_\_$. These problems were taken directly from the original study. They appeared in a horizontal format. (See Appendix C.)

**Data Analysis**

A causal-comparative research design was used in this study. Subjects were compared on the basis of an a'priori classification of propensity to coronary heart disease. The Jenkins Activity Survey was used to classify subjects into either a Type A behavior pattern, which has been found to relate to coronary heart disease, or a Type B behavior pattern, which has been found to be less strongly related to coronary heart disease. Subjects were then randomly assigned to two experimental conditions, Deadline or No Deadline.

Measures were obtained on all subjects for the number of arithmetic problems attempted and the percent of errors made on the math problems. Data were analyzed using one- and two-way factorial analyses of variance and the Scheffe multiple-comparison test. The SPSS statistical computer package (Statistical Package for the Social Sciences, Inc., 1975) was used to run the statistical analysis.
Ethical Guidelines

The ethical considerations for this research were adopted and carefully followed. All subjects were asked to give their consent, and all participation was on a voluntary basis. The research data were safeguarded, and any connection between the subject and the research data obtained was dissolved. The data obtained were used only for the purpose specified in the thesis. After the data collection was finished, subjects were informed of the specific nature of the study if they desired. This research was supervised by an ethics committee of professionals. All subjects were informed of these guidelines and assured anonymity.
RESULTS

The main purpose of this study was to determine whether individuals identified as the Type A behavior pattern and the Type B behavior pattern responded differently in the presence of time pressure (Deadline condition) or in the absence of time pressure (No Deadline condition). Two dependent variables were used: number of math problems attempted and the percent of errors made on the math problems. This chapter will present the results of the data analysis for each hypothesis.

Hypothesis (1): There will be no difference in the mean number of problems attempted by Type A and Type B subjects.

A two-way analysis of variance of condition and behavior pattern was used to test this hypothesis and the two subsequent hypotheses. The main effect comparing Type A and Type B behavior patterns on the mean numbers of problems attempted was statistically nonsignificant (p > .722) (see Table 1). Calculation of Eta² revealed that only .15% of the variation in the number of problems attempted is associated with Type A or Type B.

A comparison of the marginal means for Type A and Type B behavior patterns in Table 2 reveals that the mean difference was only 2.58.

Hypothesis 1, testing the likelihood of finding chance differences in the mean number of problems attempted by Type A and Type B subjects, is accepted.

Hypothesis (2): There will be no difference in the mean number of problems attempted by subjects in the No Deadline and Deadline conditions.
Table 1

Two-Way Analysis of Variance Comparing No Deadline and Deadline Conditions and Type A and Type B Behavior Patterns on the Number of Problems Attempted

<table>
<thead>
<tr>
<th>Sources of Variance</th>
<th>Degrees of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>1</td>
<td>1,742.005</td>
<td>1,742.005</td>
<td>2.534</td>
<td>.116</td>
</tr>
<tr>
<td>Type</td>
<td>1</td>
<td>87.734</td>
<td>87.834</td>
<td>.128</td>
<td>.722</td>
</tr>
<tr>
<td>Condition X Type</td>
<td>1</td>
<td>3,571.423</td>
<td>3,571.423</td>
<td>5.196</td>
<td>.025</td>
</tr>
<tr>
<td>Residual</td>
<td>76</td>
<td>52,240.643</td>
<td>387.377</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
<td>57,685.950</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The main effect comparing the No Deadline and Deadline conditions on the number of problems attempted was found to be statistically nonsignificant (p > .116), as can be seen in Table 1. Calculation of the Eta² statistic revealed that only three percent of the variation in the number of problems attempted is associated with whether subjects were in the No Deadline or Deadline condition. Examination of the marginal means for the No Deadline and Deadline conditions (see Table 2) shows a mean difference of 9.45. This mean difference in the number of problems attempted is not considered to be statistically significant.

Hypothesis 2, testing the likelihood of finding chance differences in the mean number of problems attempted by subjects in the No Deadline and Deadline conditions, is accepted.

Hypothesis (3): There will be no greater difference in the pattern of cell means (means for condition-by-type interactions) than one would
Table 2

Cell Means and Marginal Means for the Number of Problems Attempted Under the No Deadline and Deadline Conditions and Type A and Type B Behavior Patterns

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Type</th>
<th>Marginal Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type A</td>
<td>Type B</td>
</tr>
<tr>
<td>No Deadline Condition</td>
<td>$\bar{x} = 69.43$</td>
<td>$\bar{x} = 80.63$</td>
</tr>
<tr>
<td></td>
<td>SD = 24.45</td>
<td>SD = 24.32</td>
</tr>
<tr>
<td></td>
<td>N = 21</td>
<td>N = 19</td>
</tr>
<tr>
<td>Deadline Condition</td>
<td>$\bar{x} = 90.87$</td>
<td>$\bar{x} = 75.18$</td>
</tr>
<tr>
<td></td>
<td>SD = 30.23</td>
<td>SD = 24.40</td>
</tr>
<tr>
<td></td>
<td>N = 23</td>
<td>N = 17</td>
</tr>
<tr>
<td>Marginal Means</td>
<td>$\bar{x} = 80.64$</td>
<td>$\bar{x} = 78.06$</td>
</tr>
<tr>
<td></td>
<td>SD = 29.38</td>
<td>SD = 24.17</td>
</tr>
<tr>
<td></td>
<td>N = 44</td>
<td>N = 36</td>
</tr>
</tbody>
</table>

expect looking at the marginal means (means for condition and type) for the number of problems attempted.

The interaction effect across the means for the No Deadline and Deadline condition, and the means for the Type A and Type B behavior pattern, were found to be statistically significant ($p < .025$) (see Table 1). Calculations of $\eta^2$ revealed that six percent of the variation in the number of problems attempted is associated with whether subjects were in the No Deadline or Deadline condition or whether they were classified as Type A or Type B behavior types. Figure 1 displays in graphic form the cell means found in Table 2.

These results would indicate that when Type A subjects were presented with the No Deadline condition, they did not attempt as many problems (69.43) as when they were presented with the Deadline condition.
Figure 1. Graphic display of the interaction among the cell means on the number of problems attempted by Type A and Type B subjects under the No Deadline and Deadline conditions.

(90.87). Inversely, when Type B subjects were presented with the No Deadline condition they attempted more problems ($\bar{X} = 80.63$) than when Type B subjects were presented with the Deadline condition ($\bar{X} = 75.18$). The mean difference between Type A subjects for the two conditions was considered to be statistically significant. The mean difference for Type B subjects under the two conditions was considered to be significant. The analysis revealed a statistically significant
interaction, although the proportion of variance accounted for was small. The graphic display (Figure 1) clearly illustrates the discrepancy in performance for Type A subjects.

Hypothesis 3, testing the likelihood of chance differences in the pattern of cell means when compared to the marginal means for the number of problems attempted, was not accepted.

Hypothesis (4): There will be no difference in the mean percentage of errors made by Type A and Type B subjects.

For this hypothesis and the two subsequent hypotheses, two data analysis procedures were used. A two-way analysis of variance was conducted on the percentage of errors made by subjects. Ferguson (1966), however, recommends that when proportional or percentage data are used that an arcsine transformation on the data be made before the analysis of variance is conducted. The results from both procedures will be presented. Table 3 contains the analysis of variance for the raw percentage scores, and Table 4 contains the analysis of variance after the arcsine transformation was conducted.

The mean percentage of errors made by Type A and Type B subjects was found to be statistically nonsignificant ($p > .523$, Table 3; $p > .496$, Table 4). Calculation of $\eta^2$ revealed that only .5% (.6% with arcsine transformation) of the variation in the percentage of errors made is associated with Type A or Type B behavior patterns.

Table 5 shows the mean percentage of errors by condition and type. A comparison of the marginal means for Type A and Type B behavior patterns reveals a 1.57% mean difference. This difference is not considered to be significant.

Hypothesis 4, testing the likelihood of finding chance differences
### Table 3

**Two-Way Analysis Comparing No Deadline and Deadline Conditions and Type A and Type B Behavior Patterns on the Mean Percentage of Errors**

<table>
<thead>
<tr>
<th>Sources of Variance</th>
<th>Degrees of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
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<td>121.16</td>
<td>1.218</td>
<td>.273</td>
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<td>.523</td>
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<td>4.33</td>
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<td>.835</td>
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<td>7,560.86</td>
<td>99.48</td>
<td></td>
<td></td>
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<tr>
<td>Total</td>
<td>79</td>
<td>7,727.33</td>
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### Table 4

**Two-Way Analysis with Arcsine Transformation Comparing No Deadline and Deadline Conditions, and Type A and Type B Behavior Patterns on the Mean Percentage of Error**

<table>
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<tr>
<th>Sources of Variance</th>
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<th>Sum of Squares</th>
<th>Mean Square</th>
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<td>.496</td>
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Table 5

Cell and Marginal Means for the Percentage of Errors Made Under the No Deadline and Deadline Conditions, and Type A and Type B Behavior Patterns

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<th>Conditions</th>
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<tr>
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<td>$\bar{x} = 10.17$</td>
<td>$\bar{x} = 11.15$</td>
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<tr>
<td></td>
<td>$SD = 9.86$</td>
<td>$SD = 13.84$</td>
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<td></td>
<td>$N = 21$</td>
<td>$N = 19$</td>
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<td></td>
<td>$SD = 7.54$</td>
<td>$SD = 7.57$</td>
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<td></td>
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<td></td>
<td>$SD = 8.74$</td>
<td>$SD = 11.21$</td>
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<td></td>
<td>$N = 44$</td>
<td>$N = 36$</td>
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</table>

The mean difference between the No Deadline and Deadline conditions was 2.53%.

in the mean percentage of errors made by Type A and Type B subjects, is accepted.

Hypothesis (5): There will be no difference in the mean percentage of errors made by subjects in the No Deadline and Deadline conditions.

The main effect comparing the mean difference between the No Deadline and Deadline conditions on the percentage of errors made was found to be statistically nonsignificant ($p > .273$, Table 3; $p > .517$, Table 4 with arcsine transformation). Calculation of $\eta^2$ revealed that only 1.6% (.5% with arcsine transformation) of the variation in the percentage of errors is associated with whether subjects were in the No Deadline or Deadline conditions.

When the marginal means are compared in Table 5, the mean difference between the No Deadline and Deadline conditions was 2.53%.
This difference was not found to be significant.

Hypothesis 5, testing the likelihood of chance differences in the mean percentage of errors made by subjects in the No Deadline and Deadline conditions, was accepted.

Hypothesis (6): There will be no difference in the pattern of cell means (means for condition-by-type combinations) that one would expect looking at the marginal means (means for condition and type) for the percentage of errors made.

The interaction effect across the means for the No Deadline and Deadline conditions and the means for the Type A and Type B behavior pattern were found to be statistically nonsignificant \((p > .835, \text{ Table 3}; \ p > .284, \text{ Table 4 with arcsine transformation})\). Calculation of \(\text{Eta}^2\) revealed that only \(0.06\% (1.5\% \text{ with the arcsine transformation})\) of the variation in the percentage of errors made is associated with whether subjects were in either No Deadline or Deadline conditions, or whether they were classified as Type A or Type B behavior patterns.

Comparison of the cell and marginal means shows that subjects in the No Deadline condition made slightly more errors than subjects in the Deadline condition. It can also be seen that Type B subjects made more errors than Type A subjects.
**DISCUSSION**

**Evaluation of Findings**

This systematic replication of Burnam et al. (1973) indicated that college students performed differently than the employed adults used in this study. Burnam et al. (1973) found a significant main effect for the Deadline versus No Deadline condition and significant interaction between this variable and the Type A-B classification for college students. Unlike the original study, this study using adults did not find a significant main effect for the Deadline versus No Deadline condition. However, the mean differences of the interaction of condition and type were statistically significantly different using adults or college students. Although the interaction effects were statistically significant in both studies, the reported pattern of interaction of the means for the condition and type of variables were not similar.

In the college sample, the comparison of means between the two experimental conditions indicated that Type A subjects performed at a similar level under Deadline and No Deadline conditions, but Type B attempted more problems under Deadline than No Deadline. Comparison of means for the adult samples indicated that Type A attempted more problems under Deadline than under No Deadline conditions, but Type B attempted more problems under No Deadline than Deadline conditions, the reverse of Type A performance.

Based on the analyses in this study, it appears that Type A subjects do not consistently perform in the manner described in the
original study by Burnam et al. (1973). Type A individuals demonstrated more variability in their performance than was previously noted from the data obtained on adult Type A subjects. It appears that these individuals in the present study perform differently when Deadline conditions are present. These results may indicate that their Type A characteristics may be specific to work, career or, when they perceive a situation as leisure, non-work, or non-pressured, they behave in a similar fashion to what Type B individuals are postulated to behave in the literature. These findings are inconsistent with the original study, which indicated Type A individuals produce high levels of effort even in the No Deadline condition.

It appears that Type B subjects also do not perform in the manner described in the original study. Burnam and his associates (1973) found Type B to respond with greater effort only when the situation requirements specified a Deadline condition. The adult study indicated that the adult Type B attempted more problems under No Deadline conditions than under Deadline conditions. Type B behavior has been somewhat neglected in the literature, with the basic assumption being their characteristics were opposite of Type A. Perhaps Type B individuals are a poorly understood and misclassified group in terms of behavioral characteristics.

The large error variance found in each analysis conducted in this study indicated that researchers have not touched the surface in determining the important variables associated with Type A and Type B individuals. Therefore, the predictive ability of the characteristics of intense achievement striving is probably less powerful than previously indicated. More research is needed to determine the most
critical variables associated with Type A and Type B individuals. Presently, available evidence identified only isolated factors.

Finally, both the studies found no significant differences between experimental conditions and subject groups in percentage of errors on the arithmetic task. The adult percentage of errors, using a frequency histogram, indicated 15% of the sample had no errors, indicating the difficulty level of the problems was controlled adequately in order to eliminate contamination of difficulty in a speed situation.

**Observations on Methods and Procedures**

**Selection of Subjects**

The present research was limited by the use of subjects from one geographic area: Jackson, Wyoming.

The socio-economic background of the population was largely middle class. It was necessary to limit the selection of subjects to one geographic area due to the great expense of travel to many locations and the difficulty in obtaining subjects that would have been encountered in moving from one site to another. The expensive nature of the Jenkins Activity Survey also limited the sample size of this study.

**Direct Replication of Directions**

The directions given to subjects in this study were directly replicated from the original study. However, one section, "You will be given about five minutes," (a direction presented in the No Deadline condition) may have influenced subjects' performance. The directions included what could be perceived as a time limit. However, both Type A and Type B subjects performed under the No Deadline condition differently than under the Deadline condition. It could be postulated
that the influence of the time factor in the No Deadline condition may have been minimal. That is, the differential responding of subjects under these conditions may indicate they perceived the directions differently.

A rival hypothesis to the above interpretation is that subjects may not have perceived the directions differently but that they may have perceived them as ambiguous. Ambiguity in statistical terms would appear as error variance. Large standard deviations and a small percentage of explained variance were present. Unexplained variability was present under all conditions, however. The indications, then, are that there were uncontrolled variables operating in the performance of subjects regardless of experimental conditions. The No Deadline condition directions may have been one factor which contributed to variation in responding. A host of other unidentified factors was also present during the experimental conditions. Presently, it is not possible to identify those factors contributing to the differential responses of subjects under the Deadline and No Deadline conditions.

Recommendations for Further Research

Due to the significant difference in performance between Type A subjects in Deadline and No Deadline conditions, as found in this study as compared to the results of Burnam et al. (1973), the nature of the task (math problems) may have made a difference. Perhaps the Type A college students were more geared toward increased performance of an academic nature while adult Type A subjects were not. Other variables more related to employed adult needs for achievement, such as job performance, may be more inclined to get maximum effort from employed
adult Type A subjects than simple math problems. Additional research using employed adults and non-math problems needs to be conducted to examine variables that may be more relevant to job performance.

Also, further research is needed to document behavior characteristics of Type B individuals. Research has tended to somewhat under-interpret results of Type B subjects because of the lack of data available. It is possible that a very detailed description of Type B individuals may serve as a more appropriate model of "what to be like" to prevent coronary heart disease than so much emphasis on "what to avoid" in terms of the Type A model.

In summary, the modification and definition of behavioral variables relating to coronary heart disease is still an area which needs a great deal more research using an adult population. The treatment, as well as the etiology of coronary heart disease, remains a multi-faceted matter. Physicians and other health personnel need more defined and specific behavioral definitions in order to treat coronary heart disease behaviorally as well as pharmacologically.
REFERENCES


International Society of Cardiology. (1969). World health organization warns heart diseases are becoming mankind's greatest epidemic (Bulletin). Dallas, TX: Author.


APPENDICES
Appendix A

Consent Form

I give my voluntary consent to be a subject in an experimental study conducted by Jolene Adams, a graduate student from Utah State University, Logan, Utah. I understand that I will be given complete anonymity and that my connection with the information I furnish will be fully dissolved.

Signature ____________________ Date ____________________
Appendix B

Jenkins Activity Survey, Form T

A copy of the Jenkins Activity Survey, Form T, is presented here to give the reader a sample of what type of test was used for A-B classification. Form T was developed by Glass for use with college students. The Jenkins Activity Survey for Health Predictions, used for A-B classification with adults in this study, is currently undergoing copyright procedures and may not be reproduced at this time.
Medical research is trying to track down the causes of several diseases which are attacking increasing numbers of people. This survey is part of such a research effort.

Please answer the questions on the following pages by marking the answers that are true for you. Each person is different, so there are no "right" or "wrong" answers. Of course, all you tell us is strictly confidential—to be seen only by the research team. Do not ask anyone else about how to reply to the items. It is your personal opinion we want.

Your assistance will be greatly appreciated.

For each of the following items, please circle the number of the ONE best answer:

1. Do you ever have trouble finding time to get your hair cut or styled?
   1. Never.
   2. Occasionally.
   3. Almost always.

2. Does college "stir you into action?"
   1. Less often than most college students.
   2. About average.
   3. More often than most college students.

3. Is your everyday life filled mostly by
   1. Problems needing solution?
   2. Challenges to be met?
   3. A rather predictable routine of events?
   4. Not enough things to keep me interested or busy?

4. Some people live a calm, predictable life. Others find themselves often facing unexpected changes, frequent interruptions, inconveniences, or "things going wrong." How often are you faced with these minor (or major) annoyances or frustrations?
   1. Several times a day.
   2. About once a day.
   3. A few times a week.
   4. Once a week.
   5. Once a month or less.
5. When you are under pressure or stress, do you usually
   1. Do something about it immediately?
   2. Plan carefully before taking any action?

6. Ordinarily, how rapidly do you eat?
   1. I'm usually the first one finished.
   2. I eat a little faster than average.
   3. I eat at about the same speed as most people.
   4. I eat more slowly than most people.

7. Has your spouse or some friend ever told you that you eat too fast?
   1. Yes, often.
   2. Yes, once or twice.
   3. No, no one has told me this.

8. How often do you find yourself doing more than one thing at a time, such as working while eating, reading while dressing, figuring out problems while driving?
   1. I do two things at once whenever practical.
   2. I do this only when I'm short of time.
   3. I rarely or never do more than one thing at a time.

9. When you listen to someone talking, and this person takes too long to come to a point, do you feel like hurrying him along?
   1. Frequently.
   2. Occasionally.
   3. Almost never.

10. How often do you actually "put words in his mouth" in order to speed things up?
    1. Frequently.
    2. Occasionally.
    3. Almost never.

11. If you tell your spouse or a friend that you will meet them somewhere at a definite time, how often do you arrive late?
    1. Once in a while.
    2. Rarely.
    3. I am never late.

12. Do you find yourself hurrying to get places even when there is plenty of time?
    1. Often.
    2. Occasionally.
    3. Rarely or never.
13. Suppose you are to meet someone at a public place (street corner, building lobby, restaurant) and the other person is already 10 minutes late. Will you

1. Sit and wait?
2. Walk about while waiting?
3. Usually carry some reading matter or writing paper so you can get something done while waiting?

14. When you have to "wait in line," such as at a restaurant, a store, or the post office, do you

1. Accept it calmly?
2. Feel impatient but do not show it?
3. Feel so impatient that someone watching could tell you were restless?
4. Refuse to wait in line and find ways to avoid such delays?

For each of the following items, please circle the number of the ONE best answer:

15. When you play games with young children about 10 years old, how often do you purposely let them win?

1. Most of the time.
2. Half the time.
3. Only occasionally.
4. Never.

16. Do most people consider you to be

1. Definitely hard-driving and competitive?
2. Probably hard-driving and competitive?
3. Probably more relaxed and easy-going?
4. Definitely more relaxed and easy-going?

17. Nowadays, do you consider yourself to be

1. Definitely hard-driving and competitive?
2. Probably hard-driving and competitive?
3. Probably more relaxed and easy-going?
4. Definitely more relaxed and easy-going?

18. How would your spouse (or closest friend) rate you?

1. Definitely hard-driving and competitive.
2. Probably hard-driving and competitive.
3. Probably more relaxed and easy-going.
4. Definitely more relaxed and easy-going.
19. How would your spouse (or best friend) rate your general level of activity?

1. Too slow. Should be more active.
2. About average. Is busy much of the time.
3. Too active. Needs to slow down.

20. Would people who know you well agree that you take your work too seriously?

1. Definitely yes.
2. Probably yes.
3. Probably no.
4. Definitely no.

21. Would people who know you well agree that you have less energy than most people?

1. Definitely yes.
2. Probably yes.
3. Probably no.
4. Definitely no.

22. Would people who know you well agree that you tend to get irritated easily?

1. Definitely yes.
2. Probably yes.
3. Probably no.
4. Definitely no.

For each of the following items, please circle the number of the ONE best answer:

23. Do people who know you well agree that you tend to do most things in a hurry?

1. Definitely yes.
2. Probably yes.
3. Probably no.
4. Definitely no.

24. Would people who know you well agree that you enjoy a "contest" (competition) and try hard to win?

1. Definitely yes.
2. Probably yes.
3. Probably no.
4. Definitely no.
25. Would people who know you well agree that you get a lot of fun out of your life?

1. Definitely yes.
2. Probably yes.
3. Probably no.
4. Definitely no.

26. How was your "temper" when you were younger?

1. Fiery and hard to control.
2. Strong, but controllable.
3. No problem.
4. I almost never got angry.

27. How is your "temper" nowadays?

1. Fiery and hard to control.
2. Strong, but controllable.
3. No problem.
4. I almost never get angry.

28. When you are in the midst of studying and someone interrupts you, how do you usually feel inside?

1. I feel OK because I work better after an occasional break.
2. I feel only mildly annoyed.
3. I really feel irritated because most such interruptions are unnecessary.

29. How often are there deadlines in your courses? (If deadlines occur irregularly, please circle the closest answer below.)

1. Daily or more often.
2. Weekly.
4. Never.

30. Do these deadlines usually

1. Carry minor pressure because of their routine nature?
2. Carry considerable pressure, since delay would upset things a great deal?

(Remember, the answers on these questionnaires are confidential information and will not be revealed to officials of your university.)
31. Do you ever set deadlines or quotas for yourself in courses or other things?
   1. No.
   2. Yes, but only occasionally.
   3. Yes, once per week or more often.

32. When you have to work against a deadline, is the quality of your work
   1. Better?
   2. Worse?
   3. The same (pressure makes no difference)?

33. In school do you ever keep two projects moving forward at the same time by shifting back and forth rapidly from one to the other?
   1. No, never.
   2. Yes, but only in emergencies.
   3. Yes, regularly.

34. Do you maintain a regular study schedule during vacations such as Thanksgiving, Christmas, and Easter?
   1. Yes.
   2. No.
   3. Sometimes.

35. How often do you bring your work home with you at night or study materials related to your courses?
   1. Rarely or never.
   2. Once a week or less often.
   3. More than once a week.

36. How often do you go to the university when it is officially closed (such as nights or weekends)? If this is not possible, circle here: 0
   1. Rarely or never.
   2. Occasionally (less than once a week).
   3. Once or more a week.

37. When you find yourself getting tired while studying, do you usually
   1. Slow down for a while until your strength comes back?
   2. Keep pushing yourself at the same pace in spite of the tiredness?
38. When you are in a group, do the other people tend to look to you to provide leadership?
   1. Rarely.
   2. About as often as they look to others.
   3. More often than they look to others.

39. Do you make yourself written lists of "things to do" to help you remember what needs to be done?
   1. Never.
   2. Occasionally.
   3. Frequently.

In each of the following questions, please compare yourself with the average student at your university. Please circle the most accurate description.

40. In amount of effort put forth, I give
   Much more effort.
   A little more effort.
   A little less effort.
   Much less effort.

41. In sense of responsibility, I am
   Much more responsible.
   A little more responsible.
   A little less responsible.
   Much less responsible.

42. I find it necessary to hurry
   Much more of the time.
   A little more of the time.
   A little less of the time.
   Much less of the time.

43. In being precise (careful about detail), I am
   Much more precise.
   A little more precise.
   A little less precise.
   Much less precise.

44. I approach life in general
   Much more seriously.
   A little more seriously.
   A little less seriously.
   Much less seriously.
Appendix C
Arithmetic Problems

ADDING AND SUBTRACTING

INSTRUCTIONS: You are to write down your answer in the space to the right of each problem. Each problem will be stated in this form:

\[ 9 - 6 + 2 = \]

Do not begin until you are told to do so.

1. \[4 + 7 - 2 =\]
2. \[3 + 9 - 6 =\]
3. \[5 + 4 + 7 =\]
4. \[3 - 6 + 4 =\]
5. \[9 - 5 + 3 =\]
6. \[4 - 2 + 8 =\]
7. \[1 + 6 + 3 =\]
8. \[8 - 5 + 4 =\]
9. \[5 + 4 - 6 =\]
10. \[7 + 2 - 3 =\]
11. \[2 + 9 + 3 =\]
12. \[9 - 3 + 7 =\]
13. \[4 - 8 + 2 =\]
14. \[7 - 6 + 1 =\]
15. \[6 + 3 - 4 =\]
16. \[4 + 1 + 3 =\]
17. \[3 + 9 - 7 =\]
18. \[7 - 4 + 6 =\]
19. \[3 - 7 + 9 =\]
20. \[6 + 3 - 5 =\]
21. \[8 - 2 - 4 =\]
22. \[2 + 8 - 4 =\]
23. \[6 - 3 + 9 =\]
24. \[3 + 4 - 3 =\]
25. \[6 - 4 + 1 =\]
26. \[5 + 7 - 3 =\]
27. \[3 + 6 + 7 =\]
28. \[7 - 4 + 6 =\]
29. \[7 - 3 + 9 =\]
30. \[6 + 5 - 7 =\]
31. \[4 - 2 + 3 =\]
32. \[5 + 7 + 3 =\]
33. \[8 - 6 + 2 =\]
34. \[3 - 9 + 2 =\]
35. \[9 - 6 + 4 =\]
36. \[7 - 4 + 6 =\]
37. \[6 + 9 + 7 =\]
38. \[4 + 5 - 7 =\]
39. \[6 - 3 + 5 =\]
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<td>82</td>
<td>$3 - 7 + 9 =$</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td>84</td>
<td>$5 - 7 + 4 =$</td>
<td>85</td>
<td>$7 - 3 + 9 =$</td>
</tr>
</tbody>
</table>
109. $3 - 8 + 9 = $
110. $7 + 4 + 5 = $
111. $4 - 5 + 8 = $
112. $8 - 2 + 7 =$
113. $8 - 3 + 9 =$
114. $9 - 7 + 6 =$
115. $3 + 2 - 5 =$
116. $6 + 4 + 5 =$
117. $8 + 2 + 7 =$
118. $5 - 1 + 4 =$
119. $7 - 3 + 5 =$
120. $5 - 3 + 9 =$
VITA

Jolene L. Adams

Candidate for the Degree of

Master of Science

Thesis: The Relationship of Type A and Type B Coronary Behavior Patterns and Achievement Striving

Major Field: Counseling Psychology

Biographical Information:


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