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Cognitive adaptation's implication on diabetic adherence

Martin Ancona
Louisiana State University and Agricultural and Mechanical College

COGNITIVE ADAPTATION'S IMPLICATION ON DIABETIC ADHERENCE

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Martin Ancona
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ABSTRACT

Diabetes, affecting more than 18 million people in the United States, is an epidemic problem. The illness is usually progressive, leading to neuropathy, blindness, and limb amputation. The most common type of the illness, Type 2 diabetes, is usually controllable through a strict combination of diet, exercise, and medication. However, non-compliance, rather than compliance, to prescribed diabetes regimens is the norm. Although past research has uncovered many of the reason that diabetics may fail to adhere to their regimen, the whole puzzle has not yet been solved. This study looked at the Cognitive Adaptation Theory in relation to diabetic adherence. In the past, patients with high levels of cognitive adaptation, or high levels of mastery, optimism and self-esteem, have shown better disease prognosis. However, participants in past studies had illnesses that were largely out of their control (i.e., cancer, AIDS before HAART). This study hypothesized that high levels of cognitive adaptation would predict poorer diabetic adherence, as measured by HbA1c levels. This hypothesis was not supported by the data.

INTRODUCTION

Diabetes mellitus ("diabetes") is one of the most prevalent chronic illnesses in the United States. Approximately 18.3 million Americans, 6.3 percent of the total population, are currently afflicted with diabetes (American Diabetic Association [ADA], 2003). In addition, over 200,000 people die each year of diabetes related complications such as coronary heart disease and kidney failure (Journal of the American Medical Association [AMA], 2003). Although diabetes affects people of every cultural, geographic, and racial background, certain segments of the population seem to bear an especially high risk for developing the illness.

Race is a key factor in being diagnosed with diabetes. The data indicates that minority populations have higher per-capita levels of diabetes than non-minority (Caucasian) populations. Between the years of 1980 and 2000, the age-adjusted prevalence of diagnosed diabetes was higher among African Americans than it was in Caucasians. In particular, African American females were the group hardest hit (CDC, 2003). People of all ages are vulnerable to diabetes. However, a person's risk of developing the disease seems to be positively correlated with increasing age. In the year 2000, people ages 65 to 74 years old were at the highest risk for being diagnosed with diabetes. Conversely, people ages 0 to 44 were at the lowest risk for being diagnosed with the illness. Thus, being older or a minority increases one's risk for developing diabetes (CDC, 2003).

Although it has not been definitively determined why being an older person, being a minority, and/or living in a Southern area increases one's risk for developing diabetes, the research literature suggests that diabetics tend to engage in many high-risk health behaviors such

as tobacco use, sedentary lifestyle, and lack of weight control. Therefore, the risk factors for developing diabetes type 2 are a constellation of biology and lifestyle (Weng, Coppini, and Sonksen, 2000).

As the United States' demographic make-up shifts to include increasing numbers of groups at high risk for the illness, namely the aged and African Americans, the rate of diabetes will most likely increase as well. This emerging increase in the nation's number of diabetics will not only reduce the quality of life for Americans in general, it will also put measurable strain on the already overwhelmed and nearly insolvent American health care system. The repercussions of diabetes will be felt both directly, through the increasing amount of money spent on American health care services, and indirectly, by the increasing levels of diabetes-related illnesses including coronary heart disease, disease of the eye, kidney failure, and neuropathy.

Diabetes has already had a marked economic impact on the American health care system. Research literature suggests that the costs of treating diabetes and its common chronic complications cost the American health care system over 44.1 billion dollars per year. When an additional 54.1 billion dollars to cover diabetes-related disability and inpatient hospital care for indirect costs is added to that total, it can be seen the true epidemic status diabetes has achieved in the United States (White, 2002).

Perhaps even more surprising than the amount of money spent on diabetes, both directly and indirectly, is the manner in which the money is spent on the illness. Although numerous studies have shown that the costs of diabetes can be lowered through programs helping diabetics control their blood sugar levels, the American government continues to spend the vast amount of money allocated to diabetes in a reactive, as opposed to a proactive, manner. Thus, health care

resources are being used to treat the complications resulting from the illness with less emphasis on preventative (White, 2003; Stratton, Adler, Neil et al., 2000).

Controlling diabetes would not only help stave off the primary illness but also serve to curb the rates of many other secondary illnesses. Diabetes is a very insidious illness, because persons diagnosed with diabetes almost never succumb to the illness, itself, but rather to its various health complications for which diabetes serves as a catalyst. Some of the more common secondary illnesses related to diabetes include coronary heart disease, renal failure, eye complications, peripheral nerve damage, and unstable angina (Wittheimer, 2003). For example, cardiovascular disease accounts for 65 percent of deaths in persons with diabetes Type 2 (Gavin, Peterson, and Warren-Boulton, 2003).

The American Diabetic Association, the Centers for Disease Control, and the World Health Organization have come to a consensus to divide diabetes into two discrete illnesses, Type 1 (also known as insulin dependent diabetes and juvenile onset diabetes) and Type 2 (also named non-insulin-dependent diabetes), based upon their unique etiologies and subsequent clinical characteristics (CDC, 2003; American Diabetic Association, 2003).

Diabetes Type 1

Diabetes Type 1 is an illness that is caused when the pancreas, an organ that lies near the stomach, does not produce sufficient amounts of the hormone insulin. Insulin transfers glucose from consumed foods to cells. Because the glucose does not enter the cells quickly enough, the glucose remains in the blood causing the hallmark of diabetes Type 1, high blood sugar levels (Porte & Sherwin, 1997). Diabetes Type 1 accounts for five to ten percent of all presently diagnosed cases of diabetes. The risk factors for developing diabetes Type 1 are not fully

understood; however, there is a general consensus that the risk factors are a heterogeneous mixture of both environmental and biological factors. Apparent from its alternate name, juvenile onset diabetes, diabetes Type 1 has a rapid onset before the age of thirty years that is marked by an elevation of blood glucose levels as a result of an autoimmune destruction of insulin-producing beta cells (CDC, 2003).

Diabetes Type 2

Diabetes Type 2 accounts for the remaining 90 to 95 percent of diabetes cases. In contrast to its sister illness, diabetes Type 2's illness onset is much slower, and its risk factors are mostly related to lifestyle; onset usually occurs at an older age than that of diabetes Type 1. Common risk factors include long-term obesity, sedentary lifestyle, and a diet that is rich in fatty foods and low in fruits and vegetables. (Centers for Disease Control, 2003; Hu, Li, Colditz, Willet, and Manson, 2003).

In diabetes Type 2, the pancreas continues to manufacture insulin, sometimes even at higher than normal levels. However, the body develops resistance to its effects, resulting in a relative insulin deficiency and high blood sugar levels. Over time, these high blood sugar levels can cause the organs and cells of diabetics to develop insulin resistance, a phenomenon in which tissues experience a decline in their ability to respond to the action of insulin's blood glucose moving ability. To compensate for this resistance and resulting high blood sugar level, the pancreas secretes smaller amounts of insulin while at the same time storing larger amounts of the hormone. The resulting high blood sugar levels of insulin resistance are commonly associated with the metabolic syndrome of excess fat stores, especially in the stomach and thorax region.

BARRIERS TO ADHERENCE

When compared to many chronic illnesses such as HIV, which infected persons present with flu-like symptoms at its onset or coronary heart disease, which manifests itself through shortness of breath and chest pain, diabetes Type 2 is a very insidious illness. Most of the symptoms involved in the early clinical presentation with diabetes seem to be more of a nuisance than that of an indicator of a potentially life-threatening illness (U.S. Preventative Services Task Force, 2003).

Because the initial onset symptoms appear to be so inconsequential, it is easy to see why many people may go undiagnosed and why many others, once diagnosed, fail to take their diagnoses seriously. The typical onset symptoms of someone with newly diagnosed diabetes include constant and insatiable thirst, frequent urination, and frequent hunger (ADA, 2003). Although the clinical onset symptoms of diabetes are minor, the long-term complications of diabetes are as severe as any other life-threatening chronic illness. These complications can include loss of eye site, renal failure, gangrene of the lower extremities, and premature cardiovascular illness (Gatchel & Oordt, 2003; King, 2003).

Another barrier to adherence in diabetic patients is the complicated and time- consuming treatment regimen. The typical treatment regimen for a diabetic includes severe dietary restrictions such as eating prescribed foods at specific times of the day, checking urine or blood glucose levels at frequent intervals to check for proper blood sugar control, and receiving regular leg and foot exams to check for skin ulcerations. Also encouraged are regular exercise and maintenance of a healthy body mass index. Finally, many diabetic patients must inject insulin or

other diabetic-related medications as prescribed, sometimes as frequently as several times a day each (Gatchel and Oordt, 2003).

The treatment regimen for diabetes places high demands on those diagnosed with the illness for another reason; unlike persons with other severe illnesses such as cancer, coronary heart disease (CHD), HIV, or Alzheimer's disease, persons diagnosed with diabetes are expected to live a normal life and are usually not allowed the sick role (also known as the patient role) that persons with other chronic illnesses are allowed to take. Thus, the diabetic patient must perform all these complex, tedious, and lengthy self-care behaviors without much sympathy or support from society as a whole, the medical community, or the patient's family (Wilkinson, 1987).

Adherence to a prescribed treatment regimen is a problem for most people diagnosed with diabetes. This trend of non-adherence to prescribed treatment regimens is very alarming considering the serious long-term consequences. Research has shown that 75 percent of diabetics do not eat with sufficient regularity or eat foods recommended in their treatment plan (Wing, Epstein, Nowalk, and Lamparski, 1986). Research, despite its many efforts, has failed to fully explain why people with diabetes fail to adhere to their prescribed treatment regimens, especially when the disease can be devastating if left unmanaged.

Psychological and Social Factors

Although no definitive answers have been discovered to explain exactly why persons with diabetes fail to follow their treatment recommendations, research has identified numerous psychosocial variables which can contribute to poor adherence. Kubeck (2002) concluded that treatment regimen complexity, defined as the number of steps that must be performed, is

associated with the greater non-compliance. Because the diabetic self-care regimen is complex for many individuals, regimen adherence is typically low.

Many educational initiatives have attempted to make the typical diabetic treatment regimen less intimidating. However, education concerning the diabetic treatment regimen has not been significant correlated (Hills-Briggs, 2003).

Social factors have also been positively correlated with adherence rates. Social support is associated with increased adherence and, through adherence, better metabolic control (Tillotson and Smith, 1996; Wang & Fenske, 1996). Contrary to this finding, Murphy, Williamson, and Nease (1994) found that familial social support failed to result in better metabolic control. One explanation may be that, although social support promotes adherence to self-care, adherence to self-care does not always lead to better metabolic control. Wilkinson (1987) found the intentional omission of insulin appears to be a major factor in complications stemming from diabetes (Fenske). The deliberate omission of insulin was found to be associated with patients' desire to escape from domestic difficulties present in their lives.

There is also some evidence that economic factors may have an effect on the degree to which patients adhere to their treatment regimen. Donnan, McDonald, and Morrist (2002) found a positive correlation between social deprivation and failure to adhere to prescribed hypoglycemic medication. In another study, the cost of testing supplies was shown to be initially unrelated to the degree of a person's treatment adherence as (Crofford, 1995) found that even when diabetic testing supplies are completely free of charge, people who are non compliant with their regimens still largely fail to comply.

Surprisingly, even knowledge about the consequences of letting diabetes go uncontrolled does not always enhance people's resolve to manage their illness. Ford, Havstad, Brooks, and Tilley (2002) found that African-American subjects felt that diabetes was a disfiguring illness (i.e., causing loss of limbs, enervation of sex drive, and blindness). At the same time, however, literature has shown African- American diabetics to be amongst the least compliant ethnic groups to following their treatment regimens and engaging in health behaviors such as calorie restriction and exercise that could help stave off the onset of diabetes (Grinstein, Muzumdar, Aponte, Vaguin, Saenger, and DiMartino-Nardi, 2003).

Albert Bandura's Social Cognitive Theory has also found that there are psychological variables, namely self-efficacy and outcome expectancy, that are related to treatment adherence. Alfred Bandura defined self-efficacy as the belief that one can successfully carry out the actions demanded by a specific situation. Self-efficacy is usually measured by asking "How much belief do you have that you can perform behavior X in situation Y?" Like the measurement of similar constructs, avoidance of ambiguity, using multiple indices of the concept and sensitivity to the level of specicifity is crucial when assessing self-efficacy (DeVellis and DeVellis, 2001).

Level of specicifity is becoming increasingly recognized as an important variable in self-efficacy measurement. This is because self-efficacy, once viewed as a single, global concept, is now seen as being contingent upon the particular behavior (DeVellis and DeVellis, 2001). Thus, it is important that self-efficacy be measured on a one-to-one basis with a particular behavior and not in general terms.

Research on persons has linked the level of self-efficacy as a key psychological variable in diabetes research (Jenkins, 1995; Poradzisz, 2002). Padgett (1991) noted that self-

efficacy was positively correlated with both self-rated and physician-rated levels of treatment adherence in diabetic patients. In addition, Poradzisz found that the lower the self-efficacy of the diabetic, the less adherent the patient was to the prescribed treatment regimen and the higher the perceived demand of the illness .

According to Albert Bandura, self-efficacy when combined with positive outcome expectancy can be used to best predict behavior. Outcome expectancy is defined as the belief that the performance of a particular behavior will produce the desired result (Bandura, 1977). Those diabetics who believe that they can effectively perform a particular behavior and that the performance of the behavior will lead to some control of the illness will be most likely to adhere to their treatment regimen.

Skelly, Marshall, Haughey, Davis, and Duford (1995) have presented a model that included both outcome expectancies and self-efficacy measures. The model accounted for 22 percent, 24 percent, and 56 percent, of the variance in blood glucose testing, diet, and exercise adherence, respectively, although the individual predictor, outcome expectancy, only reached significance for blood glucose testing.

Psychological distress, defined as depressive symptoms and anxiety, has been documented to be a major cause of dietary non-adherence (Catz, Gore-Felton, and McClure, 2002). Some research has documented that the stress associated with having a chronic illness may adversely affect the psychological well being of people with the disease (Fielding, 1985) causing psychological distress. In addition, when the person is required to be actively involved in treating the illness, psychological distress tends to increase while treatment adherence decreases (Kaplan, 1983). However, a great deal of research does not support a link between

high levels of psychological distress and low treatment adherence. Simoni, Asarnow, Munford, Koprowski, Belin, and Salusky (1997) found that among people with end stage renal disease higher levels of psychological distress do not predict higher blood phosphorous levels (the higher the blood phosphorous level, the less adherent the person).

COGNITIVE ADAPTATION THEORY

The view of people as rational beings who see the consequences of their actions in an objective and realistic fashion has not been entirely supported by psychological research. Some evidence cited as proof of people's tendency to view their actions in a more subjective and unrealistic fashion as opposed to an objective and realistic fashion comes from people's widespread use of cognitive adaptations. The use of these cognitive adaptations, also know as defense mechanisms, has been widely documented by eminent psychiatrists as far back as Sigmund Freud. The use of these cognitive adaptations was once thought of as a maladaptive behavior insofar as these adaptations impeded patients from an accurate view of their problems (Erikson, 1950). However, the stance that cognitive adaptations are always maladaptive is less frequently seen in the psychological literature. It is now largely acknowledged that when people are faced with life-altering situations, such as the diagnosis of a life-threatening illness, cognitive adaptations in the area of mastery over the situation, self-esteem, and optimism are utilized and provide utility to the person in the form of mental and physical benefits (Taylor, 1983; Helgeson, 1993). The aforementioned theory has been appropriately name the Cognitive Adaptation Theory and has been used to look at people's thought processes in regards to chronic illnesses that are largely out of their control.

The Disconfirmation of the Cognitive Management of Threat

When faced with an illness that is both chronic and progressive, positive beliefs about one's control of the illness are extremely susceptible to disconfirmation. The belief that one can control one's cancer can, for example, be disconfirmed by learning that one's cancer has

metastasized or that the cancer has recurred. If people's adjustment to threat is contingent on the maintenance of such illusory thoughts, what happens when their illusions are disconfirmed?

According to Taylor (1983) when their illusory beliefs are disproved, people sometimes react by shifting their attention to things that they believe they do have control over. An example of this behavior would be the persons who believe they can control their cancer. When they learn the cancer has spread, they often focus their attention on other factors, such as how they will respond to chemotherapy.

Thus far, the Cognitive Adaptation Theory and its repercussions have been researched in persons who have membership in two distinct groups. First, those who have been diagnosed with illnesses such as breast cancer and HIV which have outcomes that may be largely beyond the patient's control and second, people, who have suffered from an acute illness, such as myocardial infarction, which presents the person with immediate pain-evoking and fear-inducing stimuli (Berkow, 1997).

Cognitive Adaptation is measured by scores on the 33-item Cognitive Adaptation Theory Index. As mentioned above, higher levels of cognitive adaptation, have been positively linked to improved psychological and physiological wellness. The benefits gained from the employment of these cognitive adaptations have been shown to be significant. For instance, men infected with the HIV virus who used cognitive adaptations in regard to the prognosis of their disease were shown to have lower declines in CD4 helper cells and to live an average of nine months longer than those HIV-positive men who were more realistic about their condition and its prognosis (Taylor, Kemeny, Reed, Bower, and Gruenwald, 2000).

Cognitive adaptations not only confer physiological benefits to those who employ them, but have also been shown to bestow psychological benefits as well. Taylor (1983) found that women with breast cancer frequently enhanced their self-esteem through the use of downward social comparisons that were not completely objective. For example, a woman whose cancer was treated by lumpectomy (removal of isolated parts of breast tissue) as opposed to mastectomy (removal of the entire breast) may think: "I had a comparatively small amount of surgery. How awful it must be for women who had a mastectomy. I just can't imagine; it would seem so difficult" (Taylor).

However, a woman who had undergone a mastectomy seemed to have a very different perspective: "It was not tragic. It's worked out okay. Now if the thing had spread all over, I would have had a whole different story for you." The pattern of downward social comparison also involved age, with older women saying they felt badly for younger women (who "needed breasts to attract men") and marital status, with married women saying they don't know how single women, being "all alone", handled their diagnosis (Taylor, 1983).

Because cognitive adaptations give people diagnosed with an illness that is largely out of their control (e.g., cancer) a false sense of empowerment and allows the patient to exert control over the few disease-related situations where control is possible (e.g., social support level, feelings about the illness), it seems logical that people will reap benefits from these adaptations. However, what happens when the opposite situation is true? Namely when people diagnosed with one of the most common chronic illnesses, diabetes Type 2, which in its early stages usually presents the patient with no painful stimuli and can be largely managed, even controlled, by engaging in health behaviors such as eating low-carbohydrate unprocessed foods, checking

blood serum glucose levels frequently and consistently, and implementing and following a regular and consistent exercise program.

PURPOSE OF STUDY

Summary

Diabetes, particularly diabetes Type 2, is on the rise around the world, particularly in America. Although the illness is largely manageable through health behaviors such as eating a low fat diet, regular monitoring of blood serum glucose levels, and engaging in a regular and consistent exercise program, many people fail to follow the treatment regimens set forth by their health care professional.

Previous research has pointed out a myriad of factors that are suspected to serve as barriers to diabetic regimen adherence. These factors are believed to include the high degree of complexity of following the average diabetic regimen (e.g., frequently checking of blood serum glucose levels, taking oral hypoglycemic medications several times a day, eating prescribed foods several times a day, and instituting a weight-loss program that includes engaging in frequent and consistent exercise), the amount of control patients have in regards to their illness, the amount of social support people with the illness receive, and the level of psychological distress people with chronic illnesses such as diabetes may experience. Despite explaining some of the variance in diabetic adherence, our ability to identify individuals at risk for non-adherence remains poor.

This study explored another variable, that of the employment of cognitively adaptive thoughts, in the yet unsolved equation of diabetic adherence. The use of cognitive adaptations has been shown in people with illnesses such as cancer and AIDS. These adaptations, although not accurate, frequently aid the patient in exercising control over the illness where control is possible and give the diagnosed a sense of control over his/her condition. Although adaptations

used to be viewed by the scientific community as inappropriate and maladaptive reactions to a situation, cognitive adaptations in the face of uncontrollable illness have been linked to favorable outcomes such as longer life spans and more confidence in facing uncontrollable situations.

Thus, the use of cognitive adaptations has proven useful in the face of largely uncontrollable illnesses. However the use of the same adaptations (e.g., inaccurate estimates of the amount of control one has over the illness and optimism in face of the illness) may contribute to unfavorable health outcomes when people are diagnosed with illnesses that in the early stages present themselves with no life-threatening stimuli and are largely manageable through one's daily actions.

This study explored the relationship between the level of employment of cognitive adaptations (independent variable) with control of blood serum glucose levels (dependent variable) in subjects diagnosed with diabetes Type 2. To measure the control of blood serum glucose levels, a biological marker, HbA1c, the benchmark medical indicator for adherence among diabetic patients, was used to indicate the level of compliance to the prescribed treatment regimen. Additionally, the same subjects were administered the Cognitive Adaptation Theory Index, to measure individual's use of cognitive adaptations

RESEARCH QUESTIONS AND HYPOTHESES

The following specific questions were addressed:

Question: What is the relationship between the use of cognitive adaptations and adherence to a diabetic regimen among individuals without serious diabetic complications?

Hypothesis: It was believed that higher scores on the Cognitive Adaptation Theory Index (CATI) would be positively correlated to higher levels of non-adherence evidenced by HbA1c levels exceeding eight percent.

Should enough subjects with other chronic illnesses participate, it was hypothesized that participants who endorsed the diagnosis of co-morbid chronic illnesses in addition to diabetes Type 2 would obtain higher scores on the Cognitive Adaptation Theory Index (CATI) than those persons who just endorsed the diagnosis of diabetes Type 2.

Hypothesis: Persons endorsing one or more co-morbid chronic illnesses, in addition to diabetes Type 2, would obtain lower Cognitive Adaptation Theory Index (CATI) scores than those persons who endorse only being diagnosed with diabetes Type 2.

METHODS

Participants

Participants in this study were volunteers who were patients at various outpatient clinics housed within Earl K. Long Medical Center. One clinic, The Diabetes Clinic, specialized in the care of diabetics. Other clinics (e.g., Emergency Room, Medicine Clinic, Opthamology Clinic, Women's Clinic) also provide primary care services to individuals with diabetes. Earl K. Long Medical Center is a Baton Rouge hospital that provides medical services to low-income and uninsured individuals. Diabetes care management is provided by a team of health care professionals including a primary care physician, diabetes nurse, diabetes educators, and nutritionists. Patients diagnosed with diabetes Type 2 from six months to three years and prescribed medication or encouraged to follow a dietary regimen to control their blood serum glucose levels, who are attending a routine three-month visit were approached to participate. At each three-month visit, patients are given a mandatory blood test and, therefore, recent HbA1c levels would be available the same day the other study data was collected. Patients were ineligible if they were under 18 years of age, had diagnosed with diabetes Type 2 for over thirty-six months or under six months, or if their oral comprehension was below a fifth grade level as indicated by the Woodcock Johnson-II Oral Comprehension Test.

MEASURES

Demographic Questionnaire

A demographic questionnaire was administered to all participants in order to collect the following information: Earl K. Long patient number, name, type of diabetes (Type 1 or Type 2), time elapsed since being diagnosed with diabetes Type 2, date of birth, gender, marital status, age, last grade completed, and current employment status.

Woodcock-Johnson Oral Comprehension Scale

The Oral Reading Comprehension Scale of the Woodcock Johnson III – Test of Achievement (Woodcock, McGrew, & Mather, 2001) was administered to each participant in order to ascertain the person's current reading and comprehension level. This information was important because the person needed to fully understand the questions that were read to them. The Woodcock Johnson III is a standardized test of achievement that was revised in 2001. The Oral Reading Comprehension scale tests the ability of the testee to supply the correct word in a short passage, based on contextual clues. Oral comprehension has a median reliability of .89 in the adult age range. For the purposes of the study, participants were required to demonstrate at least a fifth grade oral comprehension level. This cut-off was determined because the scales being used in the present study have a fifth grade reading level. Patients who failed to demonstrate at least a fifth grade oral comprehension level were excluded from the study.

The Cognitive Adaptation Theory Index

The Cognitive Adaptation Theory Index has been used in previous studies to assess study participants' current levels of cognitive adaptations. The Cognitive Adaptation Theory Index (CATI) (Helgeson, 1993) was used to determine the level to which patients are presently

engaging in cognitive adaptations in regards to their Type 2 diabetes diagnoses. Each question is followed by a five-choice Likert scale in which the participant circles the box that matches the level of agreement the participant has with each statement.

The CATI includes state (illness-specific) and trait (dispositional) indices of optimism, control, and self-esteem. All six factors are shown to be intercorrelated with an average correlation of .32. The underlying source factors and their respective loadings onto the surface factor (The surface factor being a combination of high self-esteem, high optimism, and high perceived control in regards to the illness and in general.) were: Optimism, .81; Illness Optimism, .73; Self-Esteem, .81; Denial of Impact, .32; Mastery, .75; and Self-Efficacy, .50. The internal consistency between all six variables was .74. A single cognitive adaptation index was created by standardizing each of the six variables and summing them (Helgeson, 1993).

Physiological Marker of Diabetic Regimen Adherence –HbA1c

Glycosylated hemoglobin levels was used to give an objective account of the level of the subjects' compliance. Hemoglobin is the primary component of red blood cells and is a protein that transports oxygen in the blood system (Porte & Sherwin, 1997). When a diabetics' blood serum glucose level becomes elevated, glucose molecules attach to hemoglobin forming glycosylated hemoglobin, also known as HbA1c (Dwyer, 1983). The new hemoglobin-glucose molecule is permanent and easy to detect with simple lab blood tests (Porte & Sherwin, 1997). Glycosylated hemoglobin levels denote the level of diabetic treatment regimen adherence within the past 60 to 90 days (Porte & Sherwin, 1997). A laboratory technique called electrophoresis is conducted on blood drawn from diabetics. This test separates glycosylated hemoglobin molecules from non-glycosylated hemoglobin molecules (Porte & Sherwin, 1997). Medical

regimen adherence, also termed glycemic control, over the prior two to three months is indicated by the percentage of HbA1c present as compared to normal hemoglobin. Since hemoglobin holds its molecular composition for approximately 90 days, HbA1c levels are only indicative of glycemic control over the past three months. After 90 days have elapsed, most hemoglobin will lose its molecular integrity and new hemoglobin will be generated (Porte & Sherwin). Thus, if a patient adheres to the medical treatment regimen and the glucose remains stable and controlled for approximately 90 days, the HbA1c levels detected by the blood lab test will be very low (to indicate few hemoglobin molecules have been glycosylated)). HbA1c is considered a valid and reliable indicator of long-term blood glucose control (Porte & Sherwin).

Higher percentages of HbA1c, or glycosylated hemoglobin, have been linked to poorer metabolic control and which usually indicates lack of diligence in following the prescribed diabetic treatment regimens. The average range of HbA1c in non-diabetic individuals is between four and six percent. A diabetic with good metabolic control should have an HbA1c between four and eight percent. A diabetic with an HbA1c of eight percent or greater is considered to have poor metabolic control and to be largely non-adherent to the diabetic treatment regimen (Leahy, 1999). Finally, HbA1c levels that are 12% or higher are considered to have very poor metabolic control and are considered to be completely non-adherent (Porte & Sherwin, 1997).

PROCEDURE

The primary investigator collected data from outpatient clinics (e.g., Diabetes Clinic, Opthamology Clinic, Women's Clinic, Emergency Room) at Earl K. Long Memorial Hospital. Patients who had been diagnosed with diabetes Type 2 from six months to three years were approached in the waiting rooms of these clinics. If the patient was over 18 years of age, the researcher apprised the patient regarding the nature of the study, the amount of time the patient would most likely have to commit to properly complete all appropriate study materials, and the Type of compensation that would occur after the patient fully completed study materials. If patients did not wish to participate in the study, they were excused. However, if the patient agreed to participate, he/she was asked to meet the researcher or data collector in the waiting room before or after their clinic appointment. In the waiting room, the patient was asked to complete an informed consent form. All participants were informed that the study in which they are about to participate was designed to examine the impact that optimism, self-esteem, and perceived control may have on the metabolic control of low-income diabetic patients. The researcher or data collector explained the inclusion criteria (e.g., the oral comprehension requirement) and informed the participants that if they failed to meet any of the criteria, they would be excluded from the experiment and given $5. Further, the researcher explained the parameters of confidentiality to the patient. Participants were also informed that their medical chart would be examined and that their HbA1c levels would be matched to their score on the Cognitive Adaptation Theory Index (CATI). Finally, participants in the experiment were told that they had the right to withdraw from the study at any time without penalty.

After participants agreed to participate in the study, they were briefly interviewed, given a demographic questionnaire to complete (Appendix A) and a portion of the Woodcock Johnson Oral Comprehension Subscale was administered verbally. For the purposes of the present study, participants were required to obtain scores on the Woodcock Johnson Oral Comprehension Scale commensurate to a fifth grade level. The cut-off was determined because the scales being used in the study had a fifth grade reading level. Patients who do not pass the oral comprehension test were not included.

If patients showed at least a fifth grade oral comprehension level, they were given the Cognitive Adaptation Theory Index (CATI) (Appendix B) to complete by hand. Study participants had to complete all 33-items of the CATI in order to be included in the study. In conclusion, patients were remunerated for their participation with $5.

Three components of the subject's cognitive adaptation were measured during the interview: mastery, self-esteem, and optimism. Two indicators, one trait-related and one disease-state related, were used for each of the three constructs. All items were followed by 5-point scales, ranging from 1 (strongly disagree) to 5 (strongly agree). The higher the subject's score across all three constructs the higher the level of cognitive adaptation (defined as the level of mastery, self-confidence, and optimism the person is utilizing both in regard to the illness and in regard to everyday life).

The dependent variable were participant HbA1c values. Each subject's HbA1c level from the current visit was obtained by reviewing his/her Earl K. Long Hospital medical chart.

Regression analysis was used to assess the predictive relationship that the independent variable (e.g., score on the CATI) has with the dependent variable (e.g., HbA1c level).

Based on results of the most similar previous findings available, it was expected that the predictor variable would account for a significant portion of the variance in diabetic adherence. Setting the effect size (R squared) for the regression at .1 required 73 subjects to achieve a power level of .8. That is the variance of subjects' scores on the CATI (x) would account for .1 of the total variance on HbA1c (y) values. With 73 subjects, there was a .8 chance of accounting for .1 of the variance if the CATI is a valid indicator of diabetic adherence.

RESULTS

This study explored the relationship between the level of cognitive adaptation (independent variable) with control of blood glucose levels (dependent variable) in subjects. Most (80.0%) were female and about two-thirds (65.0%) were receiving medical care from The Diabetes Clinic. The age of the respondents ranged from 20 to 82 years (M = 51.11, SD = 11.79). Forty-one percent were married and 61.3% were non-adherent based on their blood serum glucose level (Table 1).

Table 1

Descriptive Statistics for the Sample (N = 80)

	N	Percent
Gender		
Female	64	80.0
Male	16	20.0
Clinic Type		
1. Diabetes	52	65.0
2. Non-Diabetes	28	35.0
Age		
20 to 39 years	12	15.0
40 to 59 years	50	62

(table continued)

Marital Status		
Married	33	41.2
Single	47	58.8
Blood Serum Glucose Level		
Compliant (7.0 or under)	31	38.7
Non-compliant (7.1 or higher)	49	61.3

[a] Age: M = 51.11, SD = 11.79

Table 2 displays the Pearson product-moment correlations among the Cognitive Adaptation Theory Index (CATI) scores. The respondent's state mastery score was not correlated with either the total CATI score or the five other subscale scores (Table 2).

Table 2

Intercorrelations Among the CATI Scores (N = 80)

	1	2	3	4	5	6	7
1. Total Score	--						
2. Trait Self-Esteem	.83[d]	–					
3. State Self-Esteem	.44[d]	.24[a]					
4. State Optimism	.62[d]	.30[b]	.21	--			
5. Trait Optimism	.81[d]	.54[d]	.35[c]	.47[d]	--		

(table continued)

6. Trait Mastery	.76[d]	.62[d]	.38[d]	.28[b]	.54[d]	--
7. State Mastery	.04	-.12	.03	-.10	.04	-.13	--

[a] $p = .05$. [b] $p = .01$. [c] $p = .005$. [d] $p = .001$.
CATI = Cognitive Adaptation Theory Index

Hypothesis One

Hypothesis One stated, "It was believed that higher scores on the Cognitive Adaptation Theory Index (CATI) would be positively correlated to higher levels of non-adherence evidenced by HbA1c levels exceeding seven percent." Inspection of Table 3 revealed none of the seven *t* tests were significant at the $p = .05$ level.

Table 3

Comparison of CATI Scores Based on Blood Glucose Compliance. t Tests for Independent Means (N = 80)

CATI Score	Group [a]	*M*	SD	*t* (78)	*p*
Trait Self-Esteem	Compliant	40.48	8.03	0.29	.77
	Non-Compliant	41.00	7.37		
State Self-Esteem	Compliant	8.29	2.00	1.01	.31
	Non-Compliant	7.82	2.06		
Trait Mastery	Compliant	19.90	3.92	0.88	.38
	Non-Compliant	19.09	4.05		

(table continued)

State Mastery	Compliant	12.06	2.61	0.26	.80
	Non-Compliant	11.90	2.94		
Trait Optimism	Compliant	30.87	5.16	1.18	.24
	Non-Compliant	29.39	5.65		
State Optimism	Compliant	24.23	4.38	0.59	.56
	Non-Compliant	23.61	4.67		
Total CATI Score	Compliant	143.03	17.94	0.75	.46
	Non-Compliant	139.80	19.26		

CATI = Cognitive Adaptation Theory Index
[a] Compliant (n = 31) Non-Compliant (n = 49)

Table 4 displays the Pearson product-moment correlations between the participant's blood glucose level (glycosylated hemoglobin or HbA1c for abbreviation purposes) and selected variables. These variables were seven CATI scores as well as their age, gender, marital status, and the type of clinic at which they were receiving medical care. Higher blood glucose levels were found in younger participants (r = -.22, p = .05) and those receiving medical care at the non- diabetes clinics (r = .51, p = .001). The findings in Table 3 and 4 provided no support for Hypothesis One. Table 4, along with all its accompanying findings, is shown below. As with all sections of this research paper, all quantitative data and statistics utilized the computer software package SPSS (Statistical Package for the Social Science) version 11.0. It was believed that this was the most effective way to conduct the required statistical analyses with the collected data.

Table 4

Correlations for Blood Glucose Level with Selected Variables (N = 80)

	Blood Glucose Level
Total CATI Score	-.01
Trait Self-Esteem	.09
State Self-Esteem	-.09
State Optimism	.06
Trait Optimism	-.10
Trait Mastery	-.03
State Mastery	-.12
Age	-.22*
Gender [a]	-.04
Marital Status [b]	-.18
Clinic Type [c]	.51****

* $p = .05$. ** $p = .01$. *** $p = .005$. **** $p = .001$.
[a] Gender: 1 = *Male* 2 = *Female*
[b] Marital Status: 0 = *Single* 1 = *Married*
[c] Clinic Type: 1 = Diabetes 2 = Non-Diabetes

Hypothesis Two

Hypothesis two maintained that participants endorsing one or more one comorbid illnesses in addition to diabetes Type 2, would also have lower levels of Cognitive Adaptation. In this study, only six participants endorsed being solely diagnosed diabetes Type 2. Therefore, this hypothesis was not testable.

Additional Findings

In the first step, the combination of the four demographic factors were significantly related to dependent variable ($p = .001$) and accounted for 27.2% of the variance in the participant's blood glucose level. Inspection of Step 1 revealed participants from the non-diabetes clinics to have higher blood glucose levels ($p = .001$). This step was proceeded by Step 2. In Step 2, the six CATI scores were added to the regression model. However, their inclusion added only 7.1% more explained variance and was not statistically significant ($p = .31$). Thus, the overall results of this analysis did not show statistical significance.

The final model accounted for 50.1% of the variance and included six independent variables. Higher levels of blood glucose were related to: (a) receiving care at the non-diabetes clinics (= .416, $p = .001$); (b) CATI Item 11, having a positive attitude about managing diabetes (= .243, $p = .006$); (c) CATI Item 21, not believing that there was little they could do (= -.276, $p = .003$); (d) CATI Item 25, believing that they could do anything that they set their mind to (= .260, $p = .005$); (e) CATI Item 37, reporting that they got upset easily (= -.236, $p = .007$); and (f) CATI Item 38, not believing that "clouds have silver linings" (= -.228, $p = .008$) (Table 6). Thus, the backward elimination regression model predicting blood glucose level which was based on demographic factors in cognitive adaptation theory index scores was not significant.

It should be noted that all outliers were cleared from the data a priori to data analysis (using Cohen's guidelines). Thus, n=3 were eliminated from data analysis. However, three additional participants were collected to make up for this shortfall.

DISCUSSION

This research study hypothesized that high levels of cognitive adaptation would be predictive of poorly controlled blood serum glucose levels in an African American diabetic population. Taken as a whole, high-levels of cognitive adaptation, as measured by the Cognitive Adaptation Theory Index (CATI), failed to be a significant predictor of blood glucose levels. In addition, the individual scales that make-up the CATI, namely state and trait mastery, self-esteem, and optimism, also failed to reach significance in predicting participant HbA1c levels.

Since this is the first investigation using the Cognitive Adaptation Theory Index on a cohort of individuals with an illness that is largely controllable (diabetes Type 2), there is no precedent that provides a theoretical framework to which this study can be compared. This being said this study followed the traditional scientific method in order to ensure the results obtained were due to the variables put forth by the hypotheses and not due to errors in research design. A power analysis was used to determine the number of participants needed to find a significant result while minimizing the probability that either a Type I or Type II error would occur. In addition, to avoid the problem of restricted range, this study obtained participants from various Earl K. Long Medical Center clinics (e.g., Emergency Room, Medicine Clinic, Opthamology Clinic, Women's Clinic) at different times of the day on different days of the week. In order to avoid the confound of inflated range, this study included strict inclusion and exclusion criteria. To avoid response bias, the CATI included filler items and items that were both positively and negatively worded. Finally, HbA1c, the biological marker used to assess whether participants were adherent to diabetic regimens, is commonly regarded as the benchmark for assessing adherence. Since the CATI measures psychological traits, which are

stable, and states, which are fluid, it made the most sense to use only the participant's most recent HbA1c levels. In other words, the participant's most recent HbA1c level would most accurately measure the person's state mastery, optimism, and self-esteem at the time of being administered the questionnaire (as opposed to a HbA1c reading obtained one year before participating) and also accurately measure the participant's stable psychological traits.

Although level of cognitive adaptation failed to prove a significant predictor of a patient's HbA1c level when looked at in isolation, other variables unexamined in the study could have possibly served as moderators and mediators between a diabetic's level of cognitive adaptation and that person's degree of adherence. These possible moderating variables include: racial and family patterns of diabetes and non-adherence (moderating variable), the combination of the perceived threat of diabetes and perceived value of changing long-standing health behaviors (mediating variable), and the knowledge regarding the illness consequences (moderating variable).

Racial and Family Patterns of Non-Adherence

Both diabetes Type 2 and non-adherence to diabetic regimen have been widespread in the African-American community for many years (Campbell, Kushner, & Falkner, 2004; Banerji, 2004; Savoka, Miller, & Ludwig, 2004; Wilisake, 2003). Since this study sampled from a predominantly African-American population, it is likely that many participants had relatives who were diagnosed with diabetes Type 2 and were non-adherent to their prescribed treatment regimens. In fact, many of this study's participants consisted of parents and their young adult children both of who had medical histories significant for diabetes Type 2. Because of these extensive family histories of diabetes Type 2, it is likely that the illness is simply a part of

everyday life for many people. As a result, a diagnosis of Type 2 diabetes is not regarded as catastrophic or threatening, and their self-esteem, mastery, and optimism would remain high. Thus, family history of both Type 2 diabetes and familial attitudes towards adherence may prove useful to explore in the future.

Health Belief Model

In addition to a family history of illness and non-adherence, the two components of the Health Belief Model, namely the belief that the disease is a threat and that the costs of action outweigh the costs of inaction, may be serving as mediating variables between levels of cognitive adaptation and diabetic adherence (Sackett, 1979). Research has shown that many people with chronic illness fail to adhere to their medical team's recommendations because they do not feel both sufficient threat to their health due to their illness and that the burden of changing previous negative health behaviors outweighs the benefits of adopting new, positive health behaviors (Koch, 2002, Aljasem, Peyrot, Wissow, & Rubin, 2001, Bond, Aiken, and Somerville, 1992). This would seem especially true for low-income African-American patients and other populations who have traditional high-fat diets since the prescribed treatment regimen of a low-fat diet is antipodal to their traditional diet and therefore requires the most effort to change.

Level of Illness Knowledge

Cognitive adaptation levels may have served as a stronger predictor when looked at in conjunction with the level of awareness of proper self-care techniques and the level of knowledge in regards to long-term diabetic complications that may result when diabetes goes uncontrolled. Some research in the public health and psychological fields shows a connection

between level of education and compliance with treatment regimens (Williamson, Hunt, Pope, & Tolman, 2000). Therefore high levels of mastery, self-esteem and optimism may be due to a lack of knowledge regarding diabetes and its complications. In other words, if people are ignorant to the fact that diabetes has serious consequences, they may maintain high levels of self-esteem, mastery, and optimism in the face of the their illness. Thus, the CATI may prove to be more efficacious when combined with instruments, such as the Diabetes Patient Questionnaire, measuring a patient's diabetes-related knowledge (Tolman, 2000).

It could be possible that many of the negative health behaviors that many of the participants engage in (e.g., smoking, eating high fat foods) are used for affect regulation in the same way that tobacco users use cigarettes to help modulate depressive affect (Thomas, 1994). Both the popular media and scientific journals have widely reported that the consumption of high fat or high carbohydrate foods can help reduce people's psychological distress (Ciechanowski & Russo, 2000). Thus, engaging in these negative health behaviors may actually raise people's level of cognitive adaptation. Therefore, the frequency of diabetics' health behaviors along with their levels of cognitive adaptation may help the instrument account for more variance in the prediction of diabetic adherence. Although the level of cognitive adaptation of the population in this study was equivalent to the level found in Helgeson (2003).

This study highlights some interesting issues for health care providers providing services to those diagnosed with Type 2 diabetes. Among the issues raised by this study is the finding that levels of optimism, mastery, and self-esteem are not shown to directly predict patient HbA1c levels. Thus, pessimism regarding illness may not be a predictor of future adherence to a patient's diabetic regimen.

The fact that cognitive adaptation, which some view as the flip-side to depression (Helgeson, 2003), was shown to be uncorrelated with patient HbA1c levels is an anomalous finding when looked at with the larger body of health psychology research showing that high levels of depression and anxiety do serve as an impediment to diabetic adherence (Skinner, 2004; Lin et al., 2004; Connell, 1990). The two main questions raised by this finding are 1.) Is cognitive adaptation really the opposite of depression, and 2.) Is there a mediating or moderating variable that is accounting for the relationship between mood disorders and anxiety spectrum disorders that the CATI is accounting for that other studies are not? Both of these questions would be interesting directions for future research.

This study also has implications for future directions in public health research. High levels of cognitive adaptation are a significant indicator of prognosis in breast cancer, AIDS [before the advent of Highly Active Anti-Retroviral Therapy (HAART)], and myocardial infarction prognosis (Helgeson, 2003; Taylor, 1987). However, this study failed to find any connection between levels of cognitive adaptation and participant blood serum glucose levels. This may speak to the fact that high levels of cognitive adaptation may be beneficial when the illness affords the person little control in terms of prognosis but may not have an impact when adherence level is a major part of disease management. However, this observation is beyond the purview of this study but does warrant further research.

It should be noted that the clinic in which the participant was recruited significantly predicted the participants' HbA1c levels. Even more interesting is the fact that although participants' HbA1c levels differed significantly between the Diabetes Clinic (1) and other clinics (2), both clinics had mean HbA1c levels that fell within the uncontrolled range. These

statistics highlight that the population this study sampled had a range of HbA1c levels that are considered poorly controlled. The CATI may prove to be more predictive if used with larger samples or in populations with wider variance in their HbA1c levels.

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APPENDIX A

DEMOGRAPHIC QUESTIONNAIRE

My Earl K. Long number is: _____

My name is: _____

I am a _____(Male/Female).

My date of birth is: _____

The last grade I completed was:_____

I am married, single, widowed:_____

I am employed, unemployed: _____

I have the following chronic illness(es):_____

Date I was diagnosed with diabetes Type 2:_____

APPENDIX B

COGNITIVE ADAPTATION THEORY INDEX (CATI)

(Helgeson, 1993)

Place circle the box that most closely matches your feeling in regards to each question.

I feel that I am a person of worth, at least on an equal plane with others.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I feel that I have a lot of good qualities.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

All in all, I am inclined to feel that I am a failure

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I am able to do things as well as most other people

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I feel I do have much to be proud of.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I have a positive attitude toward myself.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

On the whole, I am satisfied with myself.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I wish I could have more respect for myself.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I certainly feel useless at times.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

At times I think I am no good at all.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I have a positive attitude about my managing my diabetes.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I am optimistic about managing my diabetes.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I do NOT count on smooth management of my diabetes.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

Although the future course of my diabetes is uncertain, I expect the best.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I expect something to go wrong with the management of my diabetes.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I do not expect things to go my way in managing my diabetes.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

It takes more than diabetes to make me fall apart.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I do not spend much time thinking about the possibility of diabetes complications.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I have little control over the things that happen to me.

(Strongly Agree) _ _ __ _ _ (Strongly Disagree)

There is really NO way I can solve SOME of the problems I have.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

There is little I can do to change many of the important things in my life.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I often feel helpless in dealing with the problems of life.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

Sometimes I feel that I am being pushed around in life.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

What happens to me in the future depends on me.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I can do just about anything I really set my mind to do.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I feel that all the fuss about my diabetes is blown out of proportion.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

Deep inside, I'm not really convinced that I have diabetes.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

In uncertain times, I usually expect the best.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

It is easy for me to relax.

(Strongly Agree) _ _ _ _ _ _(Strongly Disagree)

If something can go wrong, it will for me.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I always look on the bright side of things.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I’m always optimistic about my future.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I enjoy my friends a lot.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

It’s important for me to keep busy.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I hardly ever expect things to go my way.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

Things never work out the way I want them to.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I don’t get upset too easily.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I’m a believer in the idea that “every cloud has a silver lining.”

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

I rarely count on good things happening to me.

(Strongly Agree) _ _ _ _ _ (Strongly Disagree)

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VITA

Martin Ancona is a doctoral candidate in the clinical psychology program at Louisiana State University in Baton Rouge, Louisiana. He has participated in many research programs including Validation of the BDI-II in a Low-Income, African-American Sample of Outpatients (in press). His primary research interest is Axis I and Axis II psychopathology in diabetic and HIV population.