



The instances and occurrences that influence individuals with impaired glucose tolerance in their decision to exercise
by Peter Kenneth Shatwell

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Health and Human Development
Montana State University
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Abstract:

The purpose of this preliminary investigation was to identify the instances and occurrences (instances and occurrences that most easily come to mind) used by MSU employees with IGT during the decision balance process that determines engagement in physical activity. In this study, both qualitative and quantitative methods were used. The qualitative methods involved a series of 10 tape recorded interviews put through a content analysis that revealed trends and themes throughout the integrated theoretical model in three areas: memories of exercise in the past, ideas and thoughts associated with exercise in the present, and expectations of exercise in the future. Based on the content analysis, a survey was created using the statements generated from the interviews. In the survey, each area of the integrated model contained its own set of questions. The survey also contained 16 gold standard decision balance model questions to compare the integrated model with. The area, ideas and thoughts associated with exercise in the present, was the most robust component of the integrated model as it was a statistically significant predictor of exercise engagement at a p-value of .012 and predicted 19% of the variance in exercise behavior. However, memories of exercise in the past and expectations of exercise in the future were not significant predictors of exercise engagement. The gold standard decision balance model was also a significant predictor of exercise behavior predicted 18.2% of the variance. There were two conclusions that could be made from this preliminary study. First, instances and occurrences associated with exercise in the present, used by MSU employees with impaired glucose tolerance was a significant determinant of exercise engagement. Second, the association model predicted more of the variance in exercise engagement than the gold standard decision balance model.

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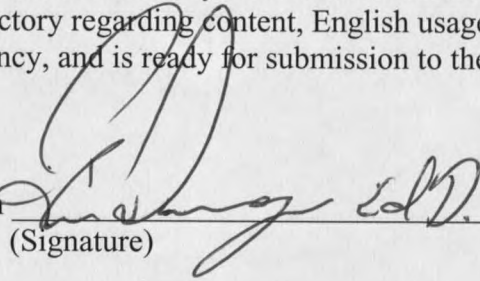
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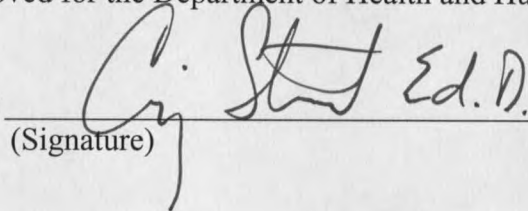
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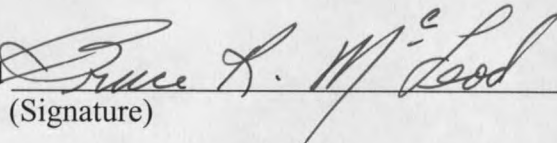
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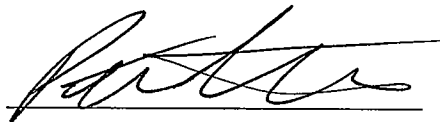
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ABSTRACT

The purpose of this preliminary investigation was to identify the instances and occurrences (instances and occurrences that most easily come to mind) used by MSU employees with IGT during the decision balance process that determines engagement in physical activity. In this study, both qualitative and quantitative methods were used. The qualitative methods involved a series of 10 tape recorded interviews put through a content analysis that revealed trends and themes throughout the integrated theoretical model in three areas: memories of exercise in the past, ideas and thoughts associated with exercise in the present, and expectations of exercise in the future. Based on the content analysis, a survey was created using the statements generated from the interviews. In the survey, each area of the integrated model contained its own set of questions. The survey also contained 16 gold standard decision balance model questions to compare the integrated model with. The area, ideas and thoughts associated with exercise in the present, was the most robust component of the integrated model as it was a statistically significant predictor of exercise engagement at a p-value of .012 and predicted 19% of the variance in exercise behavior. However, memories of exercise in the past and expectations of exercise in the future were not significant predictors of exercise engagement. The gold standard decision balance model was also a significant predictor of exercise behavior predicted 18.2% of the variance. There were two conclusions that could be made from this preliminary study. First, instances and occurrences associated with exercise in the present, used by MSU employees with impaired glucose tolerance was a significant determinant of exercise engagement. Second, the association model predicted more of the variance in exercise engagement than the gold standard decision balance model.

CHAPTER 1

INTRODUCTION

It is estimated that 80% of all employers with 50 or more employees in the United States have worksite health promotion programs in place (Association for Worksite Health Promotion, 2000). Programs of this nature are initiated to increase the health of employee populations, to increase productivity, and to reduce the overall health insurance costs of a university, business, or corporation. To this end, worksite health promotion programs strive to facilitate a practice called “wellness,” defined as “an active process of becoming aware of and making choices toward a more successful existence” (National Wellness Institute [NWI], 1979, pp. 1).

Worksite wellness programs often provide a blood screening that produces information pertaining to disease risk. The Montana State University Employee Wellness Program (MSUEWP) is a worksite wellness program that has been screening its employees for select health risk factors over the past 15 years. Information from the blood screening is used to identify risk factors for several diseases such as cardiovascular disease, stroke, anemia, and diabetes.

Over the past five years, the program physician for the MSUEWP has identified an increasing incidence of high fasting blood glucose levels, which is a risk factor for impaired glucose tolerance (IGT). IGT or pre-diabetes is a condition in which an individual's fasting plasma glucose levels are above normal (110 mg/dl-125 mg/dl) but not in a range indicative of diabetes (American Diabetes Association, 2002). Without

some form of intervention, these individuals are likely to acquire Type 2 diabetes. However, Tuomilehto, Lindstrom, Eriksson, Valle, Hamalainen, Ilanne-Parikka, et al. (2001) found that an increase in exercise was directly correlated with a decreased incidence of diabetes among those with IGT. Therefore, a need exists to increase physical activity among those who have IGT.

Health promotion practitioners are facing the difficult challenge of encouraging behavior change within the area of exercise among many at-risk populations, including those with IGT. Over the past 30 years several models have been used to influence exercise recruitment. The majority of these models have been utilized with varying levels of success; however, none have made a statistically significant impact on exercise recruitment rates of worksite populations (Dishman, Olenburg, O'Neal, & Shepard, 1998). One of the most prominent approaches to increasing exercise recruitment incorporates the decision balance model in which the pros and cons of a behavior change are weighed against one another. It is theorized that when the net gains (pros) of the outcome of the behavior change are greater than the net losses (cons) of the behavior change, an individual will engage in the activity (Janis & Mann, 1977). This framework has proved to be an effective mechanism for predicting exercise behaviors; however, the decision process is based on the assumption that health is of the greatest value to the individual. For example, a young smoker who wants to have friends engages in smoking because the immediate consequence is peer acceptance, a very valuable pro to a teenager. However, the adolescent fails to comprehend the very serious and adverse health

conditions associated with tobacco use. Since peer acceptance is of greater value than future health, the decision to smoke has more valuable pros than cons.

Kahneman and Tversky used the term “vivid information” to describe how tangible or conceivable something is (1984). The smoker’s most vivid information is of the peer acceptance he or she has just gained because it is immediately tangible and much easier to conceive of than the potential experience of lung cancer in the future. The bias caused by the vivid information can be identified and modified through the use of the “availability heuristic.” Kahneman and Tversky describe the availability heuristic as a concept used to explain decision-making, based on behavioral economic modeling to identify the information that an individual uses to make a decision. Through a population analysis, health practitioners can identify the instances and occurrences in which the availability heuristic leads to biased judgments within the decision balance model. Once those instances and occurrences are identified, fitness programming can be adapted to modify the factors that generate the bias thus increasing the probability that an individual will initiate exercise.

Purpose Statement

The purpose of this preliminary investigation was to identify the instances and occurrences that most easily come to mind used by Montana State University (MSU) employees with IGT during the decision balance process that determines engagement in physical activity.

Significance of the Problem

Diabetes is a growing epidemic in the United States. Currently 6.2% of the population or 17 million Americans have diabetes (American Diabetes Association [ADA], 2002). It is estimated that 11.1 million people have been diagnosed while another 5.9 million are unaware that they have the disease. Diabetes resulted in 210,000 deaths in 1999 making it the fifth deadliest disease in the United States. There are currently 2,200 newly diagnosed cases of diabetes per day (ADA, 2002)

Diabetes is not a curable condition. It is a group of chronic metabolic diseases due to defects in either insulin action, insulin secretion, or both (ADA, 2001). This disease results in a lifetime of costly medical treatment and management. Those with diabetes have an increased risk of many adverse health conditions including heart disease, stroke, high blood pressure, retinopathy, kidney damage, nervous system damage, peripheral vascular disease, and coronary heart disease. It is estimated that 73% of those with diabetes have high blood pressure. Retinopathy stemming from diabetes results in 12,000 to 24,000 new cases of blindness each year. Many of those with diabetes face severe kidney damage and, in fact, 114,478 had to engage in dialysis treatment or transplantation in 1999. Approximately 60-70% of those with diabetes have some form of nerve damage ranging from impaired sensation in their feet and hands to slowed digestion of food in the stomach. The inability to sense or feel pain resulted in 82,000 amputations of lower limbs from 1997-1999 (ADA, 2002).

Due to the significant amount of adverse health conditions and symptom management caused by diabetes it is estimated that the total annual cost in the U.S. was

\$98 billion dollars in 1999. This disease accounts for 5.8% of the total U.S. health care cost (ADA, 2002). These figures demonstrate an alarming number of both monetary and personal costs.

Impaired glucose tolerance (IGT) or pre-siabetes is a condition in which an individuals fasting plasma glucose levels are above normal (110 mg/dl - 125 mg/dl) but not in a range indicative of diabetes (ADA, 2002). This condition not only increases the risk of diabetes onset, but also substantially increases the risk of cardiovascular disease and death (ADA, 2002).

Exercise has been shown to significantly decrease the risk of diabetes onset among those with IGT as well as other populations. Major health entities such as the American College of Sports Medicine (ACSM), the Centers for Disease Control and Prevention(CDC), and the Surgeon General have suggested that Americans should be engaging in 30 minutes of moderate intensity exercise on most or all days of the week (Pate, Pratt, Blair, Haskell, Macera, & Bouchard, et al., 1995). Despite these recommendations, 40-60% of Americans are sedentary. As the incidence of IGT continues to rise, it is important to develop exercise interventions targeted at those with IGT.

Definition of Terms

For the purpose of this study, these terms were operationally defined as:

1. Employee Wellness Program: Programs adopted by companies, businesses, or universities to address health risks and lifestyle behaviors that are costly.

The purpose of such programs is to assess disease risk and intervene through lifestyle modifications such as exercise, nutrition, and counseling.

2. Disease risk: A measure of how likely someone is of contracting a disease based on multiple health and lifestyle factors.
3. Regular physical activity: Engaging in at least 30 minutes of moderate intensity physical activity at least five days of the week. Moderate physical activity is at an intensity of 3-6 METs (metabolic rate), that is, walking briskly at 3-4 miles per hour (Pate et al., 1995)
4. Impaired glucose tolerance: A physiological state between normal glycemic action and the onset of diabetes. This is represented by a fasting glucose measurement between 110 mg/dl and 126 mg/dl.
5. Blood chemistry panel: A blood analysis that includes a comprehensive measurement of blood glucose levels. Blood panels can identify those who have IGT.
6. Decision balance model: A theoretical framework that assumes decision making is based on the relative weight associated with the pros and cons for engaging in a given behavior in four areas of consequence: gains and losses for self, gains and losses for significant others, self-approval or disapproval, and approval or disapproval from significant others (Janis & Mann, 1977).
7. Gains and losses for self: The costs and benefits of a decision with respect to

personal objectives (Janis & Mann, 1977). For example, when considering the decision to exercise, an individual may compare the health benefits of exercise with the time costs of going to the gym.

8. Gains and losses for significant others: The cost and benefits of a decision as with respect to groups or individual with whom the decision maker is associated or recognized (Janis & Mann, 1977). For example, when considering the decision to exercise, an individual may compare the time used to exercise with the time that he or she can spend with his or her children.
9. Self-approval or disapproval: Evaluation of how a decision will fit with internal moral standards and self image (Janis & Mann, 1977). For example, an individual may decide to exercise because it makes them feel good about themselves.
10. Approval or disapproval by significant others: An evaluation of how a decision will fit with the moral standards and ethics held by those with whom the decision maker is associated or recognized (Janis & Mann, 1977). For example, an individual may not exercise because his or her peer group believes that if there is any free time from work it should be spent with family.
11. Availability heuristic: Decision makers assess the likelihood of engaging in an event by the ease with which particular examples of similar events can be brought to mind through memory recall, association, and construction (Kahneman & Tversky, 1984).

12. Memory recall: A mental process in which individuals retrieve the most relevant outcomes related to a current situation (Kahneman & Tversky, 1984). For example, an individual may make a decision not to exercise because he or she recalls that when he or she exercised in high school physical education class it was embarrassing.
13. Construction: A mental process where individuals create various outcomes a particular decision (Kahneman & Tversky, 1984). For example, an individual who is considering exercise may construct an instance where he or she begins to exercise and pull a muscle.
14. Association: A mental process where a decision maker assesses the strength of association between a choice and an occurrence (Kahneman & Tversky, 1984). For instance, for an individual, an association may exist between exercise and respect where increased exercise is associated with increased respect.

Assumptions

Assumptions in the study were: 1) all subjects (employees) completed the questionnaire honestly and correctly and 2) all subjects (employees) answered interview questions honestly and correctly.

CHAPTER 2

LITERATURE REVIEW

Employee Wellness Programs

Health care costs have continued to increase over the past 40 years. The medical expenditure of the United States has increased from \$26.9 billion in 1960 to \$1.149 trillion in 1998 (Centers for Medicaid and Medicare Services, 2000). Due to a gradual shift in responsibility for health care away from government sources to the private sector employers have been forced to take on a greater financial burden. Employers currently pay approximately 30% of the total U.S. health care expense (Pencack, 1991). The opportunity to be mobile and active at work has decreased due to the dependency on technology. This trend has led to a multitude of diseases related to sedentary lifestyle to surface such as diabetes (Anspaugh, Dignan & Anspaugh, 2000). To combat the onset of these diseases EWP's have been implemented within corporations and businesses to keep people healthy and productive.

In the mid 1970s EWP's were introduced into worksites and viewed as a perk. Today over 80% of the worksites with 50 or more employees, and 98% of worksites with 750 employees or more have adopted wellness programs to reduce double-digit increases in health care cost (Riedel, Baase, Hymel, Lynch, McCabe, Mercer, et al., 2001). In 2002, Chapman reviewed 42 articles on the cost-effectiveness of worksite wellness and found that on average for every dollar invested in a EWP the return ranged from \$2.15 to \$5.64.

Researchers have recently indicated that the total productivity of an employee work force can be maximized by a properly implemented EWP. Worksites that helped employees avoid illness and disease had lower absenteeism, improved performance, greater creativity, increased motivation, avoided accidents, and reduced personal and company health care costs (Riedel, et al., 2001). To keep employees productive, health practitioners identify the causes of disease and illness and target them through interventions.

The lack of physical activity is a major cause of disease onset therefore exercise is should be a major component of a wellness program (Chapman, 2002). The need for more effective exercise interventions is increasing as preventable diseases such as cardiovascular disease and diabetes continue to increase.

Impaired Glucose Tolerance and Diabetes

The prevention of diabetes has become an increasing concern of the National Institute of Diabetes and Digestive and Kidney Diseases and the ADA. The CDC (2003) reported that the percentage of Americans with diagnosed diabetes rose from 7.3% to 7.9% between 2000 and 2001. There are currently 17 million cases of diabetes representing a 61% increase since 1991 (ADA, 2003). As a chronic metabolic disease, diabetes damages multiple organ systems within the body. Those with diabetes have heart disease rates two to four times greater than those without diabetes. Stroke risk is two to four times greater among diabetic populations. Diabetic retinopathy results in 12,000 to 24,000 new cases of blindness every year (NIDDK, 2002). Currently 43% of new cases

of treated renal disease are due to diabetes (ADA, 2002). In 1999, people undergoing treatment for end-stage renal disease was 38,160 and 114,478 people had kidney transplants or dialysis as a result of diabetes (ADA, 2002). Among those with diabetes, 60%-70% have nerve damage varying from impaired feeling in their feet and hands to slower digestion of food in the stomach (ADA, 2002). Due to the loss of sensation in the feet, cuts and scrapes go unnoticed and become infected. This resulted in 82,000 amputations of lower extremities from 1997-1999 (ADA, 2002). A study conducted by the ADA (2002) estimated the total direct medical cost of diabetes to be \$44 billion and the indirect costs to be \$54 billion, totaling \$98 billion or 5.8% of the total U.S. health care cost in 1997.

Pre-diabetic states have become the focus of increased research. One such condition is impaired glucose tolerance (IGT), identified by a fasting glucose measurement between 110 mg/dl and 125 mg/dl. Diabetes is identified by a fasting glucose measurement greater than or equal to 126 mg/dl. Over the past decade researchers have investigated the feasibility of preventing or delaying the onset of Type 2 diabetes through lifestyle modification including weight reduction, food intake, and exercise (ADA, 2002). Tuomilhetto, et al. (2001) found that those with IGT who engage in lifestyle modification reduce their risk of diabetes onset by 58%.

The Diabetes Prevention Program Research Group (DPPRG) also found that lifestyle modification, including 150 minutes of physical activity per week, reduced the incidence of diabetes onset by 58% among those with IGT. A significant body of literature identifies exercise as a preventative behavior associated with diabetes onset.

Evidence supports that physical activity and exercise have been shown to increase the body's sensitivity to insulin thereby improving glucose tolerance (Ivy, 1987; Koivisto, 1986). Bergenstal, Weaver, Leite, Monk, Upham, & Nelson, et al. (2000) found that those with normal weight who had improved their maximum oxygen uptake through exercise had significantly less progression from IGT to diabetes. Obesity, IGT, and diabetes onset are all strongly correlated. Mokdad, Bowman, Ford, Marks, & Koplan, (2001) have shown that as the prevalence of obesity increases so does diabetes prevalence. Obesity rates are at an all time high of 20% nationally and some states are demonstrating rates at close to a quarter of their population (Mokdad et al., 2001). A major modality in the reduction of weight is regular physical exercise (Tanjii, 2000). The surgeon general recommends 30 minutes of physical activity a day on all or most days of the week. Currently 52% of the American public is not regularly exercising despite the consistent advice of the CDC, ACSM, and NIH. Research to influence the decision to engage in exercise among those with IGT who are sedentary is needed to change the current national rate of diabetes onset.

Exercise Recruitment

Exercise recruitment is a growing challenge to health promotion specialists. Several conceptual approaches have been applied to increase exercise engagement among the American public. Bauman (2002) studied determinants or causal factors that influence physical activity. They found that when the correct determinants were adjusted individuals were more likely to engage in exercise. A determinant positively associated

with physical activity was the use of a decision balance sheet. This sheet suggests that an individual weighs the consequences of engaging in a behavior (Janis & Mann, 1977) through four major categories.

The first category is gains and losses for self in which the decision maker identifies and weighs the expected outcomes of his or her choice (Janis & Mann, 1977). For example, when searching for a health club membership an individual may consider the membership fees, the services, and the programs offered by the club. The decision maker may not like the price of the membership fee but is impressed with the clubs services and programs. He or she purchases the membership because the overall gain of the services and programs is greater than the loss of money that will be incurred.

The next category is gains and losses for others wherein the decision maker considers the cost and benefits that pertain to those with which he or she is associated or affiliated (Janis & Mann, 1977). If an individual is planning on exercising, he or she may be concerned with the effect that it will have on his or her children. The time spent exercising may require the children to remain in day care for an extra hour. The decision maker may decide that it is more of a loss for the children to spend the extra hour in daycare than it is a gain for him or her to exercise.

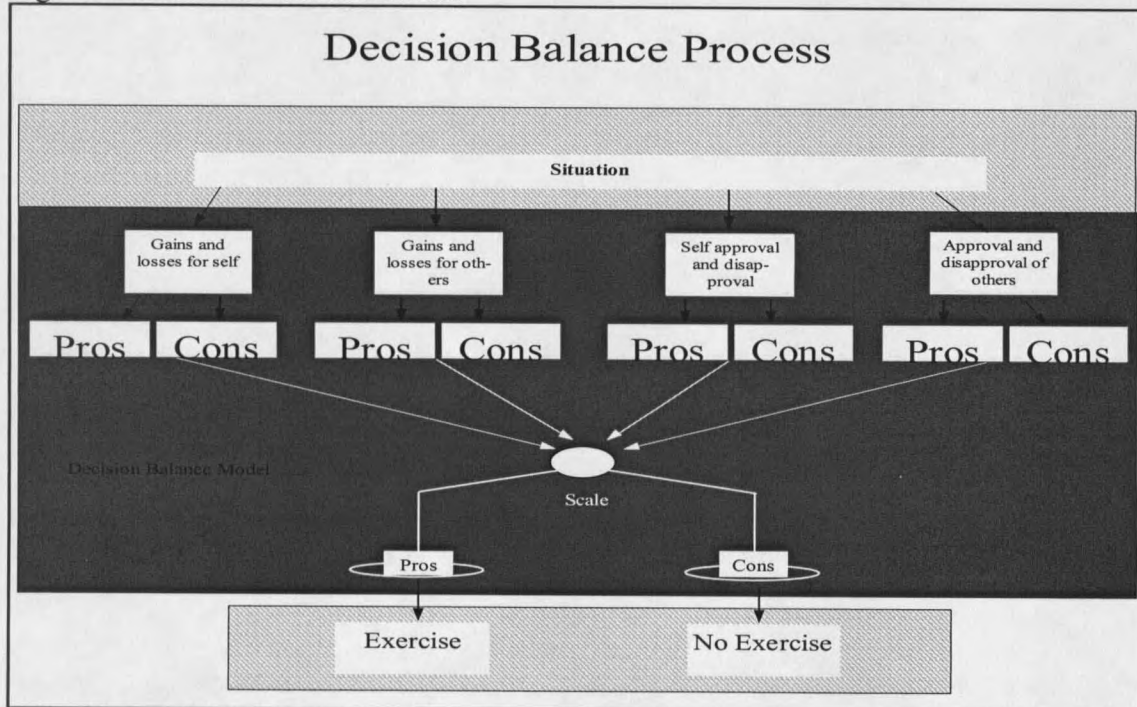
The third category is self-approval or disapproval. The individual considers how his or her decision will align with his or her own deeply rooted norms, self-image, and self-esteem (Janis & Mann, 1977). For example, an individual may contemplate the choice to exercise in his or her free time rather than work overtime. Individuals may have been raised by their parents to believe that exercise would be a selfish pursuit when they

could instead be making more money for their families; therefore, they would not exercise.

In the final category, social approval or disapproval, a decision maker compares the ideas and beliefs of other groups and people with the potential decisions (Janis & Mann, 1977). For example, an individual may contemplate joining a gym that exploits looking physically attractive by showing models doing workouts in their marketing campaigns (television ads, flyers, etc.). Their spouse feels that the commercials are part of the reason that so many people have issues with their own self-image and does not approve of joining such a club. The individual decides not to join the club because he or she knows that his or her spouse would not approve.

Figure 1 outlines the decision balance process based on these four categories.

Figure 1. Decision Balance Process



*Adapted from Janis and Mann's Decision Balance Sheet, 1977

Each of the four areas creates pros and cons to a decision. The pros are placed on one side of a decision balance scale and the cons on the other. When pros outweigh cons a person will decide to exercise. When cons outweigh pros a person will decide not to exercise.

The Need for Modifiers

Within the decision balance model (Figure 1) are causal pathways through which decisions are reached. These pathways are represented in Figure 1 by the arrows that lead from situation to gains and losses for self, gains and losses for others, self-approval and disapproval, and approval and disapproval of others. The pathways are complex and it is difficult to measure them using only the decision balance model. King, Stokols, Talen , Brassington, & Killingsworth (2002) recommended that theoretical models used in health promotion should integrate theory and concepts from other fields such as behavioral economics to improve their effectiveness in modifying exercise behavior. Behavioral economists Kahneman and Tversky (1984) merged concepts from psychology and economics to help understand how people make decisions. They discovered processes called heuristics. Heuristics are mental shortcuts or “rules of thumb” that allow people to make easy and timely decisions. Heuristics are based on the premise that people cannot accurately calculate the probability of the outcomes of their decisions so they estimate the outcomes based on rough approximations.

The heuristics modify the pathways used within the decision balance model by allowing practitioners to more specifically identify the information that individuals use to

make decisions. Kahneman and Tversky have developed a number of heuristics through their past 30 years of research. One specific type of heuristic is called the “availability heuristic.” In the availability heuristic, people bring potential outcomes associated with a decision to mind. The most vivid outcomes come to mind most easily and therefore influence the rough approximations of what the outcome of the decision will be (1984). Kahneman and Tversky call these outcomes “instances and occurrences.” Using the availability heuristic, the instances and occurrences are brought to mind using three mental processes: memory recall, construction, and association.

Memory recall occurs when an individual scans past experiences and recalls the most relevant outcomes related to the current situation. For example, an individual may make a decision not to exercise because he or she recalls embarrassing outcomes from high school physical education class. This is an example of Kahneman’s and Tversky’s (1984) outcomes instances and occurrences.

Using construction, individuals create various outcomes of a particular decision. For example, one who is considering exercise may construct an outcome where he or she begins to exercise and pull a muscle (Kahneman & Tversky, 1984).

The third process is association. In association, a decision maker assesses the strength of association between a choice and an outcome. For instance, for an individual, an association may exist between exercise and respect from friends, where increased exercise is associated with increased respect (Kahneman & Tversky, 1984).

Although heuristics can be useful and often correct, they can produce biased probabilities based on the instances and occurrences that are most easily referenced. If the

improper examples are brought to mind then a faulty outcome will be approximated and incorrect decisions will be made (Kahneman & Tversky, 1984). For example, if an individual with IGT cannot bring an instance or occurrence of diabetes onset to mind, he or she can easily underestimate the severity of becoming diabetic because there is no information to which he or she can refer.

Integrated Conceptual Framework

In Figure 2 Pat has just found he has IGT. The doctor advises him to exercise. He engages in the decision balance process to decide if he will exercise or not exercise. He quickly examines the gains and losses of exercising within the four domains. To increase the speed of his decision he uses the availability heuristic. In each of the four domains, he uses memory search, association, or construction to generate the pros and cons that will feed into the mental balance scale. He may use one, two, or all three of the mental processes in his decision-making. The heuristic channeling provides clear pros and cons to each of the domains that flow into the mental scale. When pros with greater causal significance are placed on the scale, it tilts in favor of the choice to exercise and when the cons with greater causal significance are placed on the scale, it tilts in favor of the decision not to exercise. Based on the side of the scale that has the greatest significant weight a decision is made (Janis & Mann, 1977).

