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Usefulness of an Expanded Health Belief Model With Added Constructs (Self-Efficacy And Ecological System Measures) in Modeling Compliance With Healthy Lifestyle Recommendations in Women With a Recent History of Gestational Diabetes

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USEFULNESS OF AN EXPANDED HEALTH BELIEF MODEL WITH ADDED CONSTRUCTS (SELF-EFFICACY AND ECOLOGICAL SYSTEM MEASURES) IN MODELING COMPLIANCE WITH HEALTHY LIFESTYLE RECOMMENDATIONS IN WOMEN WITH A RECENT HISTORY OF GESTATIONAL DIABETES

by

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ABSTRACT

USEFULNESS OF AN EXPANDED HEALTH BELIEF MODEL
WITH ADDED CONSTRUCTS (SELF-EFFICACY AND ECOLOGICAL SYSTEM MEASURES) IN MODELING COMPLIANCE WITH HEALTHY LIFESTYLE RECOMMENDATIONS IN WOMEN WITH A RECENT HISTORY OF GESTATIONAL DIABETES

Phyllis M. Woodson
Old Dominion University, 2019
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Problem Statement: Gestational diabetes (GDM) has been reported to affect as many as 18% of all pregnancies in the U.S. This diagnosis is costly and presents health risks to both baby and mother. The main risk to the mother with a history of GDM is her increased risk for diabetes which has been estimated at 35% to 60% in the following 10 to 20 years; more recent studies report a 7 to 8 times occurrence in the following 3 to 6 years. It is recommended that lifestyle efforts of eating healthfully and exercise can reduce this risk

Methods: Subjects (*n*=153) from a diabetes in pregnancy clinic with a recent history of GDM completed a mailed 115-question survey (10 completed by phone). Questions assessed diet and exercise behavior, health beliefs, self-efficacy, environmental support, diabetes-related variables, and socio-demographics. Five multivariate logistic regression models were used to test the utility of the Health Belief Model with added constructs in predicting diet and exercise behavior. The models consisted of varying combinations of health beliefs, self-efficacy and environmental factors.

Results: Healthy eating was analyzed in four models, but none were significant. High calorie food/beverage intake was analyzed in four models, all were significant (p < .01). Exercising ≥ 30 min three days or more weekly was analyzed in five models, all were significant (p < .01). Exercising to a sweat three days or more weekly was analyzed in five models and all were significant (p < .01); the two models assessing health beliefs, self-efficacy, and environmental support showed the most strength of prediction of all the models studied. Benefits exceed barriers and self-efficacy showed the highest prediction across all the models studied.

Conclusions: By utilizing an Expanded Health Belief Model with the added constructs, self-efficacy and diabetes-related (family history of diabetes, diagnosed with diabetes) and specific ecological/environmental (social/community support) cues to action, we were able to improve prediction of compliance with healthy lifestyle recommendations in women with a recent history of GDM.

This dissertation is dedicated to my parents, two sisters, one daughter, and her family. It begins with my parents. They were always a good example for us. They promoted strong family values along with integrity, hard work, persistence, good health, ongoing pursuit of education, professional growth, community involvement, happiness, and some adventure. Their efforts to achieve these virtues were mostly positive, rarely negative. I think about them every day, and they know how much they were loved and appreciated. Currently, my life is driven by my amazing, beautiful daughter and her family, who seem to have been there from beginning to end, always important to me in every way and constantly a reminder of what matters in life. They know how important they each are to me. It was my daughter, who, at a very young age, was the first person to encourage me to pursue this degree. My sisters are always a continued good example for me by their kindness, goodness, education and professional achievement, and most importantly, always being there when needed. Gratitude for the above experiences and blessings has been the foundation and support for most of my life's pursuits, ultimately preparing me to start and persevere in the completion of this dissertation and PhD degree.

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Words cannot thank Dr. Harry enough for being not only a wonderful professor in the classroom, but a good motivator with a strategy for developing, managing, and finally bringing to closure a nearly 300 page original study including a created 115-question survey and too many hypotheses to count. Sincerest thanks to Dr Stacey Plichta and Dr Clare Houseman for their valuable and critical guidance in the initial planning and work of this study. Kind thanks to Dr Richardean Benjamin, Associate Dean, for the very important tasks of review and preparation of this document for final submission.

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CHAPTER I

INTRODUCTION

The purpose of this study is to test the usefulness of the Health Belief Model (Rosenstock, 1966) augmented by the self-efficacy construct (Aljasem, Peyrot, Wissow, & Rubin, 2001; Janz & Becker, 1984; Rosenstock, Strecher, & Becker, 1988) and ecological systems measures (Belsky, 1980; Brofenbrenner, 1977, 1979; Eng, Hatch, & Callan, 1985; McLeroy, Bibeau, Steckler, & Glanz, 1988), in predicting compliance with healthy lifestyle recommendations in women with a recent history of gestational diabetes mellitus (GDM). Gestational diabetes or glucose intolerance first recognized during pregnancy (Metzger & Coustan, 1998) is a risk factor for type 2 diabetes. Type 2 diabetes can lead to severe health complications and is costly. The Centers for Disease Control and Prevention (CDC) estimated the cost of diagnosed diabetes in the U.S. to be $245 billion in 2012 (CDC, 2017). More recent estimates of total costs of diagnosed diabetes in the U.S. in 2017 was $327 billion, $237 billion in direct medical costs and $90 billion for reduced productivity (ADA, 2018). The Nurses' Health Study reported that healthful dietary patterns in women with a history of GDM can reduce the risk for type 2 diabetes later in life by as much as 57% (Tobias et al., 2012) and may also reduce the risk for recurrent GDM. Varner et al. (2017) reported that those women with a history of GDM and recurrent GDM were at an increased risk of type 2 diabetes (frequency of 8.0%) 5 to10 years following the index pregnancy; this was associated with body mass index (BMI) or weight. These same authors reported that the frequency of diagnosis of metabolic syndrome for this same postpartum time period was 32.9%. Of concern is

that the diabetes focused postpartum care for women who have a history of GDM is fragmented at best and non-existent at worst.

A history of GDM is a significant risk factor for developing diabetes, and between 40% to 60% of these women will be diagnosed with type 2 diabetes later in life (Kjos et al., 1990; Mestman, 1988). O'Sullivan (1991) states that over 50% of women with GDM are diagnosed with type 2 diabetes within seven years of delivery during the index pregnancy (initial GDM diagnosis). Estimates by the CDC (CDC, 2011) state 35% to 60% of persons with a history of GDM will develop diabetes in 10 to 20 years. Bellamy, Casas, Hingorani, and Williams (2009) estimated that women with a history of GDM have a 7-fold risk of developing diabetes in 5 to 10 years post-partum. The most recent and highest prediction of diabetes following a pregnancy complicated by GDM was reported by Song et al. (2017). These authors reported the findings of a meta-analysis of more than 2 million women from 16 countries: those with a history of GDM were 7 to 8 times more likely to be diagnosed with diabetes 3 to 6 years postpartum and prior to age 40 years. However, little is known about how those women diagnosed with GDM comply with healthy lifestyle recommendations in order to avoid the diagnosis of diabetes.

Description of the Problem

Depending on the population or ethnic group studied, the American Diabetes Association (ADA) reports GDM may affect up to 14% of all pregnancies and occurs in at least 200,000 cases annually in the U.S. (ADA, 2004; Engelgau, Herman, Smith, German, & Aubert, 1995). Estimates indicate GDM could represent 18% of all pregnancies, primarily due to proposed new diagnostic criteria (CDC, 2011). Koning et

al. (2017) estimated these new diagnostic criteria will result in an increase of 45% more women diagnosed with GDM. The new criteria, developed by the International Association of the Diabetes and Pregnancy Study Groups (IADPSG), were adopted by the World Health Organization in 2013.

Overall, 80% to 90% of all cases of diabetes in pregnancy (including pre-existing type 1 and type 2 diabetes) are attributed to GDM only (Coustan, 1995; Lawrence, Contreras, Chen, & Sacks, 2008). Ethnic groups having a higher incidence of GDM include Hispanic American, Native American, Asian American and Pacific Islander, and African-American.

In Metzger and Coustan (1998), GDM is defined as glucose intolerance that is first recognized during pregnancy. This wording allows for the possibility that the hyperglycemia detected during pregnancy was a pre-existing undetected condition. According to the CDC (2003), GDM has similar risk factors as type 2 diabetes. In fact, Langer (1998) referred to individuals with GDM as prediabetics. The CDC (2011) and ADA (2004) identify risk factors for GDM: obesity, prior GDM, glycosuria, family history, of diabetes, ethnicity, 25 years of age or older, and a history of poor obstetrical outcome. It has been reported, however, that approximately 50% of women with GDM do not have risk factors (Lavin, Barden, & Miodovnik, 1981; O'Sullivan, Mahan, & Charles, 1973).

Health Effects of Gestational Diabetes

Individuals with GDM are considered high-risk pregnancies presenting not only fetal risks, but maternal risks as well. The adverse perinatal outcomes associated with GDM and hyperglycemia include macrosomia (defined as birth weight ≥ 4000 gm), birth

trauma (to both baby and mother), shoulder dystocia or incomplete delivery due to impaction of the infant's anterior shoulder against the mother's pubic bone (Lurie, Insler, & Hagay, 1996), cesarean delivery mostly due to cephalopelvic disproportion (Dandrow & O'Sullivan, 1996; Gabbe, Mestman, Freeman, Anderson, & Lowensohn, 1977; Jacobson & Cousins, 1989; Miller, 1983), and respiratory distress syndrome in the infant at birth (O'Sullivan, Mahan, & Dandrow, 1973). The ADA (1996) reports that perinatal mortality or stillbirth is increased in offspring of GDM mothers with hyperglycemia. These maternal and fetal complications of GDM occur at a higher prevalence than in pregnancies uncomplicated by GDM. Major, Henry, de Veciana, and Morgan (1998) report an incidence of 40% to 50% cesarean and 35% to 50% macrosomic infant deliveries by women diagnosed with GDM. Shoulder dystocia is three to seven times more likely (Weeks, Major, de Veciana, & Morgan, 1994), major cardiovascular system defects in the infant are nearly 10 times more prevalent (Becerra, Khoury, Cordero, & Erickson, 1990), and risks for birth defects are doubled in infants of mothers with GDM than in normal pregnancies (Al-Shawaf, Moghraby, & Akiel, 1988). Billionnet et al., (2017) studied gestational diabetes and risks for adverse perinatal outcomes after 28 weeks in 716,152 births in 2012. Findings included: preterm birth (*OR*=1.3), Caesarean section (*OR*=1.4), pre-eclampsia/eclampsia (*OR*=1.7), macrosomia (*OR*=1.8), respiratory distress (*OR*=1.1), birth trauma (*OR*=1.3), and cardiac malformations (*OR*=1.3); higher risks were observed for the baby if the mother was on insulin injections. The risk for perinatal mortality moderately increased for those GDM patients treated by diet only (*OR*=1.3). Other authors cite similar harm to the baby of a GDM pregnancy (Wendland et al., 2012; Wong, Ross, Jalaludin, & Flack, 2013).

There are specific birth defects associated with GDM (Ramos-Arroyo, Rodriguez-Pinilla, and Cordero, 1992). In those mothers requiring insulin during pregnancy, birth defects were 1.9 times more likely to occur than in mothers not requiring insulin. These authors found that risks for malformations of the central nervous system (e.g., neural tube defects) and the cardiovascular system (e.g., transposition of the great vessels) were four and five times more likely, respectively, to occur when insulin was needed. Other birth defects identified include those of the skeletal system (dislocation of the hip and abnormalities of the feet), the genitourinary system (hypospadias), the skin (preauricular tag), and craniofacial defects (cleft lip and cleft palate). The severity of the above findings lead the authors to hypothesize that mothers with GDM requiring insulin may have had undiagnosed type 2 diabetes prior to pregnancy. Indeed, Langer (1998) reports that GDM mothers requiring insulin and individuals with type 2 diabetes are similar in regards to insulin resistance and impaired insulin secretion.

It has been postulated that maternal hyperglycemia leads to fetal hyperglycemia and hyperinsulinemia that may affect fetal growth and development (Pedersen, 1977). This fetal hyperglycemia causing macrosomia at birth may also have lasting effects on the delivered infant including childhood and adult obesity and diabetes (Jovanovic-Peterson, Peterson, & Wilkins, 1990).

The rate of recurrence of GDM in a subsequent pregnancy has been reported to be as high as 69% and 70%, respectively (Foster-Powell & Cheung, 1998; Major, de Veciana, Weeks, & Morgan, 1998). It has been reported (Major et al.) that in women with recurring GDM, 77% required insulin management compared to 21% managed by diet only. Langer (1998), in a review of the literature, supported the common belief that

10% to 15% of patients with GDM will require insulin management; but this assumes rigorous adherence to a management protocol including a planned diet.

Gestational diabetes is a high-risk condition during pregnancy that presents grave risks to the mother and fetus. The severity of the GDM can be predictive of recurrence of the same condition in subsequent pregnancies and the development of type 2 diabetes later in life. A history of GDM is associated with a 7-fold increase in risk for developing overt type 2 diabetes in 5 to 10 years (Bellamy et al., 2009) and over 50% of these women at risk are diagnosed with type 2 diabetes within seven years of delivery during the index pregnancy of initial GDM diagnosis (O'Sullivan, 1991). More importantly, however, from a public health standpoint, is the identification of risk factors associated with GDM and subsequent type 2 diabetes. Recurrent GDM and the development of overt type 2 diabetes later in life can be reduced by identifying patients who may benefit from more intensive and proactive management and lifestyle intervention during pregnancy, the postpartum period, and prior to subsequent pregnancies.

Epidemiology of Type 2 Diabetes

The CDC (2017) provides current statistics on diabetes in the United States. About 9.4% of the population or 30.3 million people have diabetes and of these, 7.2 million persons are undiagnosed. It has been reported in *Diabetes Care* and elsewhere that the incidence of diabetes continues to grow (Mokdad et al., 2001; CDC, 2011) due to the progressive increase in obesity. The CDC (2017) reports over 1.5 million new cases of diabetes are diagnosed each year in persons 18 years or older. In this same age group, females diagnosed with diabetes represent 8.5% of this population, and

males, 9.1%. This same source reported the major ethnic groups and prevalence of diabetes: American Indian 15.1%, Hispanic 12.1%, African American or Black 12.7%, Asian American and Pacific Islander 8%, and Caucasian 7.4%.

It has been reported by the National Institutes of Health (1995, 1997) that the number of persons diagnosed with diabetes showed a six-fold increase from 1958 (1.5 million) to 1997 (10.3 million). By 2010, the incidence of type 2 diabetes was predicted to double worldwide from 119 million to 213 million persons (Beebe, 1999). The CDC (2004) reported that the number of adults with diabetes and GDM has increased 61% since 1991 and is anticipated to double by the year 2050. The alarming rate of growth of type 2 diabetes has been described as an epidemic and a tremendous public health problem. The CDC (2016) reports that the death rate for persons with diabetes is twice as high as for persons without diabetes. Even though diabetes was listed on U.S. death certificates in 2000 as the sixth leading cause of death, it is believed that this disease is underreported both as a condition and as a cause of death.

The statistics for prediabetes are even more alarming: the CDC (2016) states that 86 million adults in the U.S. have prediabetes, 90% don't know it, and that structured lifestyle changes resulting in weight loss could reduce this risk by as much as 58%, well worth any effort undertaken.

More current estimates of the prevalence of diabetes and prediabetes in the U.S. may be as high as 14% for diabetes and 38% for prediabetes, including both diagnosed and undiagnosed (Menke, Casagrande, Geiss, & Cowie, 2015).

Of interest is the finding based on statistics from the CDC that Norfolk, Virginia, was the second most obese urban geographical area in the U.S.; New Orleans,

Louisiana, was number one (Langer, 1998; Dooley, 1997). It would be expected that there could be an association between obesity, GDM, and subsequent risk for development of type 2 diabetes in this urban geographical area.

The CDC (2003) reports that the more common form of diabetes is type *2* diabetes, representing 90% to 95% of all diagnosed cases. Risk factors include history of GDM, advancing age, obesity, family history of diabetes, impaired glucose tolerance, physical inactivity, and ethnicity. While diagnosis is usually made after 40 years of age, type 2 diabetes is increasingly occurring in children and adolescents. The individual is managed by diet and exercise or medication; insulin injections are needed in more than 40% of cases. Type *1* diabetes represents 5% to 10% of all diagnosed cases of diabetes and risk factors include auto immune, genetic, and environmental variables; diagnosis is usually made in children and young adults, but can occur at any age (CDC, 2003). This patient requires insulin injections or other insulin administration. Gestational diabetes is not considered a strong risk factor for type 1 diabetes.

Costs of Diabetes and Gestational Diabetes

Recent estimates of total costs of diagnosed diabetes in the U.S. in 2017 was $327 billion, $237 billion in direct medical costs and $90 billion for reduced productivity (ADA, 2018). The annual medical costs for the individual with diagnosed diabetes is 2.3 times higher than costs for an individual without diabetes. Diabetes is not only a disease with tremendous quality of health and life effects, but is a great financial burden on the health care system in this country.

The costs for GDM are also staggering. Chen et al. (2009) reported that medical costs for the GDM pregnancy was $3,305 with an additional cost of $209 for the baby

during the first year. Conservative estimates of medical costs for GDM in the U.S. in 2007 was $636 million, $596 million due to maternal costs and $40 million due to neonatal costs. It is estimated that 36% of these expenditures were covered by the government (Medicaid), 56% covered by private insurance, and the remaining 8% was self-pay or charity.

Health Effects of Diabetes

Diabetes mellitus is a metabolic disease characterized by hyperglycemia or elevated blood glucose resulting from inadequate secretion or utilization of the hormone insulin that is produced by the pancreas (ADA, 2004). Insulin is needed by the body to help transport glucose into the cells where it is then converted into energy for daily life. The chronic hyperglycemia associated with untreated diabetes is associated with long-term damage to the eyes, kidneys, nerves, and blood vessels. Individuals with diabetes can, however, make lifestyle changes in order to reduce their risk for these complications.

Complications of diabetes include damage to the eyes or retinopathy, resulting in the growth of new blood vessels on the retina, which can lead to blindness. Diabetes is the leading cause of new cases of blindness each year in individuals 20 to 74 years of age (ADA, 2017). Prevalence of retinopathy is directly related to duration of diabetes and glycemic control. Other eye conditions such as cataracts and glaucoma are more common in those diagnosed with diabetes.

The ADA (2004, S79-83) reports that diabetes-induced nephropathy is the most common cause of end-stage renal disease in the U.S. and Europe primarily due to the increased prevalence of type 2 diabetes and the fact that persons with diabetes are now

living longer. Individuals with type 2 diabetes represent over half of these persons, diabetes is considered the main cause of end-stage renal disease, and commonly occurs after 10 years duration of diabetes. Murphy et al. (2016), report that of persons diagnosed with diabetes, 36.5% have chronic kidney disease.

The CDC (2003) reported that about 60% to 70% of persons with diabetes have neuropathy or nervous system damage. This can cause impaired sensation or pain in the hands or feet and can contribute to carpal tunnel, digestion problems, and lower extremity amputations. More than 60% of all amputations of the lower limbs in the U.S. occur in individuals with diabetes. The CDC (2017) reports that 5 per 1,000 persons with diabetes will experience a lower-extremity amputation. The ADA (2017) states that neuropathy is related to cardiac autonomic neuropathy, genitourinary disturbances, and orthostatic hypotension. Currently the only treatment other than medication is improved glycemic control.

Heart disease is the leading cause of death in the U.S., but in persons with diabetes, the rate is 2 to 4 times as high (CDC, 2003). The CDC also reports that the incidence of stroke is 2 to 4 times higher in individuals with diabetes and 73% of this same population has elevated blood pressure. Atherosclerotic cardiovascular disease is the leading cause of death and morbidity in persons with diabetes and the main contributor to direct and indirect costs of diabetes in the U.S. (ADA, 2017). Diabetes is damaging to blood vessels and leads to the above-described premature aging processes. Diabetes takes away not only health, but quality of life, and is a tremendous financial burden on the health care system of the U.S.

As the above documentation shows, type 2 diabetes is a severe disease state affecting quality of health, quality of life, and exacting tremendous health care costs. A risk factor for type 2 diabetes is GDM, beset with its own maternal and fetal risks. Identification of socio-demographic and diabetes-related variables and community resource variables associated with compliance with healthy lifestyle recommendations may help identify individuals needing lifestyle intervention (medical nutrition therapy, weight management, exercise, and behavior modification) not only in the present pregnancy, but in the immediate postpartum period as well in order to prevent recurring GDM in subsequent pregnancies and possibly type 2 diabetes later in life.

Compliance With Healthy Lifestyle Recommendations:

Individual Variables

The ADA (2004) identifies clinical practice guidelines for the management of diabetes. These include diet recommendations, exercise, and self-monitoring of blood glucose in order to achieve and maintain blood glucose, lipid, and weight management goals. If lifestyle changes do not enable achievement of these goals, then pharmacological intervention or oral medication for type 2 diabetes becomes necessary. Over 40% of individuals with type 2 diabetes will require insulin management. Many studies have shown the value of close management of diabetes, and one of the largest and longest studies of type 2 diabetes individuals, UK Prospective Diabetes Study Group, shows that improved glycemic control may reduce the risk for complications of diabetes (ADA, 2004; UK Prospective Diabetes Study Group, 1998). Another study (Diabetes Prevention Program Research Group, 2002), launched by the National Institute of Diabetes and Digestive and Kidney Diseases, investigated the effects of

healthy lifestyle and pharmacological interventions on prevention of diabetes in 3,234 individuals with impaired glucose tolerance. This study found that lifestyle interventions of diet, exercise, and modest weight loss reduced the risks for type 2 diabetes by 58% in less than three years.

On-going compliance with healthy lifestyle recommendations in order to prevent diabetes is, however, difficult. For most patients, especially for women with a history of GDM, postpartum care is fragmented and often neglected (Simon, 2001). Much research has been directed at better understanding compliance behaviors of individuals with diabetes or who are at risk for diabetes. There are many theories regarding human behavior and compliance with healthy lifestyle recommendations. In this instance the behavior of interest is continued compliance with healthy lifestyle recommendations made during GDM in order to avoid the development of type 2 diabetes later in life.

It has been reported that as many as 80% of all patients do not follow through with at least one element of their recommended regimen (Rosenstock, 1988). In general, there is less compliance with regimens involving more lifestyle change. Diet and exercise are the foundation of most healthy lifestyle change recommendations, especially for diabetes management and the prevention of type 2 diabetes. Making lifestyle changes are further complicated by health beliefs and health behaviors that are affected by ethnic, socioeconomic, and cultural factors. Psychosocial characteristics of the individual may also affect health behaviors. These effects most likely indirectly affect the metabolic condition by directly affecting the compliance behavior.

Compliance With Healthy Lifestyle Recommendations:

Community Variables

McLeroy et al. (1988) present a variation of Brofenbrenner's (1977, 1979) and Belsky's (1980) work in their ecological model which postulates that behavior is an outcome of intra-personal factors (knowledge, attitudes, behavior, skills, and personal history), inter-personal processes and groups (formal and informal social networks including family, friends, and work), institutional factors (social organizations with formal and informal structure), community factors (relationships among organizations and institutions), and public policy (local, state, and national laws and policies). This research recognizes the importance of individual variables as well as community resource variables available to the individual in either supporting or not supporting the behavior of interest. That these community variables can be social or mandated by public policy allows an exploration of the community and all its components--family and friends of the individual; the church; retail sales; schools and universities; the workplace; and city, state, or national facilities in the community. Any or all of these institutions either singularly or by interaction may affect the behavior of the individual by presenting either supports for or barriers to the desired behavior.

Purpose of the Study

The specific goal of this study is to test the usefulness of the Health Belief Model with an added component, self-efficacy, i.e. Expanded Health Belief Model, in predicting compliance with healthy lifestyle recommendations in women with a recent history of GDM in order to reduce the risk for recurrent GDM and the development of type 2 diabetes later in life. Towards that end, this study will also identify individual level socio-

demographic and diabetes-related variables in predicting compliance with these healthy lifestyle recommendations. An ecological systems model representing specific community level resource variables predicting compliance with these recommendations will also be utilized.

It is postulated that the identification of these predictive variables in our patient population will enable more intensive antenatal and postpartum clinical interaction with certified diabetes educators providing medical nutrition therapy, exercise, and behavior modification. This in turn, may well have a positive impact on reduction of gestational diabetes recurrence or overt type 2 diabetes development in these patients later in life.

Significance of the Study

As documented in the previous sections, diabetes and its more prevalent form, type 2 diabetes, have tremendous health burdens and costs in the U.S. A strong risk factor for type 2 diabetes is GDM, considered a high-risk pregnancy and beset with its own maternal and fetal risk factors. Most of the reported research has studied risk factors for recurrence of GDM in specific patient populations. In addition, there is no known research identifying socio-demographic, diabetes-related, and perception variables as well as community resource variables that may be associated with compliance by the post GDM patient with healthy lifestyle recommendations in order to reduce the risk for type 2 diabetes. These findings may enhance the intervention efforts of certified diabetes educators during pregnancy and the postpartum period in order to reduce the risks for recurrence of GDM in subsequent pregnancies and the development in later life of type 2 diabetes and its extreme health and financial costs.

Theoretical Framework

This study employs the Health Belief Model (HBM) (Rosenstock, 1966), as shown in Figure 1 as the theoretical framework for modeling behavior in women who have had GDM. This model presents health behavior as influenced by the threat of illness (perceived susceptibility and severity), belief in efficacy of behavior to reduce this threat, estimates of perceived barriers or costs of the proposed behavior, and a stimulus or cue to action. Demographic or socio-psychological variables may influence perceptions, but

Figure 1. The Health Belief Model as a Predictor of Preventive Health Behavior

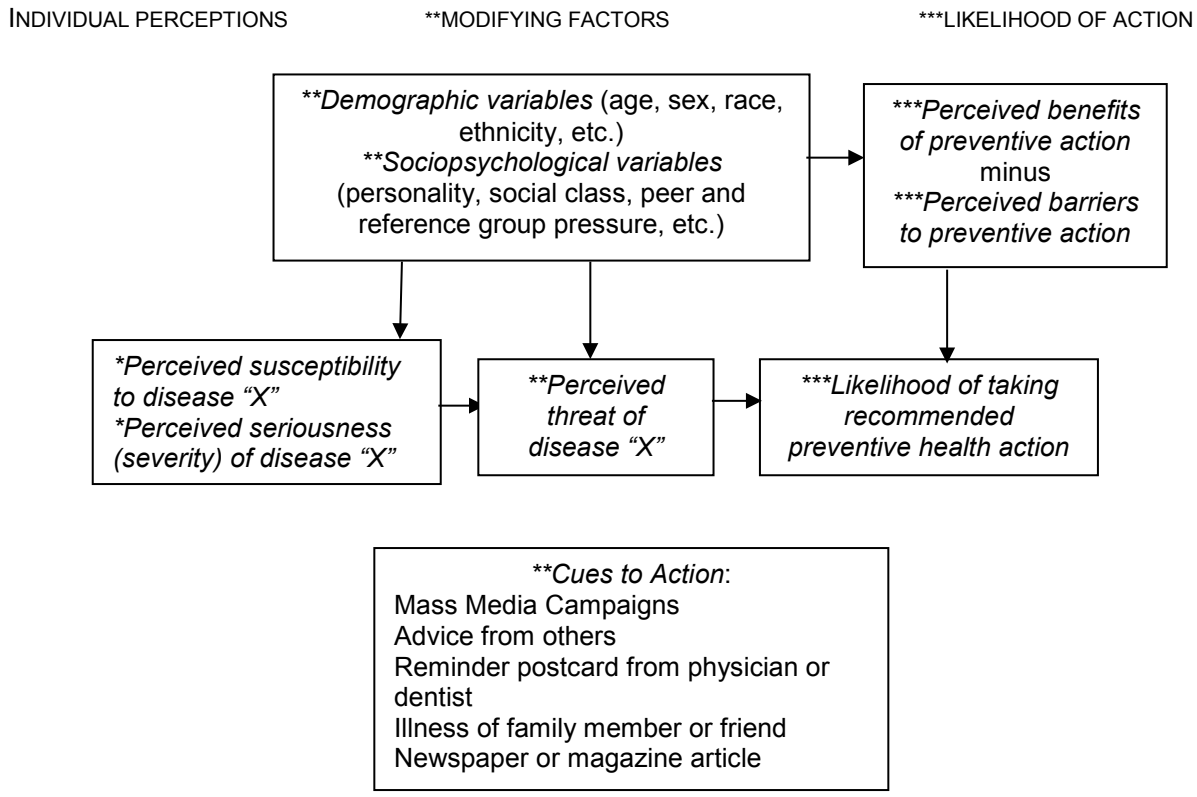


Figure 1. Source: Rosenstock, 1966.

were not thought to be directly responsible for the desired health behavior. In the case of gestational diabetes and its attendant risk factors for type 2 diabetes, the HBM could

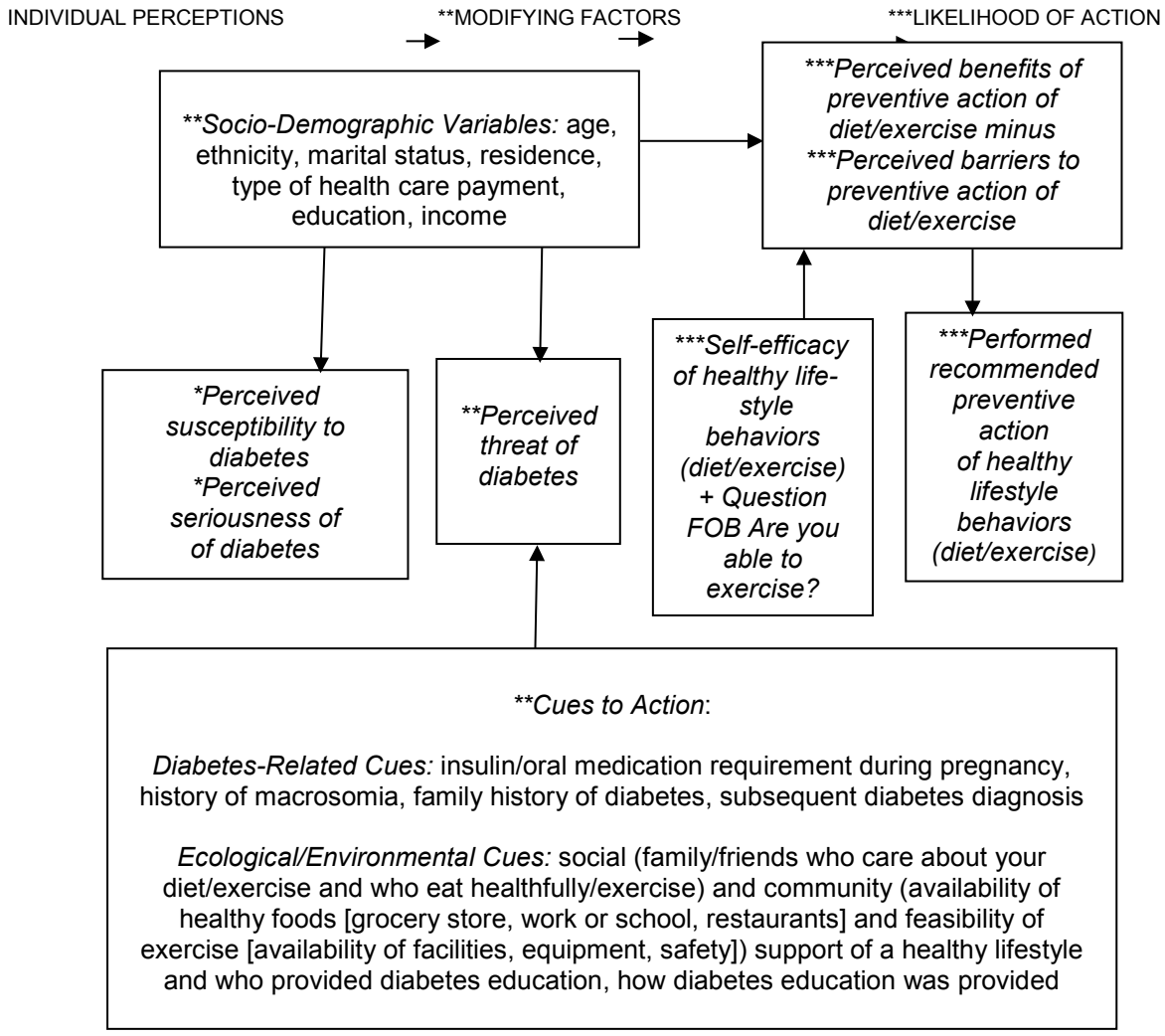
be utilized as a theoretical framework for behavior change. The threat of type 2 diabetes (susceptibility and seriousness); the belief that preventive measures (eating healthfully and exercise) would reduce this threat; the estimates of costs or barriers (time, effort, and resources needed to achieve these health actions and maintain them); and the cues to action (insulin or oral medication requirement during GDM, history of macrosomia, family history of diabetes, subsequent diagnosis of diabetes, and the ecological systems measures of social and environmental support) represent the key components of the model.

Self-efficacy theory, grounded in social cognitive or learning theory in psychology (Bandura, 1977a, b), is based on knowledge, belief in one's ability, behavior skills in problematic situations, and one's motivation for change. The self-efficacy concept, which is central to social learning theory, indicates the confidence one has in the ability to perform a behavior, how long the behavior is continued, and how much effort is put forth in achieving the behavior (Bandura, 1977a).

Rosenstock et al. (1988) incorporated Bandura's self-efficacy theory (1977a) into the Health Belief Model since on-going compliance with healthy lifestyle recommendations to reduce the risk of disease requires confidence in one's ability to do so. Thus as the Health Belief Model postulates, an individual wanting to reduce the threat of disease must have an incentive to act, be aware of the susceptibility or severity of the looming disease, and feel that effort will be beneficial at a reasonable cost. However, as these authors submit, the individual must also have self-efficacy or confidence in his or her ability to initiate and continue the work of healthy lifestyle practices. The authors recommend that self-efficacy not be included in barriers or the

"catch-all" category, but stand alone as a precursor to behavior change. In the present study, a compromise is suggested; self-efficacy is shown in Figure 2 standing alone as the authors suggest, but having an influence on perception of barriers, since it has been written that having self-efficacy decreases the perception of barriers and having less self-efficacy increases the perception of barriers (Strecher & Rosenstock, 1997). This study proposes that this Expanded Health Belief Model including self-efficacy and the cues to action (insulin or oral medication requirement during GDM, history of

Figure 2. The Expanded Health Belief Model as a Predictor of Preventive Health



macrosomia, family history of diabetes, and the subsequent diagnosis of diabetes; and the specific ecological/environmental systems measures of social and community support including how the diabetes education was presented) be constructed as shown in Figure 2. Due to space restrictions, the term “diet” will replace the more lengthy phrase, “eating healthfully”.

Dependent and Independent Variables.

The dependent variables in this Expanded Health Belief Model are measures of healthy lifestyle behaviors such as eating healthfully and exercising in order to not gain weight over time. The independent variables in this model include: perceived susceptibility to diabetes, perceived seriousness or severity of complications from diabetes should diabetes be diagnosed, perceived benefits of healthy lifestyle behaviors in order to prevent diabetes, perceived barriers to these healthy lifestyle behaviors, and perceived self-efficacy in performing these healthy lifestyle behaviors. Cues to action in the model include: insulin or oral medication requirement during GDM, history of macrosomia, family history of diabetes, subsequent diagnosis of diabetes, and the ecological/environmental variables of social and community support (the diabetes-related variables, who provided the GDM education, how was the education provided, group or individual). The intervening socio-demographic variables included age, ethnicity, marital status, residence, type of health care payment, education, and income.

Assumptions

It is assumed that all the information on the database is objective and accurate since it was taken directly from the GDM patient’s medical record. A registered nurse or registered dietitian transferred information from the medical record to the database as

each patient was admitted to the practice with frequent updates as necessary. The database used for this research includes only delivered patients. Pregnancy outcome information is reported by the patient.

It is assumed that the survey was valid and reliable. It is assumed that the persons completing the survey did so truthfully.

Limitations of the Study

The study population was limited to GDM patients listed in the Maternal-Fetal Medicine (MFM) practice database. This research was a retrospective study with no control group. Outcome data was collected only at one point, at least one year postpartum. However, for studies of this type, it may be impractical to have executed it within a more experimental design. Attitudes of the patients toward the pregnancy may have affected pregnancy outcome and subsequent postpartum health behaviors and these were not assessed. Responses regarding the outcome variable, eating healthfully, includes self-reported consumption of carbohydrate foods; this may have been influenced by the current interest of the general population in “lower carbohydrate diets”. The response of the patients may have been influenced by social desirability bias; the patients may have responded to the questions regarding diet and exercise according to what they thought they should be doing. Reliability and validity of the information can only be assumed; however, a check of randomly selected database information with the corresponding medical record was performed to ensure accuracy of the transferred information onto the database. Generalizing study results is limited to high-risk GDM pregnancies in urban geographical areas. The Hampton Roads Planning District Commission (1999) defined urban according to the U.S. Census Bureau (1995)

as any place of 2,500 or more persons unincorporated or incorporated as a city, village, borough (except in Alaska and New York), and town (except in the six states considered New England, New York, and Wisconsin). The study population served meets the above urban definition.

Delimitations include: patients in this study came from the MFM practice of Eastern Virginia Medical School, and includes the Norfolk, Virginia Beach, and Riverside sites. Patients from other clinics or practices in this geographical area were not included. Only patients diagnosed with GDM were included in this study. Patients with type 1 and type 2 diabetes preconception or pre diabetes (borderline diabetes) were not included.

Definition of Terms

(a) Gestational diabetes mellitus (GDM) is defined as elevated blood glucose first identified during pregnancy; in most cases the elevated blood glucose returns to normal upon delivery. GDM is controlled by diet, oral medication, or insulin injections.

(b) Extent of prenatal care received is defined as consult (initial assessment, treatment, and necessary follow-up for GDM management provided by MFM; other prenatal care provided by the referring physician), co-manage (GDM management provided by MFM with prenatal care provided by referring physician), or full care (GDM management and prenatal care provided entirely by MFM).

(c) Subsequent GDM is defined as having the diagnosis of GDM in a pregnancy following a previous pregnancy complicated by GDM.

(d) Subsequent diagnosis of diabetes is defined as being diagnosed with diabetes following GDM.

(e) Family history of diabetes is defined as having a blood relative diagnosed with diabetes.

(f) History of GDM is defined as a diagnosis of GDM in a previous pregnancy.

(g) Macrosomic infant is defined as delivery of infant weighing ≥4000 g (8.8 lb)

(h) From current weight and height, body mass index (BMI) will be determined. BMI = weight in kg ÷ height in m^2. BMI will be classified according to the National Heart, Lung, and Blood Institute (1998) as:

< 18.5	(underweight)
18.5-24.9	(normal)
25.0-29.9	(overweight)
30.0-34.9	(obesity class I)
35.0-39.9	(obesity class II)
≥ 40.0	(extreme obesity or class III)

(i) Weight gain is defined as any gain in weight since the last pregnancy.

(j) Glucola screen is defined as the blood plasma glucose value obtained after a 1-hr 50-g glucose load administered in a fasting state.

(k) Oral glucose tolerance test (OGTT) is defined as the blood plasma glucose values obtained after fasting (no food or drink except water for eight hr), and at one hr, two hr, and three hr after drinking a 100-g glucose load.

(l) Medical nutrition therapy provided by a registered dietitian (RD) is defined as nutrition counseling provided by a registered dietitian according to clinical

practice guidelines of the Academy of Nutrition and Dietetics (formerly the American Dietetic Association) and the American Diabetes Association (ADA, 2004).

(m) Certified diabetes educator (CDE) is defined as an eligible registered nurse, registered dietitian, or other qualified health care professional who has written and passed a national test in patient diabetes education offered by the National Certification Board of Diabetes Educators with required re-certification every five years.

(n) GDM MFM patient database is defined as the record of all non-delivered and delivered GDM patients who received prenatal care at MFM. Information for the database is taken directly from the medical record of each patient and contains demographic and clinical data. It is an ongoing record of all GDM patients seen at MFM since 1997.

(o) Individual or 1:1 GDM education is the GDM education program presented by the CDE registered nurse or the CDE registered dietitian to one patient.

(p) Group GDM education is the GDM education program presented by the CDE registered nurse or the CDE registered dietitian to a group of two or more patients.

(q) Ecological or environmental variables include social (family and friends) and community (neighborhood, school, work, grocery stores, and restaurants) support systems of the individual.

Research Questions

The purpose of this study is to test the hypothesis that an Expanded Health Belief Model with the added variable, self-efficacy, and the cues to action (insulin requirement during GDM, history of macrosomia, family history of diabetes, subsequent diagnosis of diabetes, and the specific ecological variables of social and community support) will be useful in predicting compliance with healthy lifestyle recommendations in women with a recent history of GDM in order to reduce the risk for recurrent GDM and the development of type 2 diabetes later in life.

1. Is the Health Belief Model useful in predicting healthy lifestyle behaviors?
2. Does adding the variable, self-efficacy, improve the Health Belief Model's usefulness in predicting healthy lifestyle behaviors?
3. Do the cues to action, insulin requirement during GDM, history of macrosomia, family history of diabetes, subsequent diagnosis of diabetes, and the specific ecological variables of social and community support improve the Health Belief Model's usefulness in predicting healthy lifestyle behaviors?
4. Do the intervening socio-demographic and diabetes-related variables improve the Health Belief Model's usefulness in predicting healthy lifestyle behaviors?

Study Hypotheses

Main Hypotheses

The Expanded Health Belief Model will predict compliance with healthy lifestyle recommendations in women with a recent history of gestational diabetes. The self-efficacy construct and ecological systems measures, the cue to action, will improve the

Health Belief Model's ability to predict preventive health behaviors; this prediction will still be evident when controlling for other constructs or variables in the model.

1. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to comply with healthy lifestyle recommendations.
2. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to comply with healthy lifestyle recommendations.
3. Individuals who have a greater perception of benefits of a healthy lifestyle will be significantly more likely to comply with healthy lifestyle recommendations.
4. Individuals who have a greater perception of barriers to a healthy lifestyle will be significantly less likely to comply with healthy lifestyle recommendations.
5. Individuals who have higher diet self-efficacy will be significantly more likely to comply with the recommendation to eat healthfully.
6. Individuals who have higher exercise self-efficacy will be significantly more likely to comply with the recommendation to exercise.
7. Individuals who have the diabetes-related cues to action (insulin requirement during pregnancy, history of a macrosomic infant, family history of diabetes, and subsequent diagnosis of diabetes) will be significantly more likely to comply with healthy lifestyle recommendations.
8. Individuals who have the specific ecological/environmental cues to action (social support of family or friends who care about their diet and exercise and who eat healthfully and exercise and community support of availability of healthy foods at the grocery store, work or school, and restaurants, and availability of exercise

facilities and safety of exercise) will be significantly more likely to comply with healthy lifestyle recommendations.

9. Socio-Demographic variables*:* Individuals who are older, married, live in an urban/suburban area but not in Portsmouth, and who have health insurance, more education, and more income will be significantly more likely to comply with healthy lifestyle recommendations; ethnicity will not make a difference in this compliance.
10. Diabetes-related variables: individuals who received GDM education from the dietitian and who received group GDM education will be significantly more likely to comply with healthy lifestyle recommendations.

Bivariate Hypotheses. Health Belief Model Constructs (Susceptibility, Seriousness, Benefits, and Barriers)

1.a. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to eat healthfully.

1.a.1. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to have a higher score on the Healthy Eating Index.

1.a.2. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to have a higher score for intake of high calorie food or beverage.

1.b. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to exercise.

1.b.1. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to do 30 min or more of physical activity three or more days a week.

1.b.2. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to work out enough to sweat three or more days a week.

1.b.3. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to "work-in" other types of exercise three or more days a week.

2.a. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to eat healthfully.

2.a.1. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to have a higher score on the Healthy Eating Index.

2.a.2. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to have a higher score for intake of high calorie food or beverage.

2.b. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to exercise.

2.b.1. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to do 30 min or more of physical activity three or more days a week.

2.b.2. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to work out enough to sweat three or more days a week.

2.b.3. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to "work-in" other types of exercise three or more days a week.

3.a. Individuals who have a greater perception of benefits of eating healthfully will be significantly more likely to eat healthfully.

3.a.1. Individuals who have a greater perception of benefits of eating healthfully will be significantly more likely to have a higher score on the Healthy Eating Index.

3.a.2. Individuals who have a greater perception of benefits of eating healthfully will be significantly more likely to have a higher score for intake of high calorie food or beverage.

3.b. Individuals who have a greater perception of benefits of exercising will be significantly more likely to exercise.

3.b.1. Individuals who have a greater perception of benefits of exercising will be significantly more likely to do 30 min or more of physical activity three or more days a week.

3.b.2. Individuals who have a greater perception of benefits of exercising will be significantly more likely to work out enough to sweat three or more days a week.

3.b.3. Individuals who have a greater perception of benefits of exercising will be significantly more likely to “work- in” other types of exercise three or more days a week.

4.a. Individuals who have a greater perception of barriers to diet will be significantly less likely to eat healthfully.

4.a.1. Individuals who have a greater perception of barriers to diet will be significantly more likely to have a lower score on the Healthy Eating Index.

4.a.2. Individuals who have a greater perception of barriers to diet will be significantly more likely to have a lower score for intake of high calorie food or

beverage.

4.b. Individuals who have a greater perception of barriers to exercise will be significantly less likely to exercise.

4.b.1. Individuals who have a greater perception of barriers to exercise will be significantly less likely to do 30 min or more of physical activity three or more days a week.

4.b.2. Individuals who have a greater perception of barriers to exercise will be significantly less likely to work out enough to sweat three or more days a week.

4.b.3. Individuals who have a greater perception of barriers to exercise will be significantly less likely to “work-in” other types of exercise three or more days a week.

4.c. Individuals who have a greater perception of benefits of minus barriers to diet will be significantly more likely to eat healthfully.

4.c.1. Individuals who have a greater perception of benefit of minus barriers to diet will be significantly more likely to have a higher score on the Healthy Eating Index.

4.c.2. Individuals who have a greater perception of benefit of minus barriers to diet will be significantly more likely to have a higher score for intake of high calorie food or beverage.

4.d. Individuals who have a greater perception of benefits of minus barriers to exercise will be significantly more likely to exercise.

4.d.1. Individuals who have a greater perception of benefits of minus barriers to exercise will be significantly more likely to do 30 min or more of physical activity three or more days a week.

4.d.2. Individuals who have a greater perception of benefits of minus barriers to exercise will be significantly more likely to work out enough to sweat three or more days a week.

4.d.3. Individuals who have a greater perception of benefits of minus barriers to exercise will be significantly more likely to "work-in" other types of exercise three or more days a week.

Self-Efficacy Constructs (Diet and Exercise)

5.a. Individuals who have higher diet self-efficacy will be significantly more likely to eat healthfully.

5.a.1. Individuals who have higher diet self-efficacy will be significantly more likely to have a higher score on the Healthy Eating Index.

5.a.2. Individuals who have higher diet self-efficacy will be significantly more likely to have a higher score for intake of high calorie food or beverage.

5.b. Individuals who have higher exercise self-efficacy will be significantly more likely to exercise.

5.b.1. Individuals who have higher exercise self-efficacy will be significantly more like to do 30 min or more of physical activity three or more days a week.

5.b.2. Individuals who have higher exercise self-efficacy will be significantly more likely to work out enough to sweat three or more days a week.

5.b.3. Individuals who have higher exercise self-efficacy will be significantly more likely to "work-in" other types of exercise three or more days a week.

Diabetes-Related Cues to Action

6.a. Individuals requiring medication during pregnancy will be significantly more likely than individuals not requiring medication to eat healthfully.

6.a.1. Individuals requiring medication during pregnancy will be significantly more likely to have a higher score on the Healthy Eating Index.

6.a.2. Individuals requiring medication during pregnancy will be significantly more likely to have a higher score for intake of high calorie food or beverage.

6.b. Individuals requiring medication during pregnancy will be significantly more likely than individuals not requiring medication to exercise.

6.b.1. Individuals requiring medication during pregnancy will be significantly more likely to do 30 min or more of physical activity three or more days a week.

6.b.2. Individuals requiring medication during pregnancy will be significantly more likely to work out enough to sweat three or more days a week.

6.b.3. Individuals requiring medication during pregnancy will be significantly more likely to “work-in” other types of exercise three or more days a week.

7.a. Individuals who have delivered a macrosomic infant will be significantly more likely than individuals who have not delivered a macrosomic infant to eat healthfully.

7.a.1. Individuals who have delivered a macrosomic infant will be significantly more likely to have a higher score on the Healthy Eating Index.

7.a.2. Individuals who have delivered a macrosomic infant will be significantly more likely to have a higher score for intake of high calorie food or beverage.

7.b. Individuals who have delivered a macrosomic infant will be significantly more

likely than individuals who have not delivered a macrosomic infant to exercise.

7.b.1 Individuals who have delivered a macrosomic infant will be significantly more likely to do 30 min or more of physical activity three or more days a week.

7.b.2. Individuals who have delivered a macrosomic infant will be significantly more likely to work out enough to sweat three or more days a week.

7.b.3 Individuals who have delivered a macrosomic infant will be significantly more likely to "work-in" other types of exercise three or more days a week.

8.a. Individuals who have a family history of diabetes will be significantly more likely than individuals who have no family history of diabetes to eat healthfully.

8.a.1. Individuals who have a family history of diabetes will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis was rejected. There was no significant relationship (Table 12).

8.a.2. Individuals who have a family history of diabetes will be significantly more likely to have a higher score for intake of high calorie food or beverage.

8.b. Individuals who have a family history of diabetes will be significantly more likely than individuals who have no family history of diabetes to exercise.

8.b.1. Individuals who have a family history of diabetes will be significantly more likely to do 30 min or more of physical activity three or more days a week.

8.b.2. Individuals who have a family history of diabetes will be significantly more likely to work out enough to sweat three or more days a week.

8.b.3. Individuals who have a family history of diabetes will be significantly more likely to "work-in" other types of exercise three or more days a week.

9.a. Individuals subsequently diagnosed with diabetes post pregnancy will be significantly more likely to eat healthfully.

9.a.1. Individuals subsequently diagnosed with diabetes will be significantly more likely to have a higher score on the Healthy Eating Index.

9.a.2. Individuals subsequently diagnosed with diabetes will be significantly more likely to have a higher score for intake of high calorie food or beverage.

9.b. Individuals subsequently diagnosed with diabetes post pregnancy will be significantly more likely to exercise.

9.b.1. Individuals subsequently diagnosed with diabetes will be significantly more likely to do 30 min or more of physical activity three or more days a week.

9.b.2. Individuals subsequently diagnosed with diabetes will be significantly more likely to work out enough to sweat three or more days a week.

9.b.3. Individuals subsequently diagnosed with diabetes will be significantly more likely to "work-in" other types of exercise three or more days a week.

Ecological/Environmental Cues to Action

10.a. Individuals who have family or friends who care that they eat healthfully will be significantly more likely than those who do not have this social support to eat healthfully.

10.a.1. Individuals who have family or friends who care that they eat healthfully will be significantly more likely to have a higher score on the Healthy Eating Index.

10.a.2. Individuals who have family or friends who care that they eat healthfully will be significantly more likely to have a higher score for intake of high calorie food or beverage.

10.b. Individuals who have family or friends who care about their exercise will be significantly more likely than those who do not have this social support to exercise.

10.b.1. Individuals who have family or friends who care about their exercise will be significantly more likely to do 30 min or more of physical activity three or more days a week.

10.b.2. Individuals who have family or friends who care about their exercise will be significantly more likely to work out enough to sweat three or more days a week.

10.b.3. Individuals who have family or friends who care about their exercise will be significantly more likely to "work-in" other types of exercise three or more days a week.

11.a. Individuals who know family or friends who eat healthfully will be significantly more likely than those who do not have this social support to eat healthfully.

11.a.1. Individuals who know family or friends who eat healthfully will be significantly more likely to have a higher score on the Healthy Eating Index.

11.a.2. Individuals who know family or friends who eat healthfully will be significantly more likely to have a higher score for intake of high calorie food or beverage

11.b Individuals who know family or friends who exercise will be significantly more likely than those who do not have this social support to exercise.

11.b.1. Individuals who know family or friends who exercise will be significantly more likely to do 30 min or more of physical activity three or more days a week.

11.b.2. Individuals who know family or friends who exercise will be significantly more likely to exercise to sweat three or more days a week.

11.b.3. Individuals who know family or friends who exercise will be significantly more likely to "work-in" other types of exercise three or more days a week.

12. Individuals who report that healthy foods are available at the grocery store will be significantly more likely than those who do not have this community support to eat healthfully.

12.a.1. Individuals who report that healthy foods are available at the grocery store will be significantly more likely to have a higher score on the Healthy Eating Index.

12.a.2. Individuals who report that healthy foods are available at the grocery store will be significantly more likely to have a higher score for intake of high calorie food or beverage.

13. Individuals who report that healthy foods are available at work or school will be significantly more likely than those who do not have this community support to eat healthfully.

13.a.1. Individuals who report that healthy foods are available at work or school will be significantly more likely to have a higher score on the Healthy Eating Index.

13.a.2. Individuals who report that healthy foods are available at work or school will be significantly more likely to have a higher score for intake of high calorie food or beverage.

14. Individuals who report that healthy foods are available at restaurants will be significantly more likely than those who do not have this community support to eat healthfully.

14.a.1. Individuals who report that healthy foods are available at restaurants will significantly more likely to have a higher score on the Healthy Eating Index.

14.a.2. Individuals who report that healthy foods are available at restaurants will be significantly more likely to have a higher score on high calorie food/beverage intake.

15. Individuals who report that exercise facilities are available in their environment will be significantly more likely than those who do not have this community support to exercise.

15.a.1. Individuals who report that exercise facilities are available will be significantly more likely to do 30 min or more of physical activity three or more days a week.

15.a.2. Individuals who report that exercise facilities are available will be significantly more likely to work out enough to sweat three or more days a week.

15.a.3. Individuals who report that exercise facilities are available will be significantly more likely to “work-in” other types of exercise three or more days a week.

16. Individuals who report that exercise is safe in their environment will significantly more likely than those who do not have this community support to exercise.

16.a.1. Individuals who report that exercise is safe will be significantly more likely to do 30 min or more of physical activity three or more days a week.

16.a.2. Individuals who report that exercise is safe will be significantly more likely to work out enough to sweat three or more days a week.

16.a.3. Individuals who report that exercise is safe will be significantly more likely to “work-in” other types of exercise three or more days a week.

17. Individuals who report child care issues (for example, no child care) will be significantly less likely than those who do not have this support to exercise.

17.a.1. Individuals who report child care issues will be significantly less likely to do 30 min or more of physical activity three or more days a week.

However, there was a significant relationship between those individuals reporting no child care issues and 30 min or more of physical activity three or more days a week.

17.a.2. Individuals who report child care issues will be significantly less likely to work out enough to sweat three or more days a week.

However, there was a significant relationship between reporting no child care issues and working out enough to sweat three or more days a week (Table 13).

17.a.3. Individuals who report child care issues will be significantly less likely to "work-in" other types of exercise three or more days a week.

Diabetes-Related Variables

18.a. Individuals who received GDM education from the dietitian will be significantly more likely than individuals who received GDM education from the nurse to eat healthfully.

18.a.1. Individuals who received GDM education from the dietitian will be significantly more likely to have a higher score on the Healthy Eating Index.

18.a.2. Individuals who received GDM education from the dietitian will be significantly more likely to have a higher score for intake of high calorie food or beverage.

18.b. Individuals who received GDM education from the dietitian will be significantly more likely than individuals who received GDM education from the nurse to exercise.

18.b.1. Individuals who received GDM education from the dietitian will be significantly more likely to do 30 min or more of physical activity three or more days a week.

18.b.2. Individuals who received GDM education from the dietitian will be significantly more likely to work out enough to sweat three or more days a week.

18.b.3. Individuals who received GDM education from the dietitian will be significantly more likely to "work-in" other types of exercise three or more days a week.

19.a. Individuals who received GDM education in a group setting will be significantly more likely than individuals who received individual GDM education to eat healthfully.

19.a.1. Individuals who received GDM education in a group setting will be significantly more likely to have a higher score on the Healthy Eating Index.

19.a.2. Individuals who received GDM education in a group setting will be significantly more likely to have a higher score for intake of high calorie food or beverage.

19.b. Individuals who received GDM education in a group setting will be significantly more likely than individuals who received individual GDM education to exercise.

19.b.1. Individuals who received GDM education in a group setting will be significantly more likely to do 30 min or more of physical activity three or more days a week.

19.b.2. Individuals who received GDM education in a group setting will be significantly more likely to work out enough to sweat three or more days a week.

19.b.3. Individuals who received GDM education in a group setting will be significantly more likely to "work-in" other types of exercise three or more days a week.

Socio-Demographic Variables

20.a. Older individuals will be significantly more likely than younger individuals to eat healthfully.

20.a.1. Older individuals will be significantly more likely to have a higher score on the Healthy Eating Index.

20.a.2. Older individuals will be significantly more likely to have a higher score for intake of high calorie food or beverage.

20.b. Older individuals will be significantly more likely than younger individuals to exercise.

20.b.1. Older individuals will be significantly more likely to do 30 min or more of physical activity three or more days a week.

20.b.2. Older individuals will be significantly more likely to work out enough to sweat three or more days a week.

20.b.3. Older individuals will be significantly more likely to "work- in" other types of exercise three or more days a week.

21.a. An individual's ethnicity will not be significantly related to compliance with the recommendation to eat healthfully.

21.a.1. An individual's ethnicity will not be significantly related to the Healthy Eating Index score.

21.a.2. An individual's ethnicity will not be significantly related to the high calorie food or beverage intake score

21.b. An individual's ethnicity will not be significantly related to compliance with the recommendation to exercise.

21.b.1. An individual's ethnicity will not be significantly related to doing 30 min or more of physical activity three or more days a week.

21.b.2. An individual's ethnicity will not be significantly related to working out enough to sweat three or more days a week.

21.b.3. An individual's ethnicity will not be significantly related to the outcome "work-in" other types of exercise three or more days a week.

22.a. Individuals who are married will be significantly more likely than individuals who are not married to eat healthfully.

22.a.1. Individuals who are married will be significantly more likely to have a higher score on the Healthy Eating Index.

22.a.2. Individuals who are married will be significantly more likely to have a higher score for intake of high calorie food or beverage.

22.b. Individuals who are married will be significantly more likely than individuals who are not married to exercise.

22.b.1. Individuals who are married will be significantly more likely to do 30 min or more of physical activity three or more days a week.

22.b.2. Individuals who are married will be significantly more likely to work out enough to sweat three or more days a week.

22.b.3. Individuals who are married will be significantly more likely to "work-in" other types of exercise three or more days a week.

23.a. Individuals who have health care insurance will be significantly more likely than individuals who have no health care insurance to eat healthfully.

23.a.1. Individuals who have health care insurance will be significantly more likely to have a higher score on the Healthy Eating Index.

23.a.2. Individuals who have health care insurance will be significantly more likely to have a higher score for intake of high calorie food or beverage.

23.b. Individuals who have health care insurance will be significantly more likely than individuals who have no health care insurance to exercise.

23.b.1. Individuals who have health care insurance will be significantly more likely to do 30 min or more of physical activity three or more days a week.

23.b.2. Individuals who have health care insurance will be significantly more likely to work out enough to sweat three or more days a week.

23.b.3. Individuals who have health care insurance will be significantly more likely to "work-in" other types of exercise three or more days a week.

24.a. Individuals who have more education will be significantly more likely than individuals who have less education to eat healthfully.

24.a.1. Individuals who have more education will be significantly more likely to have a higher score on the Healthy Eating Index.

24.a.2. Individuals who have more education will be significantly more likely to have a higher score for intake of high calorie food or beverage.

24.b. Individuals who have more education will be significantly more likely than individuals who have less education to exercise.

24.b.1. Individuals who have more education will be significantly more likely to do 30 min or more of physical activity three or more days a week.

24.b.2. Individuals who have more education will be significantly more likely to work out enough to sweat three or more days a week.

24.b.3. Individuals who have more education will be significantly more likely to **25.a. Individuals who have a higher income will be significantly more likely than individuals who have a lower income to eat healthfully.**

25.a.1. Individuals who have a higher income will be significantly more likely to have a higher score on the Healthy Eating Index.

25.a.2. Individuals who have a higher income will be significantly more likely to have a higher score for intake of high calorie food or beverage.

25.b. Individuals who have a higher income will be significantly more likely than individuals who have a lower income to exercise.

25.b.1. Individuals who have a higher income will be significantly more likely to do 30 min or more of physical activity three or more days a week.

25.b.2. Individuals who have a higher income will be significantly more likely to work out enough to sweat three or more days a week.

25.b.3. Individuals who have a higher income will be significantly more likely to "work-in" other types of exercise three or more days a week.

Multivariate Hypotheses

The multivariate hypotheses for the logistic regression model will be tested in four stages, (1) using the model as illustrated in Figure 2 excluding diet self-efficacy, exercise self-efficacy, and the cues to action (social and community support), (2) using the model as illustrated in Figure 2 including diet self-efficacy and exercise self-efficacy but excluding the cues to action (social and community support), (3) using the model as illustrated in Figure 2 including the cues to action (social and community support) but excluding diet self-efficacy and exercise self-efficacy, and (4) using the entire model as illustrated in Figure 2. A fifth model will include child care issues. Each of the above sub hypotheses will be tested in the logistic regression model according to the following:

(1) The odds of performing healthy lifestyle preventive behaviors (eating healthfully and exercising) will be explained by perceived susceptibility to diabetes, perceived seriousness of diabetes, perceived benefits of healthy lifestyle behaviors to prevent diabetes, and perceived barriers to these healthy lifestyle behaviors, the diabetes-related cues to action (insulin requirement during pregnancy, history of a macrosomic infant, family history of diabetes, and subsequent diagnosis of diabetes) when controlling for demographics.

(2) The odds of performing healthy lifestyle preventive behaviors (eating healthfully and exercising) will be explained by perceived susceptibility to diabetes, perceived seriousness of diabetes, perceived benefits of healthy lifestyle behaviors to prevent diabetes, perceived barriers to these healthy lifestyle behaviors, diet self-

efficacy, exercise self-efficacy, and the diabetes-related cues to action (insulin requirement during pregnancy, history of a macrosomic infant, family history of diabetes, and subsequent diagnosis of diabetes) when controlling for demographics.

(3) The odds of performing healthy lifestyle preventive behaviors (eating healthfully and exercising) will be explained by perceived susceptibility to diabetes, perceived seriousness of diabetes, perceived benefits of healthy lifestyle behaviors to prevent diabetes, perceived barriers to these healthy lifestyle behaviors, the diabetes-related cues to action (insulin requirement during pregnancy, history of a macrosomic infant, family history of diabetes, and subsequent diagnosis of diabetes), the ecological/environmental cues to action (social [family or friends who care about your diet and exercise and family or friends who eat healthfully and exercise] and community [availability of healthy foods at the grocery store, work or school, and restaurants; availability of exercise facilities and safety of exercise in the neighborhood; GDM education by the dietitian; and group GDM education] support) when controlling for demographics.

(4) The odds of performing healthy lifestyle preventive behaviors (eating healthfully and exercising) will be explained by perceived susceptibility to diabetes, perceived seriousness of diabetes, perceived benefits of healthy lifestyle behaviors to prevent diabetes, perceived barriers to these healthy lifestyle behaviors, diet self-efficacy, exercise self-efficacy, the diabetes-related cues to action (insulin requirement during pregnancy, history of a macrosomic infant, family history of diabetes, and subsequent diagnosis of diabetes) and the ecological/environmental cues to action (social [family or friends who care about your diet and exercise and family or friends

who eat healthfully and exercise] and community [availability of healthy foods at the grocery store, work or school, and restaurants; availability of exercise facilities and safety of exercise in the neighborhood; GDM education by the dietitian; and group GDM education] support) when controlling for demographics.

A fifth stage (5) was utilized to consider if there were no child care issues as this may affect exercise behavior; all other variables tested will remain the same as described above in stage (4).

Summary

As referenced earlier in this chapter, GDM is a high-risk pregnancy, presenting health risks to both the mother and baby. The main risk to the mother is the increased likelihood (40% to 60%) she will develop diabetes herself over the next 5 to 10 years; she also has an increased risk for recurrent GDM. Risks to the baby include macrosomia, birth trauma, jaundice, hypoglycemia, and insulin resistance in later years which can increase the risk for diabetes. The estimated cost of a GDM pregnancy is at least $636 million, $596 million due to maternal costs and $40 million due to neonatal costs. The estimated annual cost of diabetes in the U.S., should mother or baby develop this chronic blood vessel disease in later years, is at least $327 billion which includes direct and indirect costs. Therefore, this study proposes to identify predictors of the postpartum preventive self-behaviors of diet and exercise which can decrease this risk for diabetes. Identification of these predictors will be accomplished using the Health Belief Model with the added constructs, perceived diet and exercise self-efficacy and specific diabetes-related and ecological/environmental cues to action.

CHAPTER II

REVIEW OF THE LITERATURE

A review of diabetes, its risk factors, and costs were presented in the previous chapter. That GDM is itself a risk factor for type 2 diabetes as well as a risk factor for recurring GDM which increases the risk for type 2 diabetes was reviewed. Considering the epidemic growth of type 2 diabetes and its attendant ill health effects and costliness, it is important to gain an understanding of lifestyle behaviors of women with a history of GDM. Are they taking preventive efforts to reduce their risk for diabetes? What are their health beliefs about this risk? Does the perception of self-efficacy make a difference in carrying out the recommended preventive lifestyle behaviors? The theoretical framework selected for gaining a better understanding about these processes is the Expanded Health Belief Model (Rosenstock et al., 1988), the Health Belief Model with the added component, self-efficacy (Bandura 1977a). It is believed that if the individual has self-efficacy, she is more likely to overcome barriers to the attempted behavior. But first, a brief review of studies of health behaviors and efforts to change these health behaviors to reduce the risk for developing type 2 diabetes.

Health Behaviors

Health problems are largely preventable or treatable if individuals would follow the health recommendations given them (Rosenstock, 1988). It has been shown that two thirds of patients do not follow their physician's advice (Podell, 1975), 20% to 50% of appointments for medical treatments are not kept, and 50% of patients do not take their medications as prescribed (Sackett & Haynes, 1976). Rosenstock (1988) explained that habitual behaviors such as smoking are even harder to change, and success is usually

described only as a third of smokers in question decreasing the number of cigarettes smoked in six months. Compliance with diet recommendations is often nonexistent and significant numbers of individuals discontinue weight reduction and exercise programs. In fact, The National Institutes of Health (1985) reported that one-third to two-thirds of weight the individual loses is regained within the first year, and nearly all the weight lost is regained within 5 years. It has been shown that the most successful approach to weight loss may include eating a low fat diet, utilizing behavior modification, and exercising (O'Leary & Wilson, 1975; Brownell, Heckerman, & Westlake, 1979). It is clear, that food intake and energy expenditure patterns must be identified.

Rosenstock (1988) continued that the above disappointing statistics do not point to a lack of interest or desire in healthier lifestyles; quite the contrary, for large amounts of money are spent on special foods, supplements, nutrition and exercise programs, exercise equipment and clothing, books, videos, and similar self-help products. It appears that people are unable to follow through with the advice of their health care professionals. It doesn't help that compliant individuals may not obtain the desired results and that noncompliant individuals may seemingly avoid ill effects. Furthermore, individuals are exposed to continuous contradictions and controversies in the media.

Large studies have been initiated to identify how much lifestyle behavior can reduce the risk for type 2 diabetes. Tuomilehto et al. (2001) found in the Finnish Diabetes Prevention Study Group that lifestyle changes over three years in 522 overweight adults with impaired glucose tolerance resulted in a 58% reduction in risk for diabetes. The intervention included reducing weight and intake of fat and saturated fat

and increasing fiber intake and activity. Impaired glucose tolerance presents a greater risk for diabetes than does GDM.

Hu et al. (2001) presented results from a study of 84,941 women who were followed for 16 years. The relative risk for diabetes was only 0.09 (95% CI [0.05-0.17]) in individuals who weren't overweight; consumed a diet low in trans fat, high in polyunsaturated fat and cereal fiber, low in glycemic load, and included at least half a drink of alcohol daily; were nonsmokers; and exercised at least 30 min daily. In the rest of this cohort of women who did not have this same low risk lifestyle, 91% (95% CI [83%-95%]) of the diabetes cases that developed was attributed to a high-risk lifestyle and especially to weight gain or obesity.

The above studies showed how critical a lifestyle that includes a healthful diet, exercise, and not gaining weight over time is to the prevention of type 2 diabetes. The present study seeks to understand health beliefs, perceptions of self-efficacy, and other relevant variables in women with a history of GDM that may influence health behaviors affecting the risk for developing diabetes.

The Health Belief Model

The Health Belief Model is one of the most widely used theoretical frameworks to study health behavior (Strecher & Rosenstock, 1997). The Health Belief Model and its original four concepts or perceptions, (a) susceptibility to a health condition, (b) severity or seriousness of this health condition once developed, (c) benefits of taking preventive action in order to prevent it, and (d) barriers to taking the preventive action, were first promoted in the 1950s (Rosenstock, 1966). Rosenstock (1974) explained that benefits include perceptions of availability and effectiveness of actions and may be influenced by

the social environment. Barriers include inconvenience, cost, pain, or unpleasant associations. Maiman and Becker (1974) added further clarification to this theoretical model, that behavior is dependent upon the expectancy of goal attainment or the likelihood that a particular outcome will occur. In the Health Belief Model in Figure 1, this likelihood of outcome is also dependent upon perceived benefits of action minus barriers to this action.

Hochbaum (1958) added “cues to action” that may either be internal (physical symptoms) or external (social or environmental factors). Cues were not empirically studied and are difficult to quantify. Hochbaum suggested that the individual’s readiness to begin action was dependent upon the perceptions of susceptibility and benefits that could be triggered by these internal or external cues. Rosenstock (1974) explained that internal cues could include perceptions of a physical or personal state and external cues could include the communication media or even a reminder card from the dentist.

This model was originally used to study behavior in order to detect or prevent disease. In the absence of disease or symptoms, it was initially noticed that the individual is not likely to practice recommended preventive health behavior or to even take advantage of free screening tests for tuberculosis (Hochbaum, 1958), cervical cancer, dental disease, rheumatic fever, polio, or influenza (Rosenstock, 1974). Researchers were in search of theories of behavior that could predict or explain this complex observation. Rosenstock explains that the Health Belief model is rooted in the social psychology theories of Kurt Lewin. It is proposed that human behavior, to a large degree, may be influenced by a phenomenological orientation, that is our environment influences our perceptions and subsequent behaviors. Lewin also proposed that

developed theories be used to explain these behaviors rather than isolated explanations for each event observed.

Strecher and Rosenstock (1997) pointed out that the Health Belief Model has been utilized to explain health behaviors such as influenza inoculations, breast examination, screenings for Tay-Sachs disease and high blood pressure, seat belt utilization, exercising, food intake, smoking, medical checkups, and alcohol intake. These same authors point out that most studies utilizing the Health Belief Model have been temporal or cross-sectional in design and have measured beliefs and behavior at the same time rather than the ideal measurement of beliefs before the behavior in question in order for the beliefs measured to be more predictive of the behavior.

Other researchers have utilized the model to study behavior in response to symptoms (Kirscht, 1974) and compliance with medical regimens once a medical diagnosis has been made (Becker, 1974). Demographic, personality, social, or environmental factors were included but not thought to play a direct role in this model (Rosenstock, 1966).

Rosenstock et al. (1988) “expanded” the Health Belief Model with Bandura’s (1977a) concept of “self-efficacy”, providing a more powerful model to explain and influence health behavior. In this context, perceived self-efficacy is defined as the confidence in one’s ability to carry out the behavior in order to achieve the desired outcome. The Health Belief Model basically postulates that individuals will take the recommended health action if they feel susceptible to a health condition with serious risks, if they feel the recommended action will reduce this susceptibility or seriousness should they develop the condition, and if they feel the benefits of taking the

recommended action are greater than the costs of the barriers to the recommended action. Strecher and Rosenstock (1997) recommended that lack of perceived self-efficacy, when used in the Health Belief Model, should be considered a perceived barrier to carrying out a behavior. These authors view self-efficacy as critical when predicting life-long behaviors such as smoking, eating, exercising, and drinking. Overcoming any perceived barriers to taking action requires perceived self-efficacy.

The additional variables, a cue, a physical symptom or environmental stimulus that can trigger the individual's readiness to take the recommended action, and self-efficacy, that can increase the individual's confidence that the desired outcome can be achieved, will both provide greater understanding of this behavior model. All of these constructs will be explained in the following sections.

Studies in Support of the Health Belief Model

Becker, Maiman, Kirscht, Haefner, and Drachman (1977) reviewed that among health behaviors, adherence to diet recommendations is unique in that the threat to health is not immediate but future-oriented and any preventive action taken may actually be related to other motivating factors such as appearance or social influences. In this study, 182 mothers of newly diagnosed obese children were randomly assigned to no intervention or to a low or high fear intervention group (received weak or strong messages about the health consequences of obesity, respectively). Perceived susceptibility to and severity of obesity-related disease in offspring by mothers were significantly correlated to outcome variables of changes in child's weight and mother's appointment-keeping behavior. Mothers who perceived more health risk due to childhood obesity were more likely to change their behavior. Child weight loss was

significantly correlated to perceptions by mothers that they do have control or that the child could benefit by the behavior. Appointment-keeping behavior was significantly correlated to helpfulness or benefit of information from the dietitian. Perception of fewer barriers (putting my child on a diet will have no ill effects) by the mother was significantly correlated to more child weight loss and better appointment-keeping. Experienced mothers and perception of the diet as doable were significantly correlated to more child weight loss. Marital status (being married) was significantly correlated to weight loss in children. Analysis of Variance (ANOVA) tests showed significant association between weight loss in children and participation of mothers in the intervention groups of low or high fear education material compared to the control group. These findings lend support for the Health Belief Model and its constructs of susceptibility, severity, benefits, and barriers to predict outcomes of child weight loss and mother's appointment-keeping behaviors.

Langlie (1977) reported a study of preventive health behavior in a random sample of 383 urban adults (59.4% women), having some college education (27.9%), under 65 years of age (86.6%), and with a higher median income compared to other adults in the surrounding area. The study utilized 11 additive scales including eating habits (intake of fruits, vegetables, and protein), exercise (number of blocks walked yesterday, uses stairs rather than the elevator), and other health behaviors (immunizations, dental care, medical checkups, miscellaneous exams, seat belt use, pedestrian, driving, hygiene, and smoking). The internal reliabilities (Cronbach's Alpha) of these scales were all over .70 and the discriminant validity or covariation was less than .36 in all scales. These scales measured three of the four main constructs of the

Health Belief Model, perceived susceptibility, benefits, and barriers. Selected demographic variables of education, occupation, income, and residence and selected social variables of non-kin interaction were also assessed using weighted scales to form the Social Network variables.

It was shown that perceived susceptibility, benefits, and low barriers were significantly (p = .05) related to preventive health behavior. The social variables studied explained 19 to 34% of the variance in preventive health behavior. Socioeconomic status variables were significantly (p = .05) related to preventive health behavior. This includes neighborhood socioeconomic status (measured by a factor score of the census tract in where the individual resides). Other significant findings showed that positive attitude towards the health care provider, high family socioeconomic status, frequent non-kin interaction, and being internal (having control) are related to preventive health behavior. Forty-three percent of the variance of preventive health behavior is explained by the two models (17.3% due to the Health Belief Model and 10.2% due to the Social Network Model). The authors concluded that the Health Belief and the Social Network Models have significant influence on preventive health behaviors.

Soroudi, Wylie-Rosett, and Mogul (2004) reported in their survey study of 111 first-year medical school students that confusion regarding recommended portion sizes, inadequate food preparation skills, and lack of time or inconvenience were barriers to eating healthfully.

Demographic Variables

Rosenstock (1966) proposed that demographics may affect preventive health behavior; younger adults, Caucasians, and women more frequently demonstrated preventive health behavior by utilizing preventive services.

The outcome variables of eating healthfully and exercise will be reviewed in the context of the data collection instruments that measure them.

Dependent Variable Data Collection Instruments:

Diet and Exercise

The following instruments will be used to develop a survey to obtain information regarding the individual's food and exercise behaviors. What follows is a review of the literature supporting the selection of these instruments. More detailed methodology including modification and scoring of these instruments is found in Chapter 3.

Quick Wave Screener

The Quick Wave Screener or WAVE (Soroudi, 2004) was designed to help primary care physicians quickly assess a patient's "weight and activity" and food intake "variety and excess." Evaluating weight, activity, and variety and excess of food intake is valuable in order to identify obese individuals or others who may be at risk for diabetes and other chronic diseases. This tool has its origins in the National Heart, Lung, and Blood Institute's Nutrition Academic Award program (Albert Einstein College of Medicine, Department of Epidemiology and Population Health, 2003) implemented to assist medical school students and other health professionals to assess the lifestyle of patients or students, to obtain this information quickly, and to provide any needed education. A particular focus of this tool is to prevent diabetes and its components have

been featured in the American Diabetes Association publication, *101 Weight Loss Tips for Preventing and Controlling Diabetes* (Daly, Delahanty, & Wylie-Rosett, 2002). This lifestyle assessment tool focused on variety and the recommendations (number of daily servings or frequency) for vegetable, fruit, cereal and bean, milk and dairy product including low fat choices, sugared drink, and high calorie food (candy, fried food, and snack chip) intake. Sedentary lifestyle and excess food intake of both healthful and high calorie foods can be predictive of obesity, diabetes, and other chronic diseases. The questions do not address portion sizes, only the number of food servings or the frequency of intake of low fat dairy foods.

This 17-item questionnaire (Soroudi et al., 2004) originated from 34 questions with subscales modified from existing surveys, the Physical Activity Questionnaire (Paffenbarger, Wing, & Hyde, 1978) and the Behavioral Risk Survey (Brener et al, 2002). An expert panel including a registered dietitian, clinical health psychologist, medical school student, family physician, and a diabetes educator, reviewed the 34 questions and reduced these to a 17-item questionnaire. Further reduction to 14 items followed administration to and feedback from medical school students. It was decided to include two questions regarding milk intake, one to assess calcium intake and another to assess saturated fat intake found in whole milk. An additional question to assess food insecurity (enough food in household) was also included. This final version was tested with 111 first-year medical school students with an average age of 24 years. This questionnaire was completed by the medical school students, but it could also be completed by the health care professional during a patient or student interview. Another WAVE tool with similar questions (Gans et al., 2003) took 5 to10 min to administer to

the patient. In the present study (Soroudi et al., 2004), 47% of overweight medical school students reported working out less than 3 times weekly, and 53% reported "working in" other physical activity one time or less weekly. Responses to questions assessing recommended food intake according to the Food Guide Pyramid (USDA, 1996) and the Dietary Guidelines (USDA, 2000) revealed that 91% and 69% respectively, of overweight medical school students failed to consume the minimum number of recommended servings of vegetables (3 to 5) and fruit (2 to 4) per day. About 50% of these students failed to eat high fiber grains, and 59% consumed low fat dairy products but in inadequate amounts. Reasons cited for the inadequate intake included confusion about portion sizes, no cooking skills, and lack of time or not convenient. Excess intake of sugared beverage intake (2 or more such beverages daily) was reported by 80% of the overweight or obese students compared to 44% of the students having a normal weight. Overall, results of the self-reports by these students showed that one third are overweight and many have the same at-risk lifestyles as the patients for whom they provide care. Accompanying this tool is a dialogue guide for education and behavior modification of the patient or student.

Rapid Eating and Activity Assessment for Patients

The Rapid Eating and Activity Assessment for Patients (REAP) tool (Gans et al., 2003) was also selected to assess healthy lifestyles including food intake and activity. This tool was developed for the Nutrition Academic Award Program (Pearson et al., 2001), a 1997 initiative of the National Heart, Lung, and Blood Institute. The purpose of the Nutrition Academic Award Program includes improving nutrition training and curricula development in U.S. medical schools in order to provide medical students,

residents, and practicing physicians experience in nutrition assessment and counseling of the patient. This Award Program also encouraged the development of brief and easy to use diet assessment questionnaires or tools useful for clinical practice settings. The REAP tool was developed to provide a brief nutrition assessment of adults that can be self-administered by the patient or completed by the health care provider. The physician or health care provider can use this obtained information to provide subsequent nutrition counseling to the patient. The tool also offers an opportunity to identify nutrition concerns resulting in referrals to a registered dietitian. The process heightens awareness of the importance of nutrition and provides a more complete assessment of the patient for the medical record.

Gans et al., (2003) provided more information regarding the REAP tool, its usefulness, validity, and reliability. These authors stated that typically, diet assessment questionnaires are difficult, costly, and time-consuming to implement in clinical environments. Many brief diet assessment tools have been developed (Kris-Etherton et al., 2001; Roe, Strong, Whiteside, Neil, & Mant, 1994; Retzlaff et al., 1997; Peters et al., 1994; Gans, Hixson, Eaton, & Lassiter, 2000; & Gans et al., 1993). However, these tools addressed more specific topics such as cholesterol intake, not the more widely recommended diet guidelines, and generally were not brief and user-friendly. REAP was developed to address diet issues as described in the Food Guide Pyramid (USDA, 1996) and the Dietary Guidelines (USDA, 2000). REAP assessed diet intake of whole grains, calcium, fruits and vegetables, fat, saturated fat, cholesterol, sugary beverages and sweets, sodium, alcohol, and physical activity. The tool also assessed food shopping and preparation, special diet practices, and flexibility in making more healthy

diet changes. These authors reported that this tool, written at the 6th-grade reading level, takes the patient about 10 minutes to complete.

The REAP tool has 31 questions that are listed by food categories (e.g. grains, fruits and vegetables, etc.). Answer choices include “Usually/Often”, “Sometimes”, “Rarely/Never”, and ”Does not apply to me.” The food shopping and preparation questions have yes or no answers, and the question assessing flexibility in making changes is assessed by a Likert-type scale question. The questions are worded in the negative, for example, “Skip breakfast?” and “Eat less than 2-3 servings of fruit a day?” The REAP tool does not include a medical assessment; vitamin, mineral, or herb supplements; or questions regarding weight loss or gain and patient motivation for weight change.

Feasibility, validation, cognitive, and reliability studies were performed on the initial REAP tool of 32 items (Gans et al., 2004). A feasibility implementation study was completed with 61 medical students and practicing physicians at several medical schools and clinics in the U.S. These subjects used the REAP tool with patients and then they rated the tool on a 1 to 10 semantic differential scale with 10 being the highest rating for usefulness, ease, practicality, and helpfulness. The overall feasibility rating was 7.4 on a scale of 1 to 10. These same subjects also rated the tool on a scale of 1 = strongly disagree to 5 = strongly agree in response to questions assessing their subsequent awareness of nutrition, ability to assess patient eating habits, awareness of need to refer patient to a registered dietitian, evaluation of usefulness of information obtained for inclusion in the medical record, whether key nutrition issues for healthy adults were covered, how competent they feel to provide nutrition counseling to the

patient, how much they liked the tool, and if they would use the tool in the future. Results of these ratings were also high, 3.8 to 4.5 of a 5-point scale, indicating that the tool met its intended goals.

A validation study was performed with 50 second year medical school students comparing the REAP tool with three-day food records that the students completed themselves. A nutritionist entered the average of the three-day food records into the USDA interactive web site to obtain the Healthy Eating Index (Kennedy, Ohls, Carlson, & Fleming, 1995) score that assesses the diet for overall quality as recommended by the Food Guide Pyramid (USDA, 1996) and the Dietary Guidelines (USDA, 2000). This Index score is derived from 10 areas including the five food groups (grains, fruits, vegetables, dairy, meats), four nutrients (fat, saturated fat, cholesterol, sodium), and whether the diet has variety. Each of these 10 areas has a score of 0 to 10 or a possible score of 100 for the entire Index. The questionnaire for the REAP tool was scored from usually = 1 to rarely/never = 3 and covered questions not included on the Index (intake of sugar, alcohol, and physical activity). A correlation test was performed comparing the Healthy Eating Index score with the REAP tool score. Another correlation test was performed assessing how well different nutrition issues were addressed by using the Index sub scores and selected REAP tool questions. Results showed that overall the REAP tool correlated well with the Healthy Eating Index (r = .49, p = .0007). Comparison of the Index sub scores and selected REAP tool questions showed significance for fat, saturated fat, cholesterol, fruit, meat, and variety in diet.

Cognitive testing of a convenience sample of 31 consumers including staff and students from Brown University Campus was also performed on the REAP tool to

assess consumer understanding in depth. Two research assistants assisted in the interview process that took about 40 to 50 minutes. The average age of these consumers was 32 years, 62% was female, half of the consumers represented ethnic groups, 96% of the consumers had some college education, the majority (76%) had an annual income of less than $59,000, and 86% of the consumers was not married. Cognitive testing was accomplished by breaking down many of the REAP tool questions into several questions in order to assess fundamental issues such as food group examples, food preparation, and food portions. One technique involved having the consumers view photographs of food portions.

Based upon the above results of the feasibility, validation, and cognitive tests, the REAP tool questions were modified to improve appearance, usefulness, and coherency. These modifications included adding check boxes for answers; categorizing food questions; changing font, font size, and utilizing shading; adding more portion choices; adding food examples when appropriate; deleting questions regarding number of meals per day and specifics regarding beef and grains; and adding questions regarding salt and sweet intake. Validity of the modified REAP tool was then tested with the general public.

Validity was tested by comparing this modified REAP tool with a food frequency questionnaire developed at the Fred Hutchinson Cancer Research Center (Kristal, Feng, Coates, Oberman, & George, 1997; Neuhouser, Kristal, McLerran, Patterson, & Atkinson, 1999; Horner et al., 2002; Patterson et al., 1999) for consumers. Inclusion criteria included an age of at least 18 years and the ability to understand and write in English. Ninety-four subjects were recruited by advertisements in the newspaper and

various public places. The REAP tool, the food frequency questionnaire, and then the REAP tool again, were all completed by the subjects either in person or by mail over a three week period with one week or more between each survey. Forty dollars and educational material were used as incentives for survey completion. The average age of these subjects was 43 years, 57% were female, the majority (94%) was Caucasian, 57% were high school graduates (24% were college graduates), and the medium income was between $51,00 to 60,000. The scoring of REAP was performed as described earlier.

Test-retest reliability was performed on this same group of consumers by comparing the REAP tool scores between the first and second administrations (r = .86, p < .0001). Validity was tested by comparing the food frequency and the REAP tool. The food frequency variables, calories, percent calories from fat and saturated fat, cholesterol, fiber, servings of fruits and vegetables, calcium, sodium, sucrose, vitamin A, Vitamin C, and alcohol, were compared with the appropriate REAP tool variables. The results showed that the REAP tool accurately indicated food and nutrient intake except for vitamin C (p < .7838). Correlation and significance for the other food and nutrient variables in the food frequency and REAP tool ranged from r = –.62 and p < .0001 for alcohol to r = .45 and p < .0001 for vegetable servings, respectively.

In summary, feasibility tests with medical school students and physicians showed the REAP tool was easy to use. The validation studies using medical school students showed that the REAP tool has strong correlation with the Healthy Eating Index (Kennedy et al., 1995) and reflects the foods and nutrients recommended in the Food Guide Pyramid (USDA, 1996) and the Dietary Guidelines (USDA, 2000). The REAP tool

also showed excellent test-retest reliability results with the consumer group, and validity tests correlating REAP with a food frequency questionnaire showed good correlations with all nutrients tested except vitamin C. In conclusion, the REAP tool can be used with confidence in the clinic environment for quick and easy assessment of patient eating habits.

Independent Variable Data Collection Instrument:

Health Beliefs

The following instrument will be used to obtain information in a survey format regarding the individual's health beliefs. What follows is a review of the literature supporting the selection of this instrument. More detailed methodology including modification and scoring of this instrument is found in Chapter III.

The Health Belief Model and its ability to predict breast self-examination behaviors were studied by Champion (1993) at Indiana University. This study tested the constructs perceived susceptibility to and perceived severity of breast cancer. In addition, benefits of breast self-examination (BSE) minus the barriers to performing BSE behaviors in order to prevent breast cancer were analyzed. A random sample of 581 women, 35 years of age and older, from a large urban Midwestern city was studied. This sample consisted of 91% white, 8% black, and 1% Asian or Hispanic women with an average of 13.7 years of education. Seventy percent were married, 10% widowed, 15% divorced, and 5% never married. A panel of three national experts assessed the content validity of this Health Belief Model Scale. Test-retest analysis was performed in the control group (n = 151) by a mailed questionnaire and subsequent in-home interview 2 to 8 weeks later with correlation results of .45 to .70 (the experimental group was not

used due to possible change in beliefs after the interview). Constructs were measured utilizing a 5-point Likert scale. Construct validity was performed by exploratory factor analysis and principal components extraction was based on a required factor loading of .45 or greater for item retention. The BSE behavior scale showed good internal consistency as demonstrated by a Cronbach's alpha of .83 (n = 530) and reliability as demonstrated by a test-retest correlation of .82 (n = 143). Predictive validity was then assessed by BSE behavior and attitude relationships utilizing multiple regression and bivariate correlation. The independent Health Belief Model variables collectively accounted for 24% of the variation in BSE; the F values of each of the variables were significant (F < .01 to .04). Predictive validity tests of each construct resulted in correlations of r < .10 for seriousness and benefits and .14 for susceptibility; barriers correlations were negative, r = -.28 (increased barriers yielded decreased behaviors). Reliability for each of the subscales was determined by a Cronbach's alpha test of internal consistency with results ranging from .80 for seriousness and benefits to .93 for susceptibility. This study demonstrated that the Health Belief Model was a good predictor of behaviors in chronic disease prevention. The authors recommended the modification of this instrument for use in evaluating other health behaviors.

As shown by the above strong research results and tested components of the model, this instrument will be utilized to assess the usefulness of the Health Belief Model in predicting compliance with healthy lifestyle recommendations in order to prevent type 2 diabetes. Both breast cancer and diabetes are chronic diseases; therefore, the required changes in wording in this instrument will be minor. Barriers to healthful eating and exercise addressed in the health beliefs section of the survey will

include the issues of convenience, time, cost, and interest. Other barriers to these healthy lifestyle activities, including the ecological cues of social support and environment, will also be addressed in the survey.

Independent Variable Data Collection Instrument:

Diet Self-Efficacy

The following instrument will be used to obtain information in a survey format regarding perceived diet self-efficacy. What follows is a review of the literature supporting the selection of this instrument. More detailed methodology including modification and scoring of this instrument is found in Chapter 3.

Hickey, Owen, and Froman (1992, 1997) developed a 16-item perceived cardiac diet self-efficacy instrument from three samples (outpatient cardiac rehabilitation programs and running groups) of 525 participants over 3 years. The psychometric properties of perceived self-efficacy measures were developed and assessed. To determine content validity, domain identification, item generation, and instrument formation were performed (Hickey, Owen, & Froman, 1992). Ten experts in the area of cardiac rehabilitation and perceived self-efficacy (nurses, dietitians, exercise physiologists, and psychologists) developed and reviewed the conceptual definitions of perceived cardiac diet self-efficacy, reducing the original 30 items to 19. Items were retained if they scored at least 3 on a scale of 5 for fit (5 = excellent fit). Ten participants in a cardiac rehabilitation program evaluated the instrument for readability and item format. Five experts who did not participate in the first review conducted the second review and reduced the items to 16. The 5-point response scale utilized ranged from very little to quite a lot of confidence. Over 3 years, recruited subjects (*n* = 525) from

three groups provided information regarding validity. Three hundred and seventy cardiac rehabilitation program participants provided reliability and validity information. Subjects ranged in age from 32 to 79 years, 84% were male, and the mean education level was 13 years. A second group of 54 marathon runners proficient in diet and exercise were utilized to provide known groups construct validity data. This experienced group was used due to the likelihood of already established perceived self-efficacy. The age range of this group was 22 to 55 years, 66% of the runners were female, and the mean education level was 15 years. A third group of 101 cardiac rehabilitation program participants were studied to determine the relationship between perceived diet self-efficacy and goal achievement, a measure of predictive validity. The age range of this group was 40 to 77 years, 66% graduated from high school, 20% graduated from college, and 79% were male.

Factor analysis of the perceived cardiac diet self-efficacy Instrument supported the construct measured. A principal factor analysis revealed two factors with eigenvalues greater than one. 66% and 14 % of the covariations were explained by these factors. Correlation of these two factors (r = .53) resulted from a subsequent oblique rotation. When the two factors were collapsed, 70% of the total scale variation was explained. Factor loadings were positive, ranging from .41 to .73. This confirmed the one construct premise of the perceived diet self-efficacy scale. The mean scores of the 16-item scale were in the 3.49 to 4.44 range (5 = quite a lot) supporting the subjects' confidence in performing the diet behaviors.

To predict the mean perceived diet self-efficacy score, a multiple regression analysis showed a multiple R of .114 (R^2 = .012); gender was the only predictor and the

F value was significant at $p = .03$. A separate variance *t*-test analysis revealed that males had greater mean perceived diet self-efficacy scores than females ($t = 1.73$, $p = .05$).

A pooled variance *t*-test indicated that the marathon runners were more confident in performing diet behaviors when compared to the cardiac rehabilitation program participants ($t = 4.58$, $p = .0001$). The predominant female composition of the marathon runners group (66%) did not make a difference in the factor loadings of the scale items, both genders yielding loadings of at least .40 for the items.

A significant positive relationship ($r = .62$, $p < .0001$) was found between perceived diet self-efficacy and goal achievement in the 101 cardiac rehabilitation program participants. Diet goals were accomplished more often by those individuals with a higher level of perceived self-efficacy than by those with a lower level.

When tested for reliability, this instrument was found to have a Cronbach's alpha coefficient of $r = .90$. A test-retest reliability estimate of $r = .86$ was obtained from 50 cardiac rehabilitation program participants when the instrument was re-administered three days apart. These authors (Hickey et al., 1992) submit that even though data presented was self-report, the relationship between perceived self-efficacy and subsequent diet behaviors is useful for clinical practice. The authors submitted that even though self-report data was used to operationalize diet behavior, this research showed that perceived self-efficacy measures can be useful in determining future diet behavior.

Research by Bandura (1977a, 1982, 1986) showed that individuals successful in performing specific behaviors will be more confident about performing these behaviors

in the future; the second study group, the experienced marathon runners, were more confident than the less experienced cardiac rehabilitation program participants about performing diet behaviors. Also, those cardiac rehabilitation program participants with higher scores of perceived self-efficacy experienced more goal completion than those with lower scores of perceived self-efficacy.

Another study (Timlin, Shores, & Reicks, 2002), utilized the above described cardiac diet self-efficacy Instrument (Hickey et al., 1992) to determine the effectiveness of nutrition education in a group of cardiac rehabilitation program subjects assigned to either a treatment or control group. The treatment group was provided group and individual consultation with a registered dietitian while the control group was provided nutrition handouts, videotapes, and book resources. The study reported an 80% response rate to the surveys mailed to subjects three months after completion of a six-week cardiac rehabilitation program. The authors cited the validation of this instrument by the original authors (Hickey et al., 1992) who found a significant relationship between perceived self-efficacy scores and subsequent goal achievement. The 104 subjects in this study had an age range of 35 to 85 years, 80% were men, 18% also had type 2 diabetes, 63% had education past high school, and the mean body mass index was 29.4 (BMI of 30 is obese). Findings in this study showed that subjects were least confident about eating healthfully during the holidays, in restaurants, or when away from home. The subjects were more confident about purchasing and eating healthful foods, eating low fat foods, or eating healthfully alone. The subjects in the treatment group were more confident (higher perceived self-efficacy scores, $p < .0001$) in attaining desired weight; reducing fat intake; eating away from home, at restaurants, or when

alone; identifying healthy foods; and reducing intake of unhealthy snacks compared to the control group. After three months, these gains in the treatment group were similar to program entry, except for perceived self-efficacy for eating healthfully in a restaurant. The study showed no gender difference in perceived diet self-efficacy.

The above described research findings support the decision to use this survey instrument, cardiac diet self-efficacy (Hickey et al., 1992), to assess perceived diet self-efficacy. Minor changes will be made in the wording of this 16-item scale. Diet recommendations for cardiac patients and patients at risk for diabetes are similar, since heart disease is a major risk factor for those diagnosed with diabetes.

Independent Variable Data Collection Instrument:

Exercise Self-Efficacy

The following instrument will be used to obtain information in a survey format regarding perceived exercise self-efficacy. What follows is a review of the literature supporting the selection of this instrument. More detailed methodology including modification and scoring of this instrument is found in Chapter 3.

Garcia and King (1991) studied exercise adherence in 74 randomly selected sedentary but healthy men and women. These subjects were administered questionnaires evaluating the psychological measures of self-motivation and self-efficacy and then randomly assigned to one of three exercise programs for one year. The three groups included a moderate-intensity exercise group (three 60-min sessions per week), moderate-intensity exercise home-based group (same intervention as first group but not in a formal class or group), and low-intensity home-based group (five 30-min sessions per week). Subject characteristics were as follows: age range of 50 to 64

years, 57% male and 43% female, with an average education of 15 years. This study hypothesized that situational determinants of behavior rather than the personal trait, self-motivation, would predict exercise adherence. The situational approach of social-cognitive theory utilizes reciprocal determinism or the interaction between the individual and the environment in determining behavior. The authors proposed that perceived self-efficacy can predict adherence to the given exercise regimen. The authors also submitted that perceived self-efficacy as a predictor of long-term adherence to exercise is promising but not proven, since most studies have been short-term. Furthermore, most subjects studied have been in high-risk groups such as COPD (chronic obstructive pulmonary disease) and cardiac rehabilitation.

The authors in this study reported that the average baseline perceived self-efficacy score was 74.3% and internal consistency as measured by Cronbach's alpha was .90. Test-retest correlation was .67 ($N = 62$, $p < .001$). Self-efficacy was significantly ($p < .001$) more associated with exercise adherence at six and 12 months ($r = .42$ and .44, respectively) compared to self-motivation ($r = -.02$ and .10, respectively). In a multiple regression analysis, self-efficacy explained 17% of the exercise adherence variance ($F = 11.75$, $p < .01$) compared to self-motivation, which explained 2% (not statistically significant). These results showed that when compared to self-motivation, self-efficacy is a strong predictor of exercise behavior at six months and at one year from baseline. After reviewing many surveys assessing perceived self-efficacy and exercise, this particular 15-item scale was selected because of the research results utilizing it and the simplicity and usefulness of the actual questions. It will be used as described in this research (Garcia and King, 1991).

Summary

This chapter presents a review of the literature of the instruments selected to measure the independent and dependent variables. It should be noted that the instruments were selected earlier in the research process timeline. At the center of our theoretical model is the Health Belief Model, providing the most comprehensive explanation of likely human behavior considering major perceptions, demographics, and internal and external influences (the cues to action), all leading to either performing or not performing the behavior in question. The instruments selected included an instrument by Champion (1993) utilizing most of the Health Belief Model constructs but worded to evaluate the health beliefs of women with breast cancer. Other instruments selected measured perceived diet self-efficacy (Hickey, Owen, & Froman, 1992, 1997), questions worded to assess perceived cardiac diet self-efficacy, and perceived exercise self-efficacy (Garcia & King, 1991), questions worded to access exercise behavior in healthy men and women. The demographic variables and cues to action variables including the diabetes related variables were all assessed using questions specifically created for our final patient survey. The dependent variables of healthy eating and exercise were assessed using the Quick Wave Screener or WAVE (accessing weight, activity, and variety and excess of food intake) from the National Heart, Lung, and Blood Institute and REAP (Rapid Eating and Activity Assessment for Patients) which included questions derived in part from the Food Guide Pyramid and the Dietary Guidelines.

CHAPTER III

METHODOLOGY

The research design is ex post facto or after the fact since the subjects have already delivered their babies (Ary, Jacobs, & Razavieh, 1990). This study is a non-experimental, observational and cross-sectional (collection of data at one point in time) study, a widely used and recognized design (Babbie, 1990). The study is a retrospective analysis of prospectively collected data entered in a large perinatal database that was supplemented by a current survey. Data from these patients diagnosed with GDM were entered in this database, which includes demographics as well as pregnancy and diabetes-related information.

The database and survey served as the source of information for the study. A mailed self-administered questionnaire was utilized as the survey instrument. Survey items were constructed from four pre-existing scales that assessed health beliefs, perceived diet self-efficacy, perceived exercise self-efficacy, and diet and exercise habits. These scales were combined into one survey instrument including socio-demographics, diabetes-related, and ecological systems questions. Study subjects were from a cohort of women with a recent history of GDM (one to two years prior) who received prenatal care from MFM, Department of Obstetrics and Gynecology, Eastern Virginia Medical School in Norfolk. Maternal-Fetal Medicine has offices in Norfolk, Virginia Beach, and Newport News, Virginia that were utilized for this study. Maternal-Fetal Medicine provides perinatal care to a large volume of patients with high-risk pregnancies in the setting of a teaching institution, Eastern Virginia Medical School. This medical school is located in a central urban area and attracts patients throughout

Southeastern Virginia and Northeastern North Carolina. Maternal-Fetal Medicine has three outpatient clinic sites: Eastern Virginia Medical School in Norfolk, Tidewater Perinatal Center (TPC) at Sentara Virginia Beach General Hospital (SVBGH) in Virginia Beach, and Riverside Regional Medical Center (RRMC) in Newport News. The Norfolk site primarily serves patients in that city, Portsmouth, Chesapeake, and Western Tidewater (Suffolk, Franklin City, Isle of Wight, and Southampton). Tidewater Perinatal Center primarily serves residents of Virginia Beach, and RRMC serves patients mostly in Hampton and the Peninsula (Newport News, James City, Williamsburg, York, and Poquoson).

At the time of the study, the professional staff consisted of 10 physicians (six perinatologists and four generalists), nine registered nurses, three of whom were certified diabetes educators (CDE), a registered dietitian, also a CDE, and four genetic counselors. The staff also included ten ultra sound sonographers and a fetal diagnostic unit using antenatal fetal surveillance. All patients receiving prenatal care at MFM in Norfolk deliver at Sentara Norfolk General Hospital (SNGH), a 500-bed tri-level care facility that is part of the Eastern Virginia Medical School teaching and clinical program. Patients served at all the clinic sites were delivered either by their referring physicians or by the MFM team at either SNGH or SVBGH. Children's Hospital of the King's Daughters is also a part of this teaching and clinical program and provides specialized high-risk care for infants and children. In addition to these clinical activities, numerous clinical research studies are on-going at MFM.

Sample Description

The study population is a sample of prenatal patients presenting at Norfolk, TPC, and RRMC with diagnosed GDM. The sample included all patients who received prenatal care and GDM education (either class or individual instruction) July 1, 2004 to December 31, 2005. The patients were in one of three care groups: consult (received initial assessment, treatment, and any necessary follow-up for GDM at MFM, other prenatal care and delivery performed by the referring physician), co-managed (received management for GDM at MFM, other prenatal care received from the referring physician), or full care (received all their prenatal care at MFM). As indicated earlier, these patients were primarily from the Norfolk, Newport News, and Virginia Beach urban area, but include some referrals from Southeastern Virginia and Northeastern North Carolina. Although there are other individuals or facilities in this geographical area providing prenatal care or GDM education (no available statistics), MFM most likely receives the largest number of new patient referrals, usually 50 to 100 referrals a month according to the MFM database.

The exclusion criteria included any woman having a self-reported miscarriage or stillbirth or otherwise nonviable delivery as recorded on the MFM database. The few patients needing a language interpreter (usually a family member performed this role) attended the appointments with the individual during which time he or she became actively involved in assisting the patient with record keeping. This support was documented in the medical record.

Data Collection Instruments: Database

The MFM database used for this study was recorded in Excel 2000 for Windows®. The CDE, on an on-going basis, transferred information (socio-demographics, pregnancy, and diabetes-related) directly from the medical record of each patient into this database. Only the professional staff needing such information has access to the database. Data items included the following: name, address, phone number, age, ethnicity, referring physician, extent of prenatal care (consult, co-managed, or full care), health care payment, GDM classification (A1-diet controlled or A2-insulin or oral agent [Acarbose or Glyburide] controlled), due date, risk factors for GDM, obstetrical history (delivery of macrosomic infant, previous miscarriage or stillbirth), BMI, and self-reported delivery outcome of current pregnancy (collected prospectively). During the GDM education session (either group or individual), the patient was provided with a stamped, self-addressed pregnancy outcome postcard to complete and return after her delivery. Accuracy of the database over time was checked against the medical record. In addition, the researcher compared the database and medical records for accuracy and validated the survey data with a randomly selected 5% sample of the returned completed surveys (prior to survey identifiers being removed). Permission to use this database was obtained from the Director of the Diabetes in Pregnancy Program at MFM. Data was also obtained from the self-administered mailed survey.

Data Collection Instruments

Please refer to Appendix A for the theoretical construct variables evaluated by the survey questions. Additional data assessed in the survey include Question A13,

meals skipped; Question E6, weight and height; Question E7, weight change; Question F8, able to exercise; Question F12, explain why if not able to exercise; Questions G1 to 5, nutrition knowledge; and Question H4, number of persons living in home (was used to calculate if the individual meets poverty guidelines, the second part of this same question was number of children under 18 years). It is thought that these survey questions, although not selected as theoretical construct variables, nonetheless provide information about the individual and her motivation or ability to carry out healthy lifestyle behaviors.

Dependent Variables

Eating Healthfully and Exercising

The source of the majority of questions asked in this study to assess diet and exercise outcomes is the "Quick WAVE Screener: A Tool to Address Weight, Activity, Variety, and Excess" (Soroudi et al., 2004). Questions were also taken from "WAVE: A Pocket Guide for a Brief Nutrition Dialogue in Primary Care" (Barner, Wylie-Rosett, & Gans, 2001), "REAP and WAVE: New Tools to Rapidly Assess/Discuss Nutrition with Patients" (Gans et al., 2003), and "Rapid Eating and Activity Assessment for Patients (REAP): A New Tool to Help Physicians Rapidly Assess and Discuss Nutrition with Patients" (Gans et al., 2002). The resulting survey included modified questions from the WAVE and REAP surveys as well as several original questions.

The two WAVE surveys and the REAP survey were initially developed to assess health behaviors of patients in order to determine effective education interventions to prevent chronic diseases including diabetes. The intent of these two surveys make them

excellent tools for our study, to assess lifestyle behaviors in order to prevent type 2 diabetes.

Quick Wave Screener

The 17-item Quick Wave Screener or WAVE was designed to help primary care physicians quickly assess a patient's "weight and activity" and "variety and excess" of food intake (Soroudi et al., 2004). This tool has its origins in the National Heart, Lung, and Blood Institute's Nutrition Academic Award program implemented to assist medical school students and other health professionals to quickly assess the lifestyle of patients or students (Albert Einstein College of Medicine Department of Epidemiology and Population Health, 2003). The food intake assessment focuses on recommendations (number of daily servings or frequency) for vegetable, fruit, cereal and bean, milk and dairy products including low fat dairy products, sugared drink, and high calorie food (candy, fried food, and snack chip) intake. The questions do not address portion sizes, only the number of food servings or the frequency of intake of low fat dairy foods; two questions addressed food insecurity (having enough food). This questionnaire originated from 34 questions with subscales modified from existing surveys, the Physical Activity Questionnaire (Paffenbarger et al., 1978) and the Behavioral Risk Survey (Brener et al., 2002).

Internal consistency of the above survey modified for the present study was assessed by Cronbach's alpha. The questions used and how they were scored are listed here. Working out enough to sweat per week was scored as 0 (0 to 1 time), 1 (2 times), 2 (3 to 4 times), or 3 (more than 4 times). "Working-in" physical activity per day

(6 or more flights of stairs, walking more than 15 minutes, or gardening for more than 30 minutes) was scored as 0 (0 to1 time) or 1 (2 to more than 4 times).

The Rapid Eating and Activity Assessment for Patients (REAP) Scale

This scale was developed to assess healthy lifestyles including food intake and activity (Gans et al., 2003). This tool was developed for the Nutrition Academic Award Program, a 1997 initiative of the National Heart, Lung, and Blood Institute (Pearson et al., 2001). This Award Program also encourages the development of brief and easy to use diet assessment questionnaires or tools useful for clinical practice settings.

REAP was developed to address diet issues as described in the Food Guide Pyramid (USDA, 1996) and the Dietary Guidelines (USDA, 2000). REAP assesses diet intake of whole grains, calcium, fruits and vegetables, fat, saturated fat, cholesterol, sugary beverages and sweets, sodium, alcohol, and physical activity. These authors reported that the 31-question tool, written at the 6th-grade reading level, takes the patient about 10 minutes to complete. Internal consistency of this modified scale for the present study was assessed using Cronbach's alpha.

Scoring the Outcome Scale

Questions A1 (in the past week, how many days did you do 30 min or more of physical activity) and question A2 (in the past week, how many days did you work out enough to sweat) are both ratio level data. The responses include 0, 1, 2, 3, 4, and more than 4 days. The higher the score, the more desirable the level of exercise. The responses will be dichotomized; a value of 0 for responses of 0, 1, or 2 days a week and a value of 1 for responses of 3, 4, or more than 4 days a week. Question A3 (in the past week, how many days did you "work-in" other types of exercise) is ratio level data,

has the same response choices as Questions A1 and A2, and will also be scored the same. The responses will be dichotomized; a value of 0 for responses of 0, 1, and 2 days and a value of 1 for responses of 3, 4, or more than 4 days.

Five questions (A4 to 8) assessing the key recommendations of the Food Guide Pyramid (USDA, 1996) determines the outcome score for the "Healthy Eating Index". Questions A4 to 8 regarding the intake of vegetables, fruits, grains and starchy foods, milk, and meat best represent the Food Guide Pyramid's recommendations. Appropriate intake of each food group will be awarded 1 point. Each of these points will be summed, the highest possible score being 5. The score will be dichotomized as 0 for a score of less than 3 (indicating a lower score on the "Healthy Eating Index") and 1 for a score of 3 or more (indicating a higher score on the "Healthy Eating Index"). The Healthy Eating Index is a component of the outcome variable, eating healthfully.

Questions A4 (yesterday, how many servings of vegetables did you have and servings average per day over the past week) are ratio level data. The higher the number of servings consumed the more desirable the score. There is no penalty for excess vegetable intake since these foods have few calories and offer many nutrients.

Question A5 (yesterday, how many servings of fruit or fruit juice did you have and servings average per day over the past week) is ratio level data. The desired intake is 2 to 4 servings daily. Too little or too much of this food group is undesirable.

Question A6 (yesterday, how many servings of cereals, bread, grains, or starchy vegetables did you have and servings average per day over the past week) is ratio level data. The recommended intake is 6 to 11 servings daily, but for this group of women

who ideally don't want to gain weight over time, the recommended intake would include 6 to 8 servings daily. Too little or too much intake of this food group is undesirable.

Question A7 (yesterday, how many servings of milk and dairy products did you have and servings average per day over the past week) is ratio level data. Recommended intake is at least 2 servings but no more than 4 servings daily. Too little or too much of this food group is undesirable.

Question A8 (yesterday, how many ounces of meat, chicken or turkey, fish, or egg did you have and ounces average per day over the past week) is ratio level data. The desirable response will be no more than 7 ounces daily. Some individuals may be vegetarians and will eat little or no meat, but excess intake is undesirable.

Four questions (A9 to 12) will determine the outcome score for "intake of high calorie food or beverage". These questions consider consumption of added fat, fried foods, sugared drinks, and high calorie snacks and desserts. Appropriate intake of each food category will be awarded 1 point. Each of these questions will be summed, the most desirable score being 4. The score will be dichotomized as 0 for a score of 2 or less (indicating a less desirable score on the "intake of high calorie food or beverage") and 1 for a score of 3 or more (indicating a more desirable score on "intake of high calorie food or beverage"). Intake of high calorie food or beverage is a component of the outcome variable eating healthfully.

Question A9 (yesterday, how many servings of fat did you add to your food and servings average per day over the past week) is ratio level data. Desirable intake would be fewer than 7 servings daily. Very few individuals get too little fat, the concern is excess fat; this represents a moderate intake.

Question A10 (yesterday, how many servings of fried foods like fried chicken, fried fish, French fries, or pizza did you have and servings average per day over the past week) is ratio level data. To have one fried food daily could fit in an otherwise healthy diet.

Question A11 (yesterday, how many servings of sugared drinks like soda, fruit drink, Kool-Aid, lemonade, or sport drink, e.g., Gatorade, did you have and servings average per day over the past week) is ratio level data. Again, to have 1 serving daily could fit in an otherwise healthy diet.

Question A12 (yesterday, how many servings of chips, chocolate or candy, ice cream, cake or pie, cookies, or donuts did you have and servings average per day over the past week) is ratio level data. To have 1 serving daily of any of these foods could also fit in an otherwise healthy diet. It is possible that an individual could have 6 servings of added fat or 1 serving of fried food or 1 serving of a sugared drink or 1 serving of a high calorie snack or dessert on any given day or 1 serving from each of these four foods on any given day and still consume an overall healthy diet.

Question A13 (yesterday, how many meals did you skip and meals skipped average per day over the past week) is ratio level data. It is undesirable to skip any meals in a single day. The response is a ratio level data and will be dichotomized; a value of 0 for a response of any meals skipped and a value of 1 for a response of no meals skipped.

Modifications to the Outcome Scale of Eating Healthfully and Exercise

For modifications to these questions, please See Appendix I.

Survey Question (Lifestyle) Asked but Not Presented in Theoretical Model

Question A13 regarding skipped meals is included in the survey because it will help provide a good assessment of the overall diet of the individual, but it is not necessarily critical to the theoretical model presented in Figure 2.

Independent Variables

Health Belief Scales

The Health Belief Model constructs include the individual's perceived risk for diabetes or susceptibility, the seriousness of diabetes should she develop it, and benefits of and barriers to carrying out healthy lifestyle behaviors in order to reduce the risk for diabetes. This study used a modified health belief model scale developed by Champion (1993) to assess perceived susceptibility to and seriousness of breast cancer and benefits of and barriers to carrying out preventive behaviors in order to reduce the risk for breast cancer. This instrument was selected because the questions assessing health beliefs and preventive behaviors regarding cancer would be similar to questions assessing similar beliefs and behaviors regarding diabetes since both are chronic diseases. The psychometric properties of the modified scale were assessed using Cronbach's alpha statistical test for internal consistency.

Scoring the Health Belief Scales

For questions B1 to 36, each of the subscales, susceptibility (B1 to 5), seriousness (B6 to 12), benefits of eating healthfully (B13 to 18) and exercising (B25 to 30), and barriers to eating healthfully (B19 to 24) and exercising (B31 to 36), have 5-point Likert-type responses (strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, and strongly agree = 5). The higher the susceptibility and seriousness responses, the

stronger the beliefs of susceptibility to diabetes and seriousness of diabetes should diabetes develop. A higher response to benefits of eating healthfully and exercise indicates the individual thinks that positive outcomes will occur if she eats healthfully and exercises. A higher response to barriers to eating healthfully and exercise indicates the individual thinks that there are obstacles to her carrying out these preventive health behaviors.

Since the above four subscale scores were entered into the logistic regression model for statistical analysis, the ordinal level data responses for each subscale was split between responses 1 to 3 (strongly disagree, disagree, and neutral) and responses 4 and 5 (agree and strongly agree) in order to form a dichotomous variable. Strongly disagree, disagree, and neutral responses were assigned a value of 0 or negative, since they show lesser agreement with these beliefs. Agree and strongly agree responses were assigned a value of 1 or positive, since they indicate a stronger agreement with these beliefs.

Modifications to the Health Belief Scales (Subject's Health Beliefs)

Word changes to questions regarding seriousness of and susceptibility to diabetes, and benefits of and barriers to eating healthfully and exercise in order to reduce risks for diabetes were made to best describe perceptions about diabetes rather than cancer.

Susceptibility subscale (questions B1 to 5). The researcher made word changes to this subscale in order to measure beliefs about "diabetes" rather than "cancer."

Seriousness subscale (questions B6 to 12). Word changes in these questions reflect perceptions of seriousness of “diabetes” rather than “cancer”. Question B6, “The thought of breast cancer scares me”, was changed to “The thought of diabetes worries me”. Question B7, “When I think about breast cancer, my heart beats faster”, was changed to “When I think about diabetes, I become emotional”. Questions B8 to 11 are worded the same as in the original scale except “diabetes” has been substituted for “cancer”. Question B12 was changed from “If I developed breast cancer, I would not live longer than 5 years” to “If I developed diabetes, I would live a shorter life”.

Benefits of diet subscale (questions B13 to 18). Word changes in these questions reflect perceptions of benefits of eating healthfully rather than benefits of cancer prevention behaviors. “Eat healthfully” has been substituted for “breast self-examination” in Questions B13 to 14. Question B15, “Completing breast self-examination each month will allow me to find lumps early”, has been changed to ”Eating healthfully will allow me to postpone or prevent diabetes ”. Question B16, “If I complete breast self-examination monthly during the next year I will decrease my chance of dying from breast cancer”, has breast self-examination it will help me to find a lump which might be cancer before it is detected by a doctor or nurse”, has been changed to “If I eat healthfully, I can control my weight and reduce my risk for diabetes”.

Barriers to diet subscale (questions B19 to 24). These subscale questions have been modified to reflect perceptions of barriers to eating healthfully rather than barriers to cancer prevention behaviors. Question B19, “I feel funny doing breast self-examination”, has been changed to “Eating healthfully doesn’t ‘taste as good’”. Question B20, “Doing breast self-examination during the next year will make me worry about

breast cancer", has been changed to "Eating healthfully won't make a difference in my risk for diabetes". Question B21, "Breast self-examination will be embarrassing to me", has been changed to "Eating healthfully will be difficult for me". Question B22, "Doing breast self-examination will take too much time", has been changed to "Eating healthfully will take too much time". Question B23, "Doing breast self-examination will be unpleasant", has been changed to "Eating healthfully will cost too much." Question B24, "I don't have enough privacy to do breast self-examination", has been changed to "I am not interested in eating healthfully."

Benefits of and barriers to exercise subscales (questions B25 to 30 and B31 to 36). Word changes in these two subscales reflect perceptions of benefits of and barriers to exercise rather than to cancer prevention behaviors. The same word changes were made as described in the benefits of (Questions B13 to 18) and barriers to (Questions B19 to 24) diet subscales but using "exercise" instead of "eat healthfully" or "eating healthfully". Question B19, "Eating healthfully doesn't "taste as good'", has been changed to "I am too tired to exercise" (Question B31). Question B21, "Eating healthfully will be difficult for me", has been changed to "Exercising will be inconvenient for me" (Question B33).

Diet Self-Efficacy Scale

Self-efficacy was selected as a predictor of the individual's likelihood of carrying out healthy lifestyle behaviors. A diet self-efficacy instrument was used to assess the individual's confidence in her ability to eat healthfully under various situations. Modifications were made to the cardiac diet self-efficacy instrument developed by Hickey et al. (1992, 1997) that assesses eating healthfully to meet recommendations of

a cardiac diet. The proposed study made slight modifications to this instrument to assess perceived diet self-efficacy of eating healthfully to reduce the risk for diabetes. Very few word changes were necessary since the recommendations of a cardiac diet are very similar to diet recommendations to reduce the risk for diabetes. This modified instrument used in the present study will be referred to as the Diet Self-Efficacy Scale. The present study utilized the Cronbach's alpha statistical test to assess internal consistency of this scale with its modifications.

Scoring the Diet Self-Efficacy Scale

The Diet Self-Efficacy Scale has 5-point Likert-type responses (very little confidence= 1, some confidence = 2, confidence = 3, more confidence = 4, and quite a lot of confidence = 5). The following rankings were given the outcomes: 1 (very little), 2, 3 (confidence), 4, and 5 (quite a lot). The score was determined by adding the numbered response for each item and dividing this sum by the total number of questions (C1 to 16). A higher score indicates more confidence or perceived self-efficacy in being able to eat healthfully. Since this scale was entered in the logistic regression model for statistical analysis, the ordinal level data responses were split between responses 1 to 2 (very little confidence or some confidence) and responses 3 to 5 (confidence, more confidence, or quite a lot of confidence) to form a dichotomous variable. Very little confidence or some confidence responses were assigned the value of 0 or negative since this shows less perceived diet self-efficacy. Confidence, more confidence, or quite a lot of confidence responses were assigned the value of 1 or positive, since this indicates more perceived diet self-efficacy.

Modifications to the Diet Self-Efficacy Scale

Minor changes were made in the wording of this 16-item scale. Diet recommendations for cardiac patients and patients at risk for diabetes are similar, since heart disease is a major risk factor for those diagnosed with diabetes. Only two questions were modified in this scale. Question C2, “Decreasing the amount of fat and cholesterol in my diet”, was changed to read “Decreasing the amount of fat in my diet”. The GDM education emphasized reducing fat rather than cholesterol. This education also focused on carbohydrate foods more than eggs (carbohydrate foods more readily affect blood glucose levels); Question C14, “Limiting the number of egg yolks I eat in a week”, was reworded to say, “Limiting the amount of carbohydrate I eat at a meal”. The responses were scored (as in the original scale) with a 5-point Likert-type scale for each question. A yardstick was placed at the top of this diet self-efficacy scale in order for the reader to gauge her confidence in performing each diet task on a scale of 1 to 5.

Exercise Self-Efficacy Scale

Perceived exercise self-efficacy was selected to predict compliance with recommendations to stay active in order to reduce the individual’s risk for diabetes. It was decided to use a scale developed by Garcia and King (1991) that measures perceived exercise self-efficacy in healthy subjects. No wording changes were made since this scale assesses confidence of the individual to carry out basic exercise activities under conditions that the average individual would be expected to encounter. This scale was referred to in this study as the Exercise Self-Efficacy Scale. Internal consistency of this scale as used in this study will be assessed using Cronbach’s alpha.

Scoring the Exercise Self-Efficacy Scale

The Exercise Self-Efficacy Scale has 5-point Likert-type responses (very little confidence= 1, some confidence = 2, confidence = 3, more confidence = 4, and quite a lot of confidence = 5). The score was determined by adding the responses and dividing by the number of questions. A higher score indicates more confidence or perceived exercise self-efficacy in being able to exercise. Since this scale was entered in the logistic regression model for statistical analysis, the ordinal level data responses were split between responses 1 to 2 (very little confidence or some confidence) and responses 3 to 5 (confidence, more confidence, or quite a lot of confidence) to form a dichotomous variable. Very little confidence or some confidence responses were assigned the value of 0 or negative since this shows less perceived exercise self-efficacy. Confidence, more confidence, or quite a lot of confidence responses were assigned the value of 1 or positive, since this indicates more perceived exercise self-efficacy.

Modifications to the Exercise Self-Efficacy Scale

No change in wording was made to Questions D1 to 16; however, the heading of a scale in 10% intervals describing the level of confidence the individual has in performing exercise activities was modified. The modifications resemble the Diet Self-Efficacy Scale (yardstick provided at the top of the scale for the reader to gauge her confidence on a scale of 1 to 5 in performing exercise under each of the given conditions). The higher the score, the more confidence the individual has in her ability to exercise under various conditions.

Self-reported Health (Diabetes-related Variables and Cues to Action)

Nine questions (E1 to 9) assess diabetes-related variables (responses are yes and no unless otherwise indicated): Question E1, “Have you been told that you have diabetes or high blood sugar?” (cue to action); Question E2, “Do you have blood relatives who have diabetes?” (cue to action); Question E3, “Have you delivered a baby that weighed 8 pounds 8 ounces or more?” (cue to action); Question E4, “Did your pregnancy require insulin injections?” (cue to action); Question E5, “Did your pregnancy require pills to control your blood glucose?”; Question E6, “Your weight now” (response in pounds) and “Your height” (response in feet and inches); Question E7, “Has your weight changed since your last delivery?” (responses “If yes, please check one”, “gained or lost in pounds”; Question E8, “Who provided your gestational diabetes education?” (responses are “Nurse”, Dietitian”, or “Don’t know”) (diabetes-related variable); and Question E9, “How was the education session provided?” (responses are “Individually” or “In a group”) (diabetes-related variable).

Scoring Self-reported Health (Diabetes-related Variables and Cues to Action)

For Questions E1 to 5, dichotomous responses of yes or no were scored as no = 0 and yes = 1. A yes response to these questions indicates that the individual now has diabetes, has a blood relative with diabetes, delivered a macrosomic baby, and required insulin injections or oral medications to control blood glucose during pregnancy, respectively. Responses to Question E6, weight (in pounds) and height (in feet and inches), are ratio level data and were used to determine BMI which was dichotomized as obese = 0 and not obese = 1. Question E7, “Has your weight changed since your last delivery?” was dichotomized as 0 = gained weight and 1 = stayed the

same weight/lost weight. Question E8, “Who provided your gestational diabetes education?” was dichotomized as nurse/don’t know = 0 and dietitian = 1. Question E9, “How was the education session provided?” was dichotomized as individual = 0 and group = 1. These response scores were entered in the logistic regression model for statistical analysis.

Survey Question (Health) Not Presented in Theoretical Model

Question E6 regarding weight and height to determine BMI and Question E7 regarding weight change since last delivery are included in the survey because they help provide a good assessment of the overall risk of the individual for developing diabetes; it was decided to not include these variables in the theoretical model presented in Figure 2.

Subject’s Environment (Cues to Action)

Environmental support, both from individuals (social) and the community, are most influential in providing opportunities, reinforcement, as well as barriers (if absent) to the individual’s efforts to achieve a healthy lifestyle. Perceived support from the individual’s inner circle of friends and families in her geographical area can be influential. Food choices, facilities, and various health related programs available to the individual in the community, and their accessibility and safety are also critical in determining whether the individual will start and achieve healthy lifestyle behaviors. All responses are yes and no unless otherwise indicated.

Four questions (F1 to 4) assess social support of eating healthfully and exercise: Question F1, “Do you feel that you have family or friends who care that you eat healthfully?”; Question F2, “Do you feel that you have family or friends who care that

you exercise?"; Question F3, "Do you know others (family or friends) who eat healthfully?"; and Question F4, "Do you know others (family or friends) who exercise?"

Three questions (F5 to 7) assess the larger community support of eating healthfully (grocery store, work or school, and restaurants): Question F5, ''Are a variety of healthy foods available at your grocery store?"; Question F6, "Are a variety of healthy foods available at work or school?" (responses include "Not applicable"); and Question F7, "Are a variety of healthy foods available at restaurants?" Lastly, five questions (F8 to 12) assess community support of exercise: Question F8, "Are you able to exercise?"; Question F9, "Are exercise facilities available (gym/YMCA, walking/biking trails, etc.)?"; Question F10, "Do you have exercise equipment in your home?"; Question F11, "Is it safe to exercise in your neighborhood?"; and Question F12, "If you are not able to exercise, please explain why." The last question is open-ended. This last question can provide a greater understanding of "why" if the individual indicates she is not able to exercise.

Scoring Subject's Environment (Cues to Action)

Since the 12 questions are answered as yes or no (Question F6 has an additional response of not applicable and Question F12 offers a write in response and a response of not applicable), they were scored accordingly (yes = 1 and no = 0). Question F12 is open-ended and was analyzed for patterns of response. A yes response to Question F1 indicates that the individual perceives that family or friends care that the individual eats healthfully. A yes response to Question F3 indicates that the individual knows others (family or friends) who eat healthfully. A yes response to Question F2 indicates that the individual perceives that family or friends care that the individual exercises. A yes

response to Question F4 indicates that the individual knows others (family or friends) who exercise. A yes response to Questions F5 to 7 indicates that the individual can find a variety of healthy foods at the grocery store, work or school, and at restaurants, respectively. A yes response to questions F8 to 11 indicates that the individual is able to exercise, exercise facilities are available, exercise equipment is available at home, and that exercise is safe in the neighborhood. Question F12 is open-ended and allows the individual to explain why if she is not able to exercise. These dichotomous responses were entered in the logistic regression model for statistical analysis.

Survey Questions (Subject's Environment) Not Presented in Theoretical Model

Questions F8, "Are you able to exercise?", and F12, "Explain why if you are not able to exercise", are included in the survey because they help provide good information about the individual's health behaviors; it was decided to not include these variables in the theoretical model presented in Figure 2.

Self-reported Nutrition Knowledge

Knowledge about nutrition can influence food behaviors. The following questions are thought to best represent some of the key areas emphasized during the GDM education presentation. These questions also represent basic nutrition recommendations promoting an intake of a variety of low calorie foods moderate in portion size in order to avoid weight gain. Five questions were asked: Question G1, "Circle the 4 foods that are carbohydrates (carbs)" (responses are "potato", "pasta", "orange", "milk", "steak", and "chicken"); Question G2, "Circle the 4 foods that are low in carbs" (responses are "pasta", "bread", "lettuce", "cucumber", "tomatoes", and "broccoli"); Question G3, "Circle the 3 foods that are low in fat" (responses are

"sausage", "lean ham", "skim milk", "fried chicken", and "2% fat cheese"; Question G4, "Circle the 2 foods that have more fiber" (responses are "instant cereal", "whole grain cereal", "instant potatoes", and "whole potatoes with skin"); and Question G5, "What is a serving size of cooked potatoes, corn, or peas? (circle one answer)" (responses are "2 cups", "1 ½ cups", and "½ cup").

Scoring Self-reported Nutrition Knowledge

Each correct response to nutrition knowledge questions (G1 to 5) received 1 point for correct responses and 0 point for incorrect responses. The sum of these responses were dichotomized as 0 or fail (two or fewer correct responses) and 1 or pass (three or more correct responses). These dichotomous responses were entered in the logistic regression model for statistical analysis.

Survey Questions (Nutrition Knowledge) Not Presented in Theoretical Model

Questions G1 to 5 regarding nutrition knowledge were included in the survey because they assess the individual's nutrition knowledge which can help predict food intake behavior; it was decided that these questions were not critical in the theoretical model presented in Figure 2.

Socio-Demographics Information

The following eight questions were asked: Question H1, "Age" (response is "years"); Question H2, "Ethnicity" (responses are "Caucasian", "African American", "Hispanic", "Asian", and "Other [please describe]"); Question H3, "Marital status" (responses are "Married", "Divorced", "Widowed", "Single", and "Other"); Question H4, "Number of persons living in your home now" and "Number of children under 18 years "; Question H5, "Please indicate your highest level of education" (responses are "Less

than high school", "High school diploma/GED", and "College degree"); Question H6, "Your annual household income is" (responses are "Less than $18,000", "$18,000-36,000", "$36,000-50,000"; "$50,000-75,000"; "$75,000-100,000"; and "over $100,000"); question 7, "Where do you live" (responses are "city or county" [write in response], and "Is this: Rural [country]" or "Urban [city]" or "Suburban [immediately outside a city]"; and question H8, "Health insurance" (responses are "Private", "Tricare", "Medicaid", "No health insurance", and "Other".

Measurement of Socio-Demographics Information

Question H1, age in years, was dichotomized in one of two groups: 34 years or younger (1) and 35 years or older (0). Question H2, ethnicity, was scored according to the number of individuals placing themselves in one selected ethnic group and was dichotomized as Caucasian (1) and other (0). Question H3, marital status, was scored according to the number of individuals placing themselves in one selected marital status group and was dichotomized as married (1) and other (0). Question H4, number of persons living in your home now, was used with Question H6, your annual household income, in a formula to determine if the individual is within poverty guidelines (0) or not (1) (DHHS, 2004). Question H5, highest level of education, was scored according to the number of individuals placing themselves in one selected education category and was dichotomized as high school or less education (0) and college degree (1). Question H7, city or county of residence and is this rural, urban, or suburban, was scored according to the information reported and was dichotomized as Portsmouth (0) and other (1) and urban/suburban (1) and other (0). Question H8, health insurance, was scored according to the number of individuals placing themselves in one selected health

insurance payment category and was dichotomized as having health insurance (1) and not having health insurance (0). To enter these demographic variable responses in the logistic regression model for statistical analysis, the above ratio, ordinal, or nominal level variables utilized at least one dummy variable.

Survey Questions (Socio-Demographics) Not Presented in Theoretical Model

Question H4, number of persons living in your home now, was used with Question H6, your annual household income, in a formula to determine if the individual is within poverty guidelines. The second part of Question H4, number of children under 18 years, may provide a better understanding of the individual's ability to carry out healthy lifestyle behaviors. It was decided to not include these variables in the theoretical model in Figure 2.

Operational Definitions

Dependent Variables

Healthy Eating Index score. Ratio (number of servings yesterday and average per day over the past week). The intake of vegetables, fruits, grains and starchy foods, milk, and meat (given in ounces, not servings as the other food groups) that best represent the Food Guide Pyramid's recommendations. The ratio level data responses given 1 point for each response meeting the Food Guide Pyramid's recommendations for that food group. Each of these points will be summed, the highest possible score being 5. The responses will be dichotomized as 0 for a score of 3 or less (indicating a lower score on the "Healthy Eating Index") and 1 for a score of 4 or more (indicating a higher score on the "Healthy Eating Index"); this is self-reported food intake.

High calorie food or beverage intake score. Ratio (number of servings yesterday and average per day over the past week). Assesses intake of added fat, fried foods, sweetened beverages, and high calorie snack and dessert foods. Appropriate intake of each food category will be awarded 1 point. Each of these points will be summed, the most desirable score being 4. The score will be dichotomized as 0 for a score of 2 or less than (indicating a less desirable score on the "intake of high calorie food or beverage") and 1 for a score of 3 or more (indicating a more desirable score on "intake of high calorie food or beverage"); self-reported food intake.

Did 30 min or more of physical activity in the past week. Ratio (number of days). Will be dichotomized as 0 for two days or less and 1 for three days or more; self-reported exercise.

Worked out enough to sweat in the past week. Ratio (number of days). Will be dichotomized as 0 for two days or less and 1 for three days or more; self-reported exercise.

"**Worked-in" other types of exercise yesterday**. Ratio (number of days). Will be dichotomized as 0 for two days or less and 1 for three days or more; self-reported exercise.

A combined score for exercise behaviors will also be utilized represented by the addition of the above exercise scores (30 min or more of physical activity in the past week + worked out enough to sweat in the past week + worked-in other types of exercise).

Independent Variables

Perceived susceptibility to diabetes. Ratio (score is determined by adding the responses for each of the ordinal level questions assessing this variable and then dividing by the number of questions). The response to each ordinal level question will be dichotomized as 0 or negative (strongly disagree, disagree, or neutral) and 1 or positive (agree or strongly agree) and then the sum of these responses will be divided by the number of questions. Assesses how strongly the individual feels she will develop diabetes.

Perceived seriousness of diabetes. Ratio (score is determined by adding the responses for each of the ordinal level questions assessing this variable and then dividing by the number of questions). The response to each ordinal level question will be dichotomized as 0 or negative (strongly disagree, disagree, or neutral) and 1 or positive (agree or strongly agree) and then the sum of these responses will be divided by the number of questions. Assesses how strongly the individual feels that diabetes is a serious disease.

Perceived benefits of eating healthfully. Ratio (score is determined by adding the responses for each of the ordinal level questions assessing this variable and then dividing by the number of questions). The response to each ordinal level question will be dichotomized as 0 or negative (strongly disagree, disagree, or neutral) and 1 or positive (agree or strongly agree) and then the sum of these responses will be divided by the number of questions. Assesses how strongly the individual feels that by eating healthfully she can prevent or postpone the diagnosis of diabetes.

Perceived barriers to eating healthfully. Ratio (score is determined by adding the responses for each of the ordinal level questions assessing this variable and then dividing by the number of questions). The response to each ordinal level question will be dichotomized as 0 or negative (strongly disagree, disagree, or neutral) and 1 or positive (agree or strongly agree) and then the sum of these responses will be divided by the number of questions. Assesses how strongly the individual feels that there are barriers to her eating healthfully in order to prevent or postpone the diagnosis of diabetes.

Perceived benefits of exercise. Ratio (score is determined by adding the responses for each of the ordinal level questions assessing this variable and then dividing by the number of questions). The response to each ordinal level question will be dichotomized as 0 or negative (strongly disagree, disagree, or neutral) and 1 or positive (agree or strongly agree) and then the sum of these responses will be divided by the number of questions. Assesses how strongly the individual feels that exercise can prevent or postpone the diagnosis of diabetes.

Perceived barriers to exercise. Ratio (score is determined by adding the responses for each of the ordinal level questions assessing this variable and then dividing by the number of questions). The response to each ordinal level question will be dichotomized as 0 or negative (strongly disagree, disagree, or neutral) and 1 or positive (agree or strongly agree) and then the sum of these responses will be divided by the number of questions. Assesses how strongly the individual feels that there are barriers to her exercising in order to prevent or postpone the diagnosis of diabetes.

Perceived benefits of minus barriers to eating healthfully and exercise will be determined by subtracting the barrier score from the benefits score.

Perceived diet self-efficacy. Ratio (score is determined by adding the responses for each of the ordinal level questions assessing this variable and then dividing by the number of questions). The response to each ordinal level question will be dichotomized as 0 or negative (very little confidence or some confidence) and 1 or positive (confidence, more confidence, or quite a lot of confidence) and then the sum of these responses will be divided by the number of questions. Assesses how much confidence or self-efficacy the individual has in her ability to eat healthfully.

Perceived exercise self-efficacy. Ratio (score is determined by adding the responses for each of the ordinal level questions assessing this variable and then dividing by the number of questions). The response to each ordinal level question will be dichotomized as 0 or negative (very little confidence or some confidence) and 1 or positive (confidence, more confidence, or quite a lot of confidence) and then the sum of these responses will be divided by the number of questions. Assesses how much confidence or self-efficacy the individual has in her ability to exercise.

Current or subsequent diagnosis of diabetes (cue to action). Nominal (yes or no). Has the individual been told that she has diabetes.

Family history or blood relatives who have diabetes (cue to action). Nominal (yes or no). Any person related by blood to the individual who has been told that he or she has diabetes.

History of delivery of macrosomic infant (cue to action). Nominal (yes or no). Has the individual delivered a baby weighing 8 lb. 8 oz. or more.

Provider of GDM education. Nominal (nurse, dietitian, or don't know); dichotomized to yes (dietitian provided) or no (dietitian did not provide). Maternal Fetal Medicine database and records kept by the dietitian will confirm this information. Both the dietitian and nurse are certified diabetes educators and are equally qualified to provide the GDM education; it is hypothesized that since the majority of the education provided is diet-related, the dietitian may be more successful in explaining the diet to the patient and obtaining more compliance from the patient.

Type of GDM education. Nominal (individual or group). Was the GDM education presented individually or in a group with other patients.

Requirement for insulin injections during pregnancy (cue to action). Nominal (yes or no). Did the individual ever require insulin injections during her pregnancy.

Requirement for pills or oral medication to control blood glucose during pregnancy (cue to action). Nominal (yes or no). Did the individual ever require pills or medication to control blood glucose during her pregnancy.

Weight. Ratio (number of pounds). Self-described by the patient.

Height. Ratio (number of feet and inches). Self-described by the patient.

Body Mass Index or BMI. Ratio. Weight and height information will be used to determine BMI (weight in kilograms divided by height in meters squared). The BMI score, normal or underweight (BMI < 25), overweight (BMI = 25-29), or obese (BMI ≥ 30), will be dichotomized as obese and not obese.

Pounds gained or lost since last delivery. Ratio (number of pounds). This variable will be dichotomized as weight gain or no weight gain.

Social support for eating healthfully. Nominal (yes or no). Measures the individual's perception of support from family and friends who care about her diet and perception of healthy eating behaviors of family and friends.

Social support for exercise. Nominal (yes or no). Measures the individual's perception of support from family and friends who care about her exercise and of perception of exercise behaviors of family and friends.

Community support for eating healthfully. Nominal (yes or no). Measures the individual's perception of community support for eating healthfully (healthy foods at the grocery store, work or school, and restaurants).

Community support for exercise. Nominal (yes or no). Measures the individual's perception of community support for exercise (able to exercise, availability of exercise facilities, safety of exercise in neighborhood). An additional open-ended question will be asked to explain why, if the individual indicated she is unable to exercise. Not applicable is a response choice for questions assessing availability of healthy foods at work or school, and if unable to exercise, why.

Nutrition knowledge. Ratio (number of correct answers). This question is measured by correctly answering five multiple-choice questions. Will be dichotomized as pass (three or more questions correctly answered) and fail (two or fewer questions correctly answered).

Age. Ratio (number of years). Age will be dichotomized as 34 years or younger and 35 years or older.

Ethnicity. Nominal (Caucasian, African American, Hispanic, Asian, or other). Will be dichotomized as Caucasian and all the other categories (the other categories will be recoded into one category).

Marital status. Nominal (married, divorced, widowed, single, or other). Will be dichotomized as married and all the other categories (the other categories will be recoded into one category).

Residence. Nominal (fill in the blank). Will be dichotomized as Portsmouth and all the other cities (the other cities will be recoded into one category).

Residence. Nominal (rural, urban, or suburban). Will be dichotomized as rural and all the other categories (the other categories will be recoded into one category).

Type of health care payment. Nominal (Private, Tricare, Medicaid, no health insurance, or other). Will be dichotomized as having health insurance and not having health insurance.

Education. Nominal (less than high school, high school diploma/GED, or college degree). Will be dichotomized as high school or less education and college degree.

Number of persons living in home. Ratio (number or persons).

Number of children under 18 years. Ratio (number or children).

Annual Income. Interval (less than $18,000; $18,000-36,000; $36,000-50,000; $50,000-75,000; $75,000-100,000; and over $100,000). Formula will be applied using number of persons in household and income to determine if individual meets federal poverty guidelines and will be dichotomized as yes and no.

Modifications to Survey Based on

Expert Committee Recommendations

(See form in Appendix F)

A. Your Lifestyle (How You Exercise, See Appendix I)

Questions A1 to 3 "…how many times…" was changed to "…how many days…" and the responses "more than 4 times" were changed to "more than 4 days" (reason: to be more consistent with the terminology used for frequency of activity recommendations in the literature). Question A4 regarding watching TV shows or videos or DVDs was omitted (reason: survey assesses activity not inactivity).

A. Your Lifestyle (How You Eat, See Appendix I)

Modifications to questions regarding diet behavior (Questions 4 to 13) included improved wording for more food choices, serving sizes, food intake for given time periods, and additional food preparation choices.

E. Health

"Have you been diagnosed with GDM more than once?" was omitted (reason: determined to not be directly related to outcomes). Questions E8 and E9, "Who provided your gestational diabetes education?" and "How was the education session provided?", were moved to the end of this section (reason: better flow of relevant questions). Question E7, "How many pounds have you gained since your last delivery?", was changed to "Has your weight changed since your last delivery?" Choices of "Yes" and "No" and "If yes, please indicate pounds gained or pounds lost" (reason: question better conceptualized for reader).

F. Environment

Question F1, "…who care about your diet", was changed to "…who care that you eat healthfully," and Question 2, "…who care about your exercise", was changed to "…who care that you exercise" (reasons: improved wording). Questions F5 to 7, "Are healthy foods available…", were changed to "Are a variety of healthy foods available…" (reason: to better assess if a variety of healthy foods are available rather than just one healthy food). Question F7, "…available at the restaurants in your area?", was changed to "…available at restaurants?" (reason: improved wording).

Question F10, "If you need childcare, is it available in order for you to exercise?", was omitted and instead will be used as an example for Question F12, "If you are not able to exercise, please explain why (for example, no child care)" (reason: consolidates the questions). Question F11, "Are you able to exercise?", was asked as Question F8 (reason: this question is more appropriately asked first in this section rather than later.) An additional question, Question F10, "Do you have exercise equipment in your home?", was added (reason: to assess all sources of exercise).

G. Nutrition Knowledge

Question G2, "Circle the 4 foods that you can eat in large amounts because they are low in carbs", was changed to "Circle the 4 foods that are low in carbs" (reason: to simplify the wording). The responses to Question G3 regarding low fat foods, "low-fat ham" and "low-fat cheese", were changed to "lean ham" and "2% fat cheese", respectively (reason: to not offer responses with giveaway or easily detectable answers). Question A5, "What is the serving size…", was changed to "What is a serving size…" (reason: improved wording).

H. Important Information About You (Socio-demographics)

Question H2, ethnicity, was changed to include the statement "Please describe" after the category "Other" (reason: helps to clarify the response). The order of the questions was changed to age, ethnicity, marital status, number of persons living in your home now, education, annual income, residence, and health insurance (reason: to improve the natural flow of questions having similar characteristics). Responses to Question H5 regarding education, "Less than high school", "High school", "Some college", "College", and "Graduate school", were changed to "Less than high school", "High school diploma/GED", and "College degree" (reason: to simplify the responses with more meaningful categories). Question H6, "Your annual household income…", was asked as a separate question from "Number of persons living in your home now" (reason: so that each variable is a separate question). The question regarding employment was omitted (reason: determined not to be directly related to the outcome variables).

Appendix A shows the theoretical constructs described in the above scales and the scale or survey items that measure them.

Survey Distribution

After further modifications to the survey (see Appendix B) based on the Expert Committees' assessments and results of the pilot study (Table 1), the survey was mailed to the study patients (Table 2). The purpose of the pilot study was to further refine the questions asked based on input from this preliminary survey response. The details were as follows.

Table 1

Time Line for Pilot Study of 30 Patients

Introductory flier mailed	Spring/Summer 2006 and again 2 weeks later
Flier and survey mailed	When completed flier returned, approximately 2 weeks later
Survey due back	4 Weeks after survey is mailed
Reminder postcard mailed	2 Weeks after survey is mailed
Phone contact initiated	1 Month after survey is mailed
Phone contact concluded	1 Week later
Gift certificates mailed to patients returning completed survey or answering survey questions by telephone	Approximately 1 week later

Table 2

Time Line for Larger Study of 595 Patients

Introductory flier mailed	Summer 2006 and again 2 weeks later
Flier and survey mailed	When completed flier returned, approximately 2 weeks later
Survey due back	4 Weeks after survey is mailed
Reminder postcard mailed	2 Weeks after survey is mailed
Phone contact initiated	1 Month after survey is mailed
Phone contact concluded	1Month later
Gift certificates mailed to patients returning completed survey or answering survey questions by telephone	Approximately 2 weeks later

Names and addresses of the two separate groups of patients to be surveyed, the first 30 for the pilot study and the next 595 for the larger study (mutually exclusive groups) who received care for GDM from MFM in 2004 and 2005. This information was cross-referenced with the patient scheduling system and the medical record to determine the most recent and accurate address/phone number for the patients. Ten first 30 for the pilot study and the next 595 for the larger study (mutually exclusive groups) who

received care for DGM from MFM in 2004 and 2005. This information was cross-reference with the patient scheduling system and the medical record sets of mailing labels and one copy for each of the two groups (pilot study and full study) were prepared: introductory flier (see Appendix C) in envelope and an envelope for returning the completed flier, this same mailing was repeated in two weeks to ensure delivery; envelope containing the survey, survey flier (see Appendix D), and an envelope for returning the survey; reminder postcard (see Appendix E) in an envelope; two extra sets in case a survey had to be re-mailed, one for mailing the survey and one for the envelope for returning the survey; and one copy of the mailing labels containing an identifying number linking each patient to a mailed survey (the survey contains the same identifying number). The last set of mailing labels was used to mail the gift certificates when the completed survey was returned, or the information obtained by telephone. These mailing labels were kept in a secured location by the principal investigator.

To summarize, an introductory flier (see Appendix C) was sent to the patients in the pilot study and the larger study explaining that a survey assessing health beliefs and lifestyle behaviors of diet and exercise (see Appendix B) will be mailed to them in the following one to two weeks if they agree to participate in the study; return of the flier indicating the patient's willingness to participate was required in order to receive the survey (this also provided confirmation of patient's address and contact information; a numerical identification number was also placed on the survey and a copy of the mailing labels to enable tracking of the survey and its return). The introductory flier is re mailed again in two weeks. There were two ways the patient could indicate she would not

participate in the study, by not returning the completed introductory flier or returning the flier but indicating on this form she would not participate. If the patient agrees and the survey flier and survey are mailed to her, two weeks later, a reminder postcard will also be sent, and if in two more weeks the completed survey is not received, a phone call will be made to the patient with the intent of obtaining the survey information by phone. Contact information for the Eastern Virginia Medical School investigator and Old Dominion University study faculty was also provided (on the introductory flier, survey flier, and reminder postcard) should the patient have any questions or concerns. The patient-selected gift card ($10 value from Farm Fresh, Food Lion, Target, or Macy's) will be sent to the patient when the survey information is obtained, either by mail or phone.

Improving the Response Rate

The same introductory flier (see Appendix C) was mailed again in two weeks to ensure delivery to the patient. This flier explained that if the patient agreed to participate, she would receive a mailed survey, a subsequently mailed postcard two weeks later reminding her to return the survey, and if the survey was not returned one month after that, she would receive a phone call for the purpose of obtaining the survey answers over the telephone (see Appendix H for phone script). Self-addressed stamped envelopes were also provided for return correspondence. Anonymity of survey responses may have increased the quality of the response as well as the response rate. The introductory flier, sent initially and again two weeks later, explaining the study and the survey itself each contained a photograph of the health care team who provided care to these patients during their GDM experience (the physician, three registered nurses, and a registered dietitian who is also the researcher in this study). It was hoped

that this photograph personalized the survey request and enabled the patient to recall good support during the high-risk pregnancy. In addition, each patient completing and returning the survey received a $10 gift certificate to Farm Fresh, Food Lion, Target or Macy's; the patient will select the gift certificate source.

Pilot Study

The pilot study was composed of 30 selected patients who received care and education for GDM in 2004 and 2005. These patients were excluded from the cohort of 595 patients used for the larger study. All other procedures as outlined in this chapter were followed for survey development and administration, patient contact, data collection and protection, and analysis.

Expert Committees

An expert committee consisting of a MFM physician, a psychologist familiar with psychological measurements and food behavior outcomes, and two CDEs (a registered nurse and a registered dietitian) reviewed the survey for face value and content validity. The survey and its components, the modified instruments assessing health beliefs and diet and exercise self-efficacy, and the questions assessing social and community support, diabetes-related and demographic variables, nutrition knowledge, and the outcomes of healthy eating and exercise behaviors, were reviewed by the expert committee before the pilot study and after the pilot study as needed. See Appendix F for the expert committee form. The expert committee recommended any survey item deletions, changes, or additions.

Another expert (evaluator) committee consisting of two registered dietitians who are also CDEs evaluated the scoring method of the diet outcome questions. See

Appendix G for this form. Survey changes as a result of these committees' suggestions are described in this Chapter.

Protection of Human Rights

Approval by the Institution/Human Subjects Review Boards (IRB) of Eastern Virginia Medical School and Old Dominion University was obtained prior to the collection of any data (this study was approved by the Eastern Virginia Medical School IRB as exempt #05-12-XX-0367 and by the Old Dominion University IRB as exempt category 2).

The researcher (principal investigator) and as necessary, additionally trained persons who assisted in the retrieval of database information or survey information by telephone, completed the National Institutes of Health "Human Participant Protections Education for Research Teams" course and passed the required tests.

Participation in the study survey was voluntary with no negative consequence when a patient decided not to participate or answer the survey questions. As stated in the introductory flier mailed to the patient, consent was implied when the patient completed and returned the flier giving the researcher permission to mail to the patient the survey, a reminder postcard, and to contact the patient for information by telephone when the survey was not returned in a timely manner.

Completion of the survey required about 20 to 30 min of the patient's time. Minimal risk was involved since the study did not include any invasive procedures. Questions surveyed the patient's beliefs about susceptibility to diabetes, severity of complications due to diabetes should this condition develop, benefits of and barriers to eating healthfully and exercising, and confidence in eating healthfully and exercising

under certain conditions. Questions about current health of self or family members, marital status, or income may have evoked negative feelings in some individuals; however, these should be minor. The survey questions may have encouraged the patient to evaluate her lifestyle and make positive changes in eating and exercising. The information obtained from this survey can improve the delivery of prenatal and postpartum care in an effort to prevent GDM, recurring GDM, and type 2 diabetes later in life.

The MFM patient database was secured in a safe location by the appropriate staff having access to this document. Completed surveys returned to the researcher were kept in a secured location. A copy of the mailing labels (name, address, and phone number), containing the same identifying number as on the survey mailed to that individual (in order to keep track of surveys returned) was kept in a secured location and destroyed as required when each completed survey was returned or the responses obtained by telephone or if the survey was not returned by the time required. All identifying information was removed before analysis of the survey data. The results were reported as a group, not individually. The introduction flier, the same flier sent again as a reminder, a second flier sent with the survey, and a reminder postcard if necessary included instructions for contacting the MFM and Old Dominion University researchers if needed. The above protocol was followed for the pilot study and the larger study.

Statistical Analysis

The survey data was evaluated for missing values. If few surveys were returned uncompleted and they were similar to the remaining surveys, then these surveys were

omitted from analysis. If many surveys were returned with just a few items uncompleted, the missing item response were replaced with a mean (of items answered) or a neutral response.

Descriptive statistics were performed for all variables. Frequency distributions were performed for independent variables; if the variables were nominal or ordinal, modes were reported. If the variables were interval or ratio, means, standard deviation, the median, and interquartile ranges were reported; normality of data was also assessed. Dependent variables will be dichotomized and independent variables will either be dichotomized or dummy variables will be utilized for logistic regression analysis, see Appendix A for a description.

Each hypothesis was tested with the appropriate statistic. Bivariate and multivariate tests were performed on two and more than two variables, respectively. The appropriate parametric and nonparametric tests were selected for the data entered. For ratio/interval dependent variables and bi-level nominal independent variables, independent sample t-tests were utilized; for ordinal/nominal dependent variables and bi-level nominal independent variables, the Mann-Whitney U tests of comparison were utilized. If both the dependent and independent variables were nominal, then the Chi-Square test of association were selected. When the independent variables have more than two categories or levels, than the ANOVA test was selected if the dependent variable is ratio/interval; if the dependent variable is ordinal/nominal, then the Kruskal-Wallis test was selected.

Five models with varying combinations of the independent variables or predictors were utilized and tested separately. Model I evaluated the Health Belief Model; Model II

evaluated the Health Belief Model and perceived self-efficacy; Model III evaluated the Health Belief Model and the cue to action, environment (includes both social and community support); Model IV evaluated the Health Belief Model, perceived self-efficacy, and environment; and Model V evaluated the Health Belief Model, perceived self-efficacy, environment, and child care issues (utilized for exercise behavior only). Each of these five models were tested for both individual predictor effect and model effect on the outcome or dependent variables of diet and exercise behavior. Each of the five models was tested using multivariate analysis. Logistic regression analysis determined the odds that the outcome behavior would be performed. The adjusted odds ratio [Exp(B)] indicated the change in odds of the outcome behavior occurring for every unit change in the predictor, while controlling for other variables that may affect the dependent variable in the model. As the predictor value increases, the odds of the event occurring also increases. The chi-square value shows how well the model and its independent variables predict the outcome variable, or goodness of fit. If the *p* value or significance is less than .05, the *b* coefficient is significantly different from zero, this would indicate a good fit of the model and its variables and a rejection of the null hypothesis (Meyers, Gamst, & Guarino, 2006; Field, 2009). The larger the Nagelkerke value or percentage effect on the outcome variable, the stronger the effect of the predictor variable on the outcome variable, an indication of the validity of the model.

Summary

This chapter provided an extensive review of the instruments and the survey questions utilized in this study. The data collection and analyses were appropriate to achieve the overall goal of the study.

CHAPTER IV

RESULTS

This chapter includes results from individual variable, bivariate, and multivariate analyses. All the analyses followed the Health Belief Model framework. First, I analyzed the socio-demographics of the study sample. Then I conducted the bivariate analyses to examine the relationships between diet and exercise across socio-demographics, health beliefs, exercise and diet self-efficacy, and diabetes-related and environmental cues to action. Eventually, multivariate analyses were conducted on selected theoretical variables and based on performance in individual and bivariate analyses to examine how these cue-to-action factors were jointly associated with the outcomes, diet, and exercise behavior. The significance level was set at < 0.05. The major results are presented in Tables 3 through 23, while Appendix K, Tables 1 through 13 include the descriptive results. Please see Appendix L for the hypotheses test results.

Socio-Demographics of the Study Sample

Former MFM patients (n = 595) with a history of GDM who received care and education for this condition in 2004 and 2005 at MFM, Department of OB-GYN, Eastern Virginia Medical School offices in Norfolk, Newport News, and Virginia Beach, Virginia, received the survey invitation in the mail (Appendix B). The survey consisted of 115 questions; each person completing and returning the survey received a gift card for $10 to Farm Fresh, Food Lion, Macy's, or Target. I received 153 completed surveys either by mail or by phone interview. Other responses were as follows: 105 surveys were returned due to bad addresses, 8 persons declined to participate in the study, 16

persons who agreed to complete the survey never returned/completed the surveys, and 313 individuals never responded to the initial survey announcement.

Table 3 shows that 75% of the respondents were Caucasian, and the mean age was 34.51 years (SD = 5.78). African-Americans represented 15.1% of the respondents; Asian and Hispanic/other comprised 8.6% and 1.3%, respectively.

Married women represented 83% of the respondents, with single (12.4%) and divorced (3.3%) women and “other” (1.3%) making up the remainder of the study sample. The average number of adults living in the household was 2.03 (SD = 0.64). The average woman reported having 1.99 children (SD = 0.94). The majority of the women had a college degree (65.4%), followed by those with a high school degree/equivalency (32.7%) and less than high school (2%). Sixty-one percent of the women self-reported an annual household income over $50,000, and 19.7% reported incomes over $100,000. Of the survey respondents, 11.8% of the women reported annual household incomes less than $18,000, 9.2% reported incomes of $18,000 to $35,999, and 17.8% reported incomes of $36,000 to $49,999. Most of the women (85.6%) resided in urban areas (including geographical areas not reported in this table).

The majority were from Virginia Beach (37.9%), and the remainder lived in Chesapeake (16.3%), Norfolk (11.8%), Portsmouth (4.6%), other Hampton Roads locations (18.3%), other Virginia locations (2.6%), North Carolina (5.9%), or areas out of the region (2.6%) (data not reported in this table).

Table 3 shows most of the women were insured (71.9% by private insurance, 8.5% by Tricare, and 7.8% by Medicaid/Medicare). No health insurance was reported by 11.8% of the women. When the women were receiving care for GDM, 48.4% were

Table 3

Socio-Demographic Characteristics of Study Sample

	(*n* = 153)
Age [M(SD)][1]	34.51 (5.78)
Ethnicity (%)	
Caucasian	
African-American	15.1
Asian	8.6
Hispanics/Other	1.3
Marital Status (%)	
Married	83.0
Divorced	3.3
Widowed	0.0
Single	12.4
Other	1.3
Household Arrangement [M(SD)]	
Number adults living in home	2.03 (0.64)
Number children <18 years of age	1.99 (0.94)
Education (%)	
Less than HS	2.0
High School Diploma/GED	32.7
College Degree	65.4
Annual Income (%)	
<$18,000	11.8
$18,000-35,999	9.2
$36,000-49,999	17.8
$50,000-74,999	23.0
$75,000-99,999	18.4
≥$100,000	19.7
Health Insurance (%)[2]	
Private (has insurance)	71.9
Tricare (has insurance)	8.5
Medicaid/Medicare	7.8
No Health Insurance	11.8
Care Received During Pregnancy (%)	
Consult (1-2 prenatal visits)	78.4
Full Care (provide all prenatal care)	8.5
Co-Manage (shared prenatal care)	13.1

Table 3

Socio-Demographic Characteristics of Study Sample

Where Care/Education Received (%)[3]	
Newport News	11.8
Virginia Beach	39.9
Norfolk	48.4
Method of Survey Completion (%)	
By Mail	93.5
By Phone	6.5

Note. [1] = [M(SD)] = [mean (standard deviation)]; [2] = 80.4% of subjects have insurance; [3] = office site

seen at the Norfolk office, 39.9% were seen at the Virginia Beach office, and 11.8% were seen at the Newport News office. Most of these former patients were seen as consult care (78.4%); 13.1% were co-managed, and 8.5% were full care. This same table shows that 93.5% of the women completed the survey by mail; 6.5% were completed by phone interview.

Exercise and Diet Behaviors

Exercise Behavior (Appendix K1) illustrates the individual exercise behaviors: having at least 30 min of physical activity, with a mean of 2.90 days (SD = 1.40), working out enough to sweat, with a mean of 1.80 days (SD = 1.48), and working in other exercise, with a mean of 2.89 days (SD = 1.62), per week. High scores were defined as physical activity at least three days weekly: 64.7% of these women exercised for 30 min; 35.9% worked out enough to sweat; and 52.9% worked in other exercise. These results show a good effort at exercising among the women. These three scores were added to produce one score representing the total activity (30 minute physical activity + work out to sweat + work-in exercise) with a mean score (number of days) of 2.53 (1.13).

Appendix K2 includes 10 questions about food intake. Food intake is shown in two categories, healthy eating per day and high-calorie foods/beverage intake per day. The mean number of servings of vegetables per day was 2.18 (SD = 1.10). The mean number of servings of fruit/juice average per day was 1.78 (SD = 1.05). The mean number of servings of cereals and bread-type foods per day was 3.52 (SD = 1.91). The mean number of servings of milk per day was 2.04 (SD = 1.07). The mean number of servings of meat/protein foods per day was 6.95 (SD = 3.53).

To assess intake of high-calorie foods/beverages, four food categories were utilized. There are no specific recommendations for these foods other than to eat as few of these foods as possible. The mean number of servings of added fats to foods per day was 2.39 (SD = 1.32). The mean number of servings of fried/high fat foods per day was 1.01 (SD = 0.93). The mean number of servings of sugared drinks per day was 0.94 (SD = 1.42). The mean number of servings of snacks and desserts per day was 1.45 (SD = 1.25). The mean number of meals skipped per day was 0.58 (SD = 0.68).

Appendix K3 shows the dichotomized score for the finalized Healthy Eating Index, with a mean score of 2.07 (SD = 1.11). Only 9.8% of the women scored 4 or 5 (a high score), using a scoring system based on the US Food Pyramid. The mean of the high-calorie food/beverage intake score per day was 3.11 (SD = 1.00), and 75.2% of the women reported scoring 3 or 4 (a more desirable score). This means that the women respondents reported a better score in regards to their high-calorie food/beverage intake than their healthy food intake.

The above results show that the women generally scored much better in limiting high calorie foods/beverage than they did in eating adequate and moderate amounts of

healthy foods. Two of the much-emphasized objectives of the GDM education were: 1) to achieve desirable blood glucose levels during pregnancy by controlling carbohydrate food intake, and 2) to avoid weight gain after the pregnancy in order to avoid type 2 diabetes later in life. The women in this study may have been more aware of unhealthy food intake than more-healthy food intake.

The Health Belief Variable

Reliability or internal consistency of the Health Beliefs subscales (perceived susceptibility and seriousness, benefits of and barriers to diet and exercise) was determined by the Cronbach's Alpha statistic. The Cronbach's Alpha statistic for perceived susceptibility was .919; for perceived seriousness, .805; for benefits of diet, .834; for barriers to diet, .784; for benefits of exercise, .850; and for barriers to exercise, .799. Each of these subscales showed a moderate strength in reliability or internal consistency except for the perceived susceptibility subscale, which showed a very strong reliability or internal consistency of the items measured.

The survey consisted of 36 questions assessing perceived beliefs about health. Five questions assessed susceptibility to diabetes, seven questions assessed seriousness of diabetes, and six questions each assessed benefits of and barriers to both eating healthfully and exercise (see Appendices K4, K5, and K6).

Appendix K7 shows that 74.5% of the women received a 4 or 5 score in perceived benefits of healthy eating, and 17.0% of them received a 3 to 5 score in perceived barriers of healthy eating. Similarly, 71.2% of the women scored 4 to 5 on perceived benefits of exercise, and 13.1% scored 3 to 5 on perceived barriers to

exercise. Moreover, 23.5% of the women scored 4 to 5 in perceived susceptibility of diabetes, and 9.2% of the women scored 4 to 5 in perceived seriousness.

Appendix K8 shows the difference between the benefits of eating healthfully and exercising minus the barriers to these activities. The difference was measured on a 1 to 5-point scale, with 5 representing the most difference between perceived benefits and barriers. The mean difference in eating healthfully was 2.02 (SD = 1.02) and the mean difference in exercise was 2.05 (SD = 1.06).

Overall, the results show that these women with a history of GDM perceived the risk of diabetes but did not realize the seriousness of diabetes. They perceived more benefits of eating healthfully than exercising, but also perceived more barriers to eating healthfully than to exercising.

Diet Self-Efficacy

The Cronbach's alpha statistic for the diet self-efficacy scale was .90, showing a strong scale reliability or internal consistency of the items measured. Appendix K9 shows the 16 questions assessing diet self-efficacy. Appendix K11 shows that the mean score for the Diet Self-Efficacy Scale of 16 questions was 3.16 (SD = 0.79). The percentage of women scoring 3 to 5 on a scale of 5 was 60.1%, which indicates that the women had a perception of self-efficacy or confidence in managing their diet efforts.

Exercise Self-Efficacy

The reliability or internal consistency for the Exercise Self-Efficacy Scale was .90, showing a strong positive relationship between the items in the scale. Appendix K10 shows the 16 questions assessing perceived exercise self-efficacy. Appendix K11 shows that the mean score for the Exercise Self-Efficacy Scale of 16 questions was

2.77 (SD = 0.83). The percentage of women scoring high on this scale (3 to 5 on a scale of 5) was 34.9%.

These results indicate that these women were less confident in carrying out an exercise routine under various negative situations. Comparatively, nearly twice as many women were confident that they could execute a diet plan, compared to those confident in their ability to adhere to an exercise plan.

Health-Related Variables and Nutrition Knowledge

Appendix K12 shows that 9.2% of the respondents were told they have diabetes, 72.8% had blood relatives with diabetes, and 26.8% delivered a baby weighing 8.5 lb. or more (macrosomia). Of the women needing medications during the index pregnancy, 9.8% required insulin, and 16.3% required oral medications; 24.2% of the women required either insulin or oral medication (self-reported). Average BMI of the patients was 28.35 (SD = 6.86). The women had lost an average of 3.91 lb. (SD = 21.92) since the delivery. Twenty-six percent of the respondents reported losing at least 20 lb. since the delivery. Education for GDM was received from a registered nurse (62.1%) and from the registered dietitian (37.9%), both of whom are certified diabetes educators. Group setting (86.9%) was the primary environment for the GDM education presentation; the remaining were seen individually.

It is of interest that as many as 9.2% of these young women self-reported being diagnosed with diabetes (or they may have thought this meant a previous diagnosis of GDM). It is also a positive finding that the average patient did lose weight, an average of nearly 4 lb.

Appendix K12 also shows that the mean score of the five questions assessing nutrition knowledge was 20.51 (SD = 2.20). The highest possible score was 22, since each of the questions had multiple-choice answers totaling this number. The percentage of women scoring 80% or higher (maximum score of 22) was 91.5%.

These results indicate that the GDM staff was effective in getting the education message across to these patients.

Environmental Support

Appendix K13 shows that 88.9% and 87.6% of the women, respectively, reported having family or friends who cared that they ate healthfully or exercised. These women also reported that 90.2% and 86.3% had family or friends who ate healthfully or exercised, respectively. The majority, 99.3%, said they could get healthy foods at the grocery store, 33.3% said healthy foods were available at work or school (35.3% said that this question was not applicable), and 81.5% said they could order healthy foods at restaurants. When asked if they were able to exercise, 90.8% responded yes, 85.6% said exercise facilities were available, 41.2% had exercise equipment at home, and 91.4% of the women felt safe to exercise in their neighborhood. However, 26.8% of these women were not able to exercise due to child care issues. Generally, these women had supportive home and community environments.

Bivariate Analyses

Tables 4 through 14 show the cross tabulations of outcome variables, diet and exercise, with the independent variables, which included socio-demographics, health beliefs, exercise and diet self-efficacy, diabetes-related cues to action, and environmental cues to action. Tables 15 and 16 show how exercise and diet behavior

were correlated with demographic, health beliefs, and self-efficacy variables. Tables 17 and 18 show the means/ranks of grouping levels across socio-demographic, diabetes-related, and environmental factors. Table 19 shows the correlations and significance of selected independent variables.

Table 4 shows the relationship between exercise and socio-demographics. One significant relationship was identified: income and work-in exercise ($p < .05$).

The ANOVA analysis in Table 5 shows there was a significant difference among the group means across income ($F = 3.107$, $p < .05$) and the follow-up Dunnett's 2-sided test in Table 6 shows that there was a significant difference between income groups three and five ($p < .05$, 95% CI [-.63, -.03]). The multiple comparison test shows a negative difference between income groups three and five, or that those women reporting an annual income over $100,000 were more likely to work-in exercise ≥ 3 times weekly compared to women reporting an income of $50,000-74,999.

Table 4

Cross-Tabulation of Exercise and Socio-Demographic Variables (Pearson Chi-Square)

	n	% Exercise ≥ 30 min ≥ 3x Weekly	% Exercise to Sweat ≥ 3x Weekly	% Work-in Exercise ≥ 3x Weekly
Age	153			
< 30 years		71.0	45.2	58.1
≥ 30 years		63.1	33.6	51.6
Ethnicity (Self-Reported)	152			
Caucasian		65.8	36.8	52.6
Other		60.5	34.2	52.6
Marital Status	153			
Married		63.8	33.1	54.3
Other		69.2	50.0	46.2

Table 4

Cross-Tabulation of Exercise and Socio-Demographic Variables (Pearson Chi-Square) (con't.)

Income	152			
<$36,000		59.4	28.1	**43.8***
$36,000-49,999		70.4	40.7	**70.4**
$50,000-74,999		62.9	37.1	**37.1**
$75,000-100,000		78.6	39.3	**46.4**
> $100,000		56.7	36.7	**70.0**
Insurance	153			
Has Insurance		65.0	37.4	54.5
Medicaid		75.0	41.7	33.3
No Insurance		55.6	22.2	55.6
Education	153			
College		66.0	39.0	52.0
Less than College		62.3	30.2	54.7

Note. * $p < .05$, two-tailed. Income in general is significant.

Table 5

ANOVA for Comparison of Outcome Groups

	(*n* = 152)	Sum of Squares	Mean Square	*F*	*p*
Exercise ≥ 30 Min ≥ 3 Days Weekly	Between Groups	0.919	0.230	1.005	0.407
	Within Groups	33.601	0.229		
	Total	34.520			
Sweat ≥ 3 Days Weekly	Between Groups	0.295	0.074	0.311	0.870
	Within Groups	34.804	0.237		
	Total	35.099			
Work-in Exercise ≥ 3 Days Weekly	Between Groups	2.954	0.739	3.107	0.017
	Within Groups	34.940	0.238		
	Total	37.895			

Table 6

Post Hoc ANOVA (Dunnett 2-sided test) for Group Differences (Multiple Comparisons)

Dependent Variable	Income Group (i)	Income Group (j)	Mean Difference in Income Groups (i-j)	Standard Error	*p*	95% Confidence Interval
Work-in	1	5	-0.2625	0.124	0.114	[-0.57, 0.04]
Exercise ≥ 3	2	5	0.0037	0.129	1.000	[-0.32, 0.32]
Days	3	5	-0.3286	0.121	0.027	[-0.63, -0.03]
Weekly	4	5	-0.2357	0.128	0.203	[-0.55, 0.08]

Table 7 shows the relationship between diet outcomes and socio-demographics. None of these relationships were significant.

Table 8 shows the percentage of women and levels of exercise for the health belief variables. The significant relationships were exercise ≥ 30 min and exercise to a sweat, with the difference in perceived benefits and barriers to exercise ($p < .001$), exercise ≥ 30 min and perceived low barriers to exercise ($p < .01$), and exercise to a sweat and perceived low barriers to exercise ($p < .05$).

Table 7
Cross-Tabulation of Diet and Socio-Demographic Variables (Pearson Chi-Square)

	n	% Scoring 4 or More on Healthy Eating Index[1]	% Scoring 3 or More on High Calorie Food/Beverage Intake[2]
Age	153		
< 30 years		6.5	80.6
≥ 30 years		10.7	73.8
Ethnicity (Self-Reported)	152		
Caucasian		9.6	78.1
Other		7.9	65.8
Marital Status	153		
Married		11.0	78.0
Other		3.8	61.5
Income	152		
< $36,000		6.3	68.8
$36,000-49,999		11.1	74.1
$50,000-74,999		8.6	71.4
$75,000-100,000		14.3	89.3
> $100,000		10.0	73.3
Insurance	153		
Has Insurance		10.6	78.0
Medicaid		0.0	66.7
No Insurance		11.1	61.1

Table 7

Cross-Tabulation of Diet and Socio-Demographic Variables (Pearson Chi-Square) (con't.)

Education	153		
College		12.0	80.0
Less than College		5.7	66.0

Note. [1] = consumption of a variety of healthy foods in portions recommended;
[2] = a higher score for high calorie food/beverage indicates a more desirable intake.

Table 8

Cross-Tabulation of Exercise and Health Belief Model Variables (Pearson Chi-Square)

	n	% Exercise ≥ 30 Min ≥ 3x Weekly	% Exercise to Sweat ≥ 3x Weekly	% Work-in Exercise ≥ 3x Weekly
Susceptibility	150			
High		71.4	34.3	51.4
Low		62.6	36.5	53.9
Seriousness	149			
High		50.0	21.4	35.7
Low		66.7	38.5	56.3
Benefit of Exercise	149			
High		69.4	37.0	54.6
Low		53.7	34.1	48.8
Barrier to Exercise	153			
High		35.0	15.0	60.0
Low		69.2**	39.1*	51.9
Benefit of Minus Barrier to Exercise	153			
High		76.7***	47.8***	56.7
Low		47.6	19.0	47.6

Note. $^{*}p < .05$, two-tailed. $^{**}p < .01$, two-tailed. $^{***}p < .001$, two-tailed.

Table 9 indicates that the Healthy Eating Index and high-calorie food/beverage scores were significantly related to the belief that benefits exceeded barriers in healthy

eating. Overall, the results suggest that the women in this study believed they had a low susceptibility to developing diabetes, that diabetes was not serious, and that they could easily overcome barriers to healthy eating.

Table 9

Cross-Tabulation of Diet and Health Belief Model Variables (Pearson Chi-Square)

	n	% Scoring 4 or More Healthy Eating Index[1]	% Scoring 3 or More High Calorie Food/Beverage[2]
Susceptibility	150		
High		5.7	74.3
Low		10.4	76.5
Seriousness	149		
High		0.0	57.1
Low		11.1	77.0
Benefit of Diet	151		
High		9.7	78.8
Low		10.5	65.8
Barrier to Diet	151		
High		0.0	50.0
Low		10.1	75.8
Benefit of Minus Barrier to Diet	153		
High		14.1*	83.5**
Low		4.4	64.7

Note. [1] = consumption of a variety of healthy foods in portions recommended; [2] = a higher score for high calorie food/beverage indicates a more desirable intake. *$p < .05$, two-tailed. **$p < .01$, two-tailed.

Table 10 shows exercise patterns and diet behavior by exercise self-efficacy and diet self-efficacy, respectively. For all categories of exercise, a high score was defined as ≥ 3 times weekly and a low score was defined as < 3 times weekly. All levels of exercises, ≥ 30 minutes, exercise to a sweat, and work-in exercise were significantly related to high self-efficacy. A positive response to the question, “Are you able to

exercise?" was significantly related to exercise ≥ 30 min and exercise to a sweat. A high score on high-calorie food/beverage intake was significantly related to high self-efficacy.

Table 10
Cross Tabulation of Exercise Self-Efficacy and Diet Self-Efficacy Variables (Pearson Chi-Square)

	n	%Exercise ≥30 Min ≥3 x Weekly	% Exercise to Sweat ≥3 x Weekly	% Work-in Exercise ≥3 x weekly
Exercise Self-Efficacy	145			
High		86.3***	64.7***	62.7*
Low		53.2	19.1	45.7
Are you able to exercise?	152			
Yes		69.6***	39.9**	52.2
No		14.3	0.0	64.3
			% Scoring 4 or More on Healthy Eating Index[1]	**% Scoring 3 or More on High Calorie Food/Beverage[2]**
Diet Self-Efficacy	148			
High			10.1	84.3***
Low			10.2	61.0

Note. [1] = consumption of a variety of healthy foods in portions recommended;[2] = a higher score for high calorie food/beverage indicates a more desirable intake. *$p < .05$, two-tailed. **$p < .01$, two-tailed. ***$p < .001$, two-tailed.

Table 11 shows that 67.6% of the respondents indicated they took medications during pregnancy and also conducted work-in exercise ≥ 3 times weekly, and 59.1% of the respondents indicated they had a family history of diabetes and also exercised ≥ 30 min ≥ 3 times weekly.

Table 12 indicates that only one relationship was significant: 100% of the respondents who were told they have diabetes scored 3 or more on high-calorie food/beverage. Possibly, those completing the survey misunderstood the question,

since 72.5% in this same group also indicated they do not have diabetes (maybe confusing diabetes with their history of GDM).

Table 11
Cross Tabulation of Exercise and Diabetes-Related Cues to Action (Pearson Chi-Square)

	n	% Exercise 30 Min ≥ 3x Weekly	% Exercise to Sweat ≥ 3x Weekly	% Work-in Exercise ≥ 3x Weekly
Meds during pregnancy?	153			
Yes		54.1	35.1	67.6*
No		68.1	36.2	48.3
Delivered baby ≥ 8.5 lb.?	153			
Yes		68.3	39.0	58.5
No		63.4	34.8	50.9
Told you have diabetes?	152			
Yes		71.4	42.9	50.0
No		64.5	35.5	53.6
Family history of diabetes?	151			
Yes		59.1*	36.4	57.3
No		78.0	36.6	41.5

Note. $^{*}p < .05$, two-tailed.

Table 12

Cross Tabulation of Diet and Diabetes-Related Cues to Action (Pearson Chi-Square)

	n	% Scoring 4 or More on Healthy Eating Index[1]	% Scoring 3 or More on High Calorie Food/Beverage Intake[2]
Meds during pregnancy?	153		
Yes		10.8	73.0
No		9.5	75.9
Delivered baby ≥ 8.5 lb?	153		
Yes		12.2	70.7
No		8.9	76.8

Table 12

Cross Tabulation of Diet and Diabetes-Related Cues to Action (Pearson Chi-Square) (con't.)

Told you have diabetes?	152		
Yes		7.1	100.0*
No		10.1	72.5
Family history of diabetes?	151		
Yes		7.3	71.8
No		17.1	82.9

Note. [1] = consumption of a variety of healthy foods in portions recommended; [2] = a higher score for high-calorie food/beverage indicates a more desirable intake. *p < .05, two-tailed.

Table 13 shows that having family or friends who cared about the subject's exercise was significantly related to exercise ≥ 30 min (p < .05) and exercise to a sweat (p < .05). Availability of exercise facilities (e.g., gym, walking trails) was also similarly related to exercise ≥ 30 min (p < .05) and exercise to a sweat (p < .05). Safety of exercise was also related to exercise ≥ 30 min (p < .05) and exercise to a sweat (p < .05). The respondents indicated that child care issues were, in fact, not related to exercise ≥ 30 min (p < .05) and exercise to a sweat (p < .01). One could conclude from these results that support from family/friends made a difference in exercise, as did access to exercise resources and safety, but this particular population did not have an issue with child care.

Table 13

Cross Tabulation of Exercise and Environmental Cues to Action (Pearson Chi Square)

	% Exercise ≥30 Min ≥3 x Weekly	% Exercise to Sweat ≥3 x Weekly	% Work-in Exercise ≥3 x Weekly
Do you have family or friends who care that you exercise? (n = 153)			
Yes	67.9*	38.8*	55.2
No	42.1	15.8	36.8

Table 13

Cross Tabulation of Exercise and Environmental Cues to Action (Pearson Chi Square)

	% Exercise ≥30 Min ≥3 x Weekly	% Exercise to Sweat ≥3 x Weekly	% Work-in Exercise ≥3 x Weekly
Do you know family or friends who exercise? (*n* = 153)			
Yes	67.4	37.9	51.5
No	47.6	23.8	61.9
Are exercise facilities available (e.g., gym, walking trails)? (*n* =153)			
Yes	67.9*	39.7*	53.4
No	45.5	13.6	50.0
Do you have exercise equipment in your home? (*n* =153)			
Yes	71.4	42.9	57.1
No	60.0	31.1	50.0
Is it safe to exercise in your neighborhood? (*n* =152)			
Yes	66.9*	38.1*	54.0
No	38.5	7.7	38.5
Child care issues? (*n* =153)			
Yes	48.8	19.5	56.1
No	70.5*	42.0**	51.8
Who provided gestational diabetes education? (*n* =153)			
RD	62.1	29.3	46.6
RN	66.3	40.0	56.8
Gestational diabetes education provided how? (*n* =153)			
Group	64.7	35.3	51.9
Individual	65.0	40.0	60.0

Note. *$p < .05$, two-tailed. **$p < .01$, two-tailed.

Table 14 shows no significant difference in diet behaviors across environmental factors. However, a large percentage of respondents indicated having family or friends who cared that they ate healthfully influenced their diet. They also indicated having a variety of healthy foods available at work or school positively affected their intake of healthy foods and high-calorie foods. The respondents also indicated that having a variety of healthy foods available at restaurants positively influenced their intake of healthy foods and high calorie foods. Whereas the job description of the person who taught the education class (registered dietitian or registered nurse) showed similar results for intake of high-calorie food/beverage, the respondents did indicate a greater influence on intake of healthy foods if the class was taught by the registered dietitian (12.1% versus 8.4%). It also appears that being in a group versus an

individual education setting could have influenced self-reported intake of healthy foods (9% versus 15%).

Table 14
Cross Tabulation of Diet and Environmental Cues to Action (Pearson Chi-Square)

	% Scoring 4 or More on Healthy Eating Index[1]	% Scoring 3 or More on High Calorie Food/Beverage Intake[2]
	(*n*=153)	
Do you have family or friends who care that you eat healthfully?		
Yes	10.3	77.2
No	5.9	58.8
Do you know family or friends who eat healthfully?		
Yes	10.1	76.1
No	6.7	66.7
Is a variety of healthy foods available at your work or school?		
Yes	11.8	76.5
No	4.2	75.0
Is a variety of healthy foods available at restaurants?		
Yes	11.4	78.0
No	3.6	64.3
Who provided gestational diabetes education?		
RD[3]	12.1	74.1
RN[4]	8.4	75.8
Gestational diabetes education provided how?		
Group	9.0	77.4
Individual	15.0	60.0

Note. [1] = consumption of a variety of healthy foods in portions recommended; [2] = a higher score for high calorie food/beverage indicates a more desirable intake; [3] = registered dietitian; [4] = registered nurse.

Table 15 shows several significant correlations between health behaviors and health belief factors. For example, belief about seriousness of diabetes was significantly correlated with exercise ≥ 30 minutes three or more days in the past week *(r*= -.223, $p < .01$) and with working in other exercise three or more days in the past week (*rho* = -.246, $p < .01$). The negative correlation indicates that exercise more often may be associated with a lower belief in seriousness of diabetes. Belief about benefits exceeding barriers

to exercise was significantly correlated with exercise ≥ 30 minutes three or more days in the past week (r = .251, p < .01) and with exercise to sweat three or more days in the past week (*rho* = .377, p < .001). The positive correlations indicate that more exercise was associated with greater gaps between benefits and barriers to exercise (more perceived benefits). Exercise self-efficacy was significantly and positively correlated with all three levels of exercise: exercise ≥ 30 minutes (r =.486, p < .001), exercise to a sweat (*rho* = .525, p < .001), and working in other exercise three or more days in the past week (*rho* = .221, p < .01). There were no significant correlations between age or belief of susceptibility to diabetes and exercise behaviors. The positive correlation coefficients between benefits exceeding barriers to exercise and exercise self-efficacy and the outcome variable exercise behavior suggests that exercise could increase with more perceived benefits, fewer perceived barriers, and more perceived exercise self-efficacy. The strength of these correlations was weak to moderate.

Table 15

Pearson's r and Spearman's rho Correlation Coefficients for Number of Days in Past Week Exercise 30 Min or More, Exercise to Sweat, Work-in Other Exercise, and Demographic, Health Beliefs, and Self-Efficacy Variables

	Exercise ≥ 30 Min ≥ 3x Weekly	Exercise to Sweat ≥ 3x Weekly	Work-in Other Exercise ≥ 3x Weekly
		(*n* = 153)	
Age	r = -.144	rho = -.137	rho = .070
Belief of Susceptibility to Diabetes	r = -.148	rho = -.107	rho = -.147
Belief of Seriousness of Diabetes	r = -.223**	rho = -.125	rho = -.246**
Benefits of Minus Barriers to Exercise	r = .251**	rho = .377***	rho = .092
Exercise Self-Efficacy	r = .486***	rho = .525***	rho = .221**

Note. **p < .01, two-tailed. ***p < .001, two-tailed.

Table 16

Pearson's r and Spearman's rho Correlation Coefficients for Healthy Eating Index, High Calorie Food/Beverage Intake, and Demographic, Health Beliefs, and Self-Efficacy Variables

	Healthy Eating Index	High Calorie Food/Beverage Intake
	(n = 153)	
Age	r = -.084	rho = -.002
Belief of Susceptibility to Diabetes	r = -.002	rho = -258**
Belief of Seriousness of Diabetes	r = -.121	rho = -.240**
Benefits of Minus Barriers to Eating Healthfully	r = .167*	rho = .317***
Diet Self-Efficacy	r = .160*	rho = .356***

Note. *p < .05, two-tailed. **p < .01, two-tailed. ***p < .001, two-tailed.

Table 16 shows several significant positive and negative correlations between a healthy diet and health beliefs. For example, belief of susceptibility to diabetes was significantly and negatively correlated with high-calorie food/beverage intake (*rho* = -.258, $p < .01$). This would indicate that reduced perception of susceptibility to diabetes may be associated with an increased score for high-calorie food/beverage intake (more favorable dietary behavior). Belief in the seriousness of diabetes was also negatively correlated (*rho* = -.240, $p < .01$) with high-calorie food/beverage intake. This would imply that reduced belief about the seriousness of diabetes may be associated with high-calorie food/beverage intake (more favorable dietary behavior). As observed for exercise behaviors, there were also significant and positive correlations of benefits exceeding barriers with a high-calorie food/beverage score (*rho* = .317, $p < .001$) and diet self-efficacy (*rho* = .356, $p < .001$) with high calorie food/beverage intake (a more favorable diet). Similarly, there were significant and positive correlations of benefits exceeding barriers with healthy eating ($r = .167$, $p < .05$) and diet self-efficacy ($r = .160$, $p < .05$) with healthy eating. As benefits exceed barriers to healthy eating increases and as diet self-efficacy increases, one would expect that healthy eating would also increase.

Table 17 shows significant differences in the means and ranks between exercise behaviors and having family/friends who cared about the subject's exercise. These results reveal that having family/friends who cared about the subject's exercise actually enabled the subjects to score higher on all three levels of exercise.

Table 17

T-Test and Mann-Whitney U for Comparison of Independent Means (Standard Deviations) and Mean Ranks for Exercise by Socio-Demographic, Diabetes-Related, and Environmental Variables

	n	Exercise ≥ 30 Min	Exercise to Sweat	Work-in Other Exercise
		t =1.613	U = 1826.000	U = 2106.000
Caucasian	152	3.00 (1.317)	79.48	75.97
or Other		2.58 (1.605)	67.55	78.08
		t =-.418	U = 1430.000	U = 1605.500
Married	153	2.87 (1.392	75.26	77.36
or Not		3.00 (1.442)	85.50	75.25
		t = -	U = -	U= -
College Education				
or Not		2.89 (1.515)	27.00	27.00
Diabetes?	152	t = .677	U = 736.000	U = 907.500
Yes		3.14 (1.562)	92.93	72.32
No		2.88 (1.385)	74.83	76.92
Diabetes in Family?	151	t = -1.749	U = 2137.000	U = 1968.000
Yes		2.77 (1.457)	74.93	78.61
No		3.22 (1.215)	78.88	69.00
Family/Friends	153	t = 2.503*	U = 886.500*	U = 890.000*
Care About Exercise?				
Yes		3.00 (1.354)	79.88	79.86
No		2.16 (1.500)	56.66	56.84
Family/Friends	151	t = 1.832	U = 1281.000	U = 1310.500
Exercise?				
Yes		2.98 (1.333)	77.80	77.57
No		2.38 (1.687)	72.00	73.40

Note. *p < .05, two-tailed.

Table 18 shows significant differences in healthy eating across some socio-demographic groups. For example, there were significant differences in the means of the Healthy Eating Index across ethnicity (Caucasian) (t = 2.099, p = < .05) and across marital status (married) (t = 2.329, p < .05). There was also a significant difference in high-calorie food/beverage intake across marital status (U = 1171.000, p < .05). These

results show that women who are Caucasian and married were more likely to score higher on healthy eating.

Table 18

T-Test and Mann-Whitney U Test for Comparison of Independent Means (Standard Deviations) and Mean Ranks for Healthy Eating and High Calorie Food/Beverage Intake by Socio-Demographic, Diabetes-Related, and Environmental Variables

	n	Healthy Eating Index	High Calorie Food/ Beverage
		t = 2.099*	U = 1797.000
Caucasian	152	2.167 (1.088)	79.74
or Other		1.737 (1.107)	66.79
		t = 2.329*	U = 1171.000*
Married	153	2.165 (1.118)	80.78
or Not		1.615 (.983)	58.54
		t = -	U = -
College Education			
or Not		1.868 (1.038)	27.00
Diabetes?	152	t = -.505	U = 834.000
Yes		1.929 (1.141)	85.93
No		2.087 (1.117)	75.54
Diabetes in Family?	151	t = --1.486	U = 1869.000
Yes		1.991 (1.054)	72.49
No		2.293 (1.250)	85.41
Family/Friends Care?	153	t = .512	U = 872.500
Yes		2.088(1.132)	79.08
No		1.941(.966)	60.32
Family/Friends Eat Healthfully?	153	t = .263	U = 813.500
Yes		2.080(1.127)	78.61
No		2.000(1.000)	62.23

Note. *$p < .05$, two-tailed.

Table 19 shows the correlations of multiple family factors. Having a family history of diabetes was significantly and negatively correlated with having family/friends who cared about the subject's exercise ($p < .05$); family history of diabetes was also significantly and negatively correlated with knowing family/friends who eat healthfully ($p < .05$). Having family/friends who cared about the subject's eating was significantly and positively correlated with having family/friends who cared about the subject's exercise ($p < .001$), knowing family/friends who eat healthfully ($p < .001$), and knowing family/friends who exercise ($p < .001$).

Table 19

Pearson Correlations and Significance (two-tailed) of Independent Variables

	Diabetes	Family History of Diabetes	Family/Friend Care How You Eat	Family/Friend Care How You Exercise	Family/Friend Who Eat Healthfully	Family/Friend Who Exercises	Child Care Issues
Diabetes	1	0.094	-.031	-.086	.029	-.070	-.040
		.253	.701	.292	.722	.390	.626
Family History of Diabetes	.094	1	-.123	-.187*	-.203*	-.159	-.005
	.253		.132	.022	.013	.051	.954
Family/Friend Care How You Eat	-.031	-.123	1	.687***	.373***	.342***	-.021
	.701	.132		.000	.000	.000	.798
Family/Friend Care How You Exercise	-.086	-.187*	.687***	1	.409***	.368***	.004
	.292	.022	.000		.000	.000	.960
Family/Friend Who Eat Healthfully	.029	-.203*	.373***	.409***	1	.635***	-.049
	.722	.013	.000	.000		.000	.550
Family/Friend Who Exercises	-.070	-.159	.342***	.368***	.635***	1	-.145
	.390	.051	.000	.000	.000		.074
Child Care Issues	-.040	-.005	-.021	.004	-.049	-.145	1
	.626	.954	.798	.960	.550	.074	

Note. *$p < .05$, two-tailed. **$p < .01$, two-tailed. ***$p < .001$, two-tailed.

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Multivariate Analyses, Logistic Regression

The results of the logistic regression analyses show the odds of developing the condition or performing the behavior in question. The adjusted odds ratio [Exp(B)] is an indicator of the change in odds of an event occurring for every unit change in the predictor, while controlling for other variables or confounders that may affect the dependent variable in the model. The chi-square value is how well the model and its independent variables predict the outcome variable, or goodness of fit. If the *p* value or significance is less than .05, the *b* coefficient is significantly different from zero, this would indicate a good fit of the model and its variables and a rejection of the null hypothesis (Meyers, Gamst, & Guarino, 2006; Field, 2009). The larger the Nagelkerke value, the stronger the effect of the predictor variable on the outcome variable; for example .42 is more predictive than .17, the former influencing 42% of the variability of the outcome variable. This is an indication of the validity of the model.

Table 20 shows the results from different models to explain the exercise ≥ 30 min three or more times a week. The gap between perceived benefits and barriers to exercise was consistently and significantly positive across the four models (*OR* ≥ 2), which indicates that the more perceived benefits exceed perceived barriers, the more exercise was adopted by the women. High self-efficacy was also a significant and positive predictor of exercise (*OR* ≥ 4). Other factors, such as high susceptibility, were significant in some models but insignificant in other models, which indicates that the relationship was not robust when different variables were controlled.

Table 20

Adjusted Odds Ratio [Exp(B)] and 95% Confidence Interval [CI] for Exercise ≥ 30 Min Three or More Days Weekly

	Model I HBM	Model II HBM + Self-Efficacy	Model III HBM + Environment	Model IV HBM + Self-Efficacy + Environment	Model V HBM + Self-Efficacy + Environment + Child Care Issues
	OR 95% [CI] (*n* = 149)	*OR* 95% [CI] (*n* = 148)	*OR* 95% [CI] (*n* = 149)	*OR* 95% [CI] (*n* = 148)	*OR* 95% [CI] (*n* = 148)
Socio-Demographics					
Age ≥30 years	.71 [.26, 1.92]	1.10 [.38, 3.17]	.79 [.29, 2.17]	1.20 [.41, 3.49]	1.23 [.42, 3.63]
Caucasian	1.88 [.75, 4.73]	1.82 [.71, 4.66]	1.65 [.64, 4.26]	1.55 [.58, 4.12]	1.51 [.56, 4.04]
Married	.44 [.14, 1.36]	.52 [.17, 1.60]	.44 [.14, 1.40]	.52 [.16, 1.64]	.47 [.14, 1.51]
College Education	1.23 [.53, 2.86]	.99 [.41, 2.39]	1.23 [.52, 2.90]	1.02 [.42, 2.50]	1.25 [.49, 3.19]
Health Belief Model					
High Susceptibility	2.24 [.85, 5.93]	2.61 [.95, 7.19]	2.85 [.99, 8.17]	3.28* [1.11, 9.67]	3.75* [1.23, 11.47]
High Seriousness	.39 [.11, 1.42]	.50 [.13, 1.85]	.50 [.13, 1.93]	.63 [.16, 2.44]	.72 [.18, 2.92]
Benefits Exceed Barriers	4.42*** [2.02, 9.66]	3.37** [1.47, 7.75]	4.11** [1.85, 9.10]	3.14** [1.35, 7.34]	2.74* [1.14, 6.59]
Cue: Have Diabetes	1.31 [.34, 4.96]	1.42 [.35, 5.81]	1.43 [.36, 5.67]	1.53 [.36, 6.44]	1.57 [.38, 6.55]
Cue: Family History	.37* [.15, .91]	.38* [.15, .99]	.40 [.16, 1.01]	.42 [.16, 1.11]	.39 [.15, 1.05]
Self-Efficacy					
High Self-Efficacy		4.08** [1.49, 11.19]		4.18** [1.50, 11.63]	4.06** [1.43, 11.54]
Environmental Cues					
Family/Friends Care			2.48 [.66, 9.40]	2.96 [.73, 11.93]	3.44 [.83, 14.24]
Family/Friends Exercise			1.22 [.38, 3.99]	.89 [.27, 2.94]	.75 [.22, 2.60]
No Child Care Issues					2.19 [.88, 5.46]
Nagelkerke R Square	.22	.29	.24	.31	.33
Model Chi-Square	.00	.00	.00	.00	.00

Note. *p < .05, two-tailed. **p < .01, two-tailed. *** p < .001, two-tailed.

Table 21 shows the results of exercise to a sweat three or more days weekly. Different from the results in Table 20, married status became a significant barrier to exercise outcome ($OR < 1$, $p < 0.05$) in all four models. The gap between benefits and barriers to exercise was still a significant and positive predictor (*OR* ranged from 2.61 to 5.23 in all four models). High self-efficacy remained a significant predictor with high scale effects ($OR > 6$ and $p < 0.001$).

Table 22 shows the relationship between explanatory variables and the Healthy Eating Index. Compared to the outcome of exercise, the relationship was weaker. Only the gap between benefits and barriers was significant in Model II and Model IV, both of which included the self-efficacy variables. Moreover, the *ORs* of the gap were significantly over 1, which indicates a strong positive association with the healthy eating outcome. Therefore, with the enhanced health belief model, the increase in perceived benefits exceeding barriers was associated with a higher Healthy Eating Index.

Table 21

Adjusted Odds Ratio [Exp(B)] and 95% Confidence Interval [CI] for Exercise to Sweat Three or More Days Weekly

	Model I HBM OR 95% [CI] (*n* = 149)	Model II HBM + Self-Efficacy OR 95% [CI] (*n* = 148)	Model III HBM + Environment OR 95% [CI] (*n* = 149)	Model IV HBM + Self-Efficacy + Environment OR 95% [CI] (*n* = 148)	Model V HBM + Self-Efficacy + Environment + Child Care Issues OR 95% [CI] (*n* = 148)
Socio-Demographics					
Age ≥ 30 years	.68 [.26, 1.82]	1.14 [.38, 3.38]	.73 [.27, 1.94]	1.25 [.41, 3.83]	1.28 [.42, 3.93]
Caucasian	1.62 [.65, 4.06]	1.31 [.50, 3.46]	1.46 [.57, 3.76]	1.10 [.40, 3.03]	1.06 [.38, 2.95]
Married	.24* [.08, .73]	.27* [.09, .85]	.23* [.08, .72]	.27* [.08, .88]	.22* [.06, .76]
College Education	2.11 [.86, 5.16]	1.71 [.65, 4.51]	2.16 [.87, 5.36]	1.71 [.64, 4.60]	2.17 [.77, 6.07]

Table 21

Adjusted Odds Ratio [Exp(B)] and 95% Confidence Interval [CI] for Exercise to Sweat Three or More Days Weekly (con't.)

	Model I HBM OR 95% [CI] (*n* = 149)	Model II HBM + Self-Efficacy OR 95% [CI] (*n* = 148)	Model III HBM + Environment OR 95% [CI] (*n* = 149)	Model IV HBM + Self-Efficacy + Environment OR 95% [CI] (*n* = 148)	Model V HBM + Self-Efficacy + Environment + Child Care Issues OR 95% [CI] (*n* = 148)
Health Belief Model					
High Susceptibility	1.19 [.45, 3.15]	1.60 [.56, 4.55]	1.51 [.542, 4.22]	2.17 [.71, 6.61]	2.30 [.74, 7.11]
High Seriousness	.26 [.05, 1.22]	.41 [.08, 1.96]	.32 [.06, 1.61]	.52 [.10, 2.75]	.57 [.11, 3.00]
Benefits Exceed Barriers	5.23*** [2.28, 11.98]	3.40** [1.39, 8.30]	5.00*** [2.16, 11.55]	3.05* [1.23, 7.57]	2.61* [1.03, 6.62]
Cue: Have Diabetes	1.26 [.35, 4.59]	1.49 [.38, 5.83]	1.28 [.34, 4.83]	1.61 [.39, 6.66]	1.65 [.38, 7.21]
Cue: Family History	1.07 [.45, 2.54]	1.32 [.51, 3.45]	1.17 [.49, 2.79]	1.39 [.53, 3.69]	1.41 [.52, 3.82]
Self-Efficacy					
High Self-Efficacy		6.63*** [2.76, 15.94]		8.12*** [3.15, 20.93]	7.83*** [3.00, 20.44]
Environmental Cues					
Family/Friends Care			3.08 [.64, 14.80]	5.23 [.97, 28.10]	6.24* [1.14, 34.15]
Family/Friends Exercise			1.18 [.30, 4.57]	.55 [.14, 2.24]	.46 [.11, 1.94]
No Child Care Issues					2.71 [.92, 8.02]
Nagelkerke R Square	.23	.37	.25	.40	.42
Model Chi-Square	.00	.00	.00	.00	.00

Note. *p < .05, two tailed. **p < .01, two-tailed. ***p < .001, two-tailed.

Table 22

Adjusted Odds Ratio [Exp(B)] and 95% Confidence Interval [CI] for Healthy Eating Index

	Model I HBM	Model II HBM + Self-Efficacy	Model III HBM + Environment	Model IV HBM + Self-Efficacy + Environment
			OR 95% [CI] (n = 149)	
Socio-Demographics				
Age ≥ 30 years	.93 [.17, 5.24]	.69 [.11, 4.22]	.89 [.15, 5.15]	.65 [.10, 4.12]
Caucasian	1.11 [.26, 4.64]	1.30 [.30, 5.62]	1.15 [.27, 4.89]	1.37 [.31, 6.02]
Married	1.69 [.17, 16.62]	1.69 [.17, 16.55]	1.62 [.16, 16.05]	1.61 [.16, 16.02]
College Education	1.23 [.27, 5.63]	1.11 [.24, 5.18]	1.32 [.28, 6.23]	1.21 [.25, 5.81]
Health Belief Model[1]				
High Susceptibility	.86 [.16, 4.68]	.45 [.07, 3.03]	.87 [.16, 4.83]	.46 [.07, 3.16]
Benefits Exceed Barriers	2.82 [.71, 11.14]	5.67* [1.10, 29.24]	2.87 [.72, 11.46]	6.02* [1.12, 32.34]
Cue: Have Diabetes	1.02 [.11, 9.27]	.97 [.10, 9.00]	1.07 [.12, 9.92]	1.01 [.11, 9.57]
Cue: Family History Diabetes	.46 [.13, 1.56]	.42].12, 1.49]	.42 [.12, 1.54]	.39 [.10, 1.48]
Self-Efficacy				
High Self-Efficacy		.27 [.06, 1.28]		.26 [.05, 1.24]
Environmental Cues				
Family/Friends Who Care			1.27 [.11, 15.21]	1.52 [.11, 21.21]
Family/Friends Eat Healthfully			.50 [.04, 7.00]	.40 [.02, 6.57]
Nagelkerke R Square	.13	.17	.13	.17
Model Chi-Square	.42	.29	.58	.42

Note. [1]High Seriousness = .000. *$p < .05$, two-tailed.

Table 23
Adjusted Odds Ratio [Exp(B)] and 95% Confidence Interval [CI] for High Calorie Food/Beverage Intake

	Model I HBM	Model II HBM + Self-Efficacy	Model III HBM + Environment	Model IV HBM + Self-Efficacy + Environment
			OR **95% [CI]** **(*n* = 149)**	
Socio-Demographics				
Age ≥ 30 years	.52 [.16, 1.69]	.73 [.21, 2.55]	.49 [.15, 1.66]	.70 [.20, 2.51]
Caucasian	1.77 [.67, 4.69]	1.57 [.57, 4.33]	1.75 [.65, 4.71]	1.56 [.55, 4.37]
Married	1.71 [.59, 5.01]	2.23 [.74, 6.75]	1.72 [.58, 5.11]	2.24 [.73, 6.92]
College Education	1.82 [.77, 4.31]	2.20 [.88, 5.53]	1.87 [.78, 4.47]	2.29 [.90, 5.83]
Health Belief Model				
High Susceptibility	.98 [.35, 2.71]	1.97 [.62, 6.31]	.98 [.34, 2.80]	2.01 [.60, 6.74]
High Seriousness	.63 [.18, 2.26]	.56 [.15, 2.06]	.64 [.17, 2.35]	.56 [.15, 2.16]
Benefits Exceed Barriers	2.82* [1.23, 6.47]	1.60 [.63, 4.06]	2.83* [1.22, 6.57]	1.60 [.62, 4.12]
Cue: Have Diabetes[1]	8.5E+008 [.00, -]	1.4E+009 [.00, -]	8.9E+008 [.00, -]	1.4E+009 [.00, -]
Cue: Family History Diabetes	.57 [.21, 1.58]	.58 [.20, 1.65]	.57 [.20, 1.59]	.58 [.20, 1.67]
Self-Efficacy				
High Self-Efficacy		4.45** [1.57, 12.57]		4.48** [1.56, 12.83]
Environmental Cues				
Family/Friends Who Care			1.92 [.52, 7.15]	1.85 [.48, 7.21]
Family/Friends Eat Healthfully			.56 [.14, 2.25]	.57 [.14, 2.36]
Nagelkerke R Square	.24	.31	.25	.32
Model Chi-Square	.00	.00	.00	.00

Note. [1]Cue Have Diabetes = no value. *$p < .05$, two-tailed. **$p < .01$, two tailed.

The results of high-calorie food/beverage intake in Table 23 were similar as the results in Table 22. The gap between benefits and barriers remained a significantly

positive factor. The only difference is that the significance showed up in Models I and III (health beliefs and health beliefs + environmental support). High self-efficacy had a very significant association with high-calorie food/beverage intake. Compared with the results in Table 22, these high *ORs* in Table 23 indicate that high self-efficacy can be effective in preventing inappropriate intake of high-calorie food/beverage but may not significantly contribute to eating more healthy foods.

Tables 20 to 23 show the multivariate analysis of health behaviors using different health belief models. The healthy eating behaviors included the Healthy Eating Index and high-calorie food/beverage intake score. The exercise behaviors included 30 min or more of physical activity three days or more weekly and exercising to a sweat three days or more weekly. The independent variables in the four models included health beliefs, health beliefs and self-efficacy, health beliefs and environmental support, and health beliefs and self-efficacy and environmental support. "No child care issues" was added in Model V, which was only for exercise.

Summary

The outcome variable, Healthy Eating Index, was analyzed in four models, but none were significant. The predictors in these models were weak, except the gap between benefits and barriers. High-calorie food/beverage intake was analyzed in four models. All of the models were significant and Model II (health beliefs and self-efficacy) and Model IV (health beliefs and self-efficacy and environmental support) approached moderate strength in predicting this behavior.

Exercising for 30 minutes or more three days or more weekly was analyzed in five models. All were significant, and three of the models showed moderate strength in

prediction (Model II, health beliefs and self-efficacy; Model IV, health beliefs and self-efficacy and environmental support; and Model V, health beliefs and self-efficacy and environmental support and no child care issues). Exercising to a sweat three days or more weekly was analyzed by five models and all were significant. Two of the models, Model IV, health beliefs and self-efficacy and environmental support, and Model V, health beliefs and self-efficacy and environmental support and no child care issues, showed the most strength of all the models studied. Model II, health belief and self-efficacy, was significant but less moderate in strength.

Overall, these models show that health beliefs alone are a weak predictor of diet and exercise behaviors. Adding variables such as self-efficacy and specific sources of environmental support increase the prediction and strength of prediction of these outcome behaviors.

CHAPTER V

DISCUSSION AND CONCLUSIONS

The purpose of this study was to apply the Health Belief Model with the added constructs, self-efficacy and specific ecological systems measures (social and environmental support), in predicting compliance with healthy lifestyle recommendations in women with a recent history of GDM. The research design for this study is ex post facto or after the fact (Ary et al., 1990). This study is a non-experimental, observational, and cross-sectional study. To facilitate checking the results against the original hypotheses, the conclusions from these hypotheses are listed in Appendix L.

Factors Predicting Exercise and a Healthy Diet

Two outcome variables were used to measure the exercise level, exercise 30 min or more three or more days weekly and exercise to sweat three or more days weekly (Appendix K1). These outcome variables were similar to other exercise measurements in the literature (Ferrara et al., 2011; Hinton & Olson, 2001; Kaiser, Jeannot, & Razurel, 2016; Kim, McEwen, Kieffer, Herman, & Piette, 2008; Smith, Cheung, Bauman, Zehle, & McLean, 2005). This study found significant predictors of exercise for 30 min, benefits exceed barriers, exercise self-efficacy, cue to behavior (family history of diabetes), and perceived susceptibility to diabetes. Similar factors significantly predicted exercise to sweat, including benefits exceed barriers, exercise self-efficacy, being married, and having family or friends who care about the subject's exercise. The results suggest that behavioral factors and social support could be important cues for GDM women to exercise. Health education literature focuses on providing information and relying on rationality to motivate adults to exercise. Using the significant predictors above, the

Expanded Health Belief Model, based on Rosenstock's original theory (1966), proposes that the individual's decision to perform a behavior, such as exercise, is based in part on perceptions of susceptibility to a health condition (diabetes), perceived benefits minus perceived barriers, and considering demographics such as marital status, cues to behavior (family history of diabetes), and social support (having family or friends who care that you exercise), all influence the perceived threat of the health condition, along with perceived exercise self-efficacy, affecting the outcome behavior of exercise. This current study complements this line of research by emphasizing decreasing behavioral barriers while increasing behavioral benefits, perceived exercise self-efficacy, and social support, which can be incorporated into the design of future exercise interventions targeting women with GDM.

Two outcome variables were used to measure diet behavior, Healthy Eating Index and high calorie food/beverage intake score (Appendix K2, K3). The questions selected for the survey regarding overall food intake are rooted in the general diet recommendations by the federal government and are associated with healthy eating to prevent chronic diseases such as diabetes. Similar diet assessment tools have been utilized in other studies (Ferranti et al., 2014). Concerning healthy eating, only one significant factor was identified, benefits exceed barriers. High calorie food/beverage intake score was associated with two significant factors, benefits exceed barriers and perceived diet self-efficacy.

Significance of Considering Behavioral Factors in Diabetes Prevention in Women with a History of GDM

Lifestyle intervention proves to be important in preventing women with a history of GDM from developing diabetes. Chasan-Taber (2015) presented an overview of 9 studies to reduce the risk of diabetes in women post GDM. These studies showed that evidence on how to motivate these women to exercise more or maintain a healthy diet is still inconclusive. Several recent studies focused on the behavioral barriers to diabetes prevention in women with GDM (Infanti et al., 2014; Peacock, Bogossian, McIntyre, Wilkinson, 2014; Kaiser et al., 2016). Seguin, Connor, Nelson, LaCroix, and Eldridge (2014) identified barriers to physical activity (such as lack of time and lack of facilities) and barriers to healthy eating (such as cost, portion control, and eating out). Infanti et al. (2014) conducted a randomized controlled diabetes prevention trial for women with a history of GDM and identified several barriers to participation including accessibility, affordability, and how practical the intervention was. Peacock et al. (2014) reviewed 14 studies that examined interventions to prevent diabetes among women with GDM and identified lack of childcare as a barrier to lifestyle changes. Kaiser et al. (2016) identified barriers to these women's lifestyle changes, such as time, child care issues, not knowing what to eat, and fatigue. Thus behavioral barriers must be considered in studies addressing diabetes prevention in women with a history of GDM.

This study contributed to the existing literature by combining the behavioral benefits with the behavioral barriers in one variable, "benefits exceed barriers". This new variable was consistently significant in this study in predicting exercise in women with a history of GDM. Recognizing the health benefits of diabetes prevention can vary

across studies. For example, Peacock et al. (2014) found that women reporting concern about their risk for diabetes still struggled with inadequate physical activity and lack of weight loss. With the integration of benefits and barriers in the same model, we assume that GDM women can rationally decide whether to adopt the recommended lifestyle changes.

The next logical step is to identify strategies to reduce barriers in the target population. In a randomized controlled study of 59 women with a history of GDM, Jelsma, et al. (2017) examined whether a lifestyle intervention (two personal educational sessions and five follow-up phone calls) can reduce identified barriers to physical activity and a healthy diet. The intervention was significantly effective in reducing barriers to a healthy diet such as lack of time, cost, unhealthy snacks at home, and craving for sweets. The intervention also significantly reduced barriers to physical activity such as lack of energy and motivation. However, no significant effect was detected in reducing barriers to physical activity such as lack of time and lack of childcare. More comprehensive prospective studies are needed to effectively assess what specific strategies work best to reduce barriers to adopting healthy lifestyle changes.

Significance of Including Social Support in Diabetes Prevention in Women With a History of GDM

As presented earlier, our proposed Expanded Health Belief Model with the added construct, specific ecological environmental cues (social and community support), can help predict behavior changes such as exercise and diet. Social support (having family or friends who care that you exercise) was a significant predictor of the outcome

variable, exercise to sweat. Peacock et al. (2014) reviewed studies that indicated some form of social support was needed. This review suggested that lack of support could include infrequent phone calls, lack of family support or partner support, lack of encouragement, lack of child care, and feelings of abandonment postpartum. Other authors report that social support is a facilitator for physical activity or exercise and that a lower level of social support (from family and friends) and more perceived barriers were significantly associated with low adherence to a healthy lifestyle six-months postpartum (Seguin et al., 2014; Kaiser et al., 2016). Turner, Rejeski, and Brawley (1997) report that a "socially enriched instructional environment" leads to greater exercise self-efficacy, which supports our policy implication to have detailed GDM class objectives for pregnant women.

Weight management self-efficacy, exercise self-efficacy, and diet self-efficacy were all significant predictors of exercise frequency and decreased food intake in a first-year postpartum study (Hinton & Olson, 2001). Smith et al. (2005) reported that social support in the form of verbal encouragement and exercise self-efficacy was related to sufficient exercise or activity. In a study of women with a recent history of GDM, food intake was healthier with higher diet self-efficacy, reduced perception of barriers to eating healthfully, with more phone calls from a health educator (Zehle et al., 2008). Jelsma et al. (2017) also reported that interventions such as meetings and phone calls significantly improved social support, modified both diet and physical activity self-efficacy, and reduced barriers to a healthy diet and physical activity in women with a history of GDM in order to prevent type 2 diabetes.

The current study highlights the fact that different types of social support may be pertinent for different outcomes. For example, social support from family and friends was pivotal for physical exercise, especially exercise to sweat. However, social support was not significantly related to diet behavior among GDM women. Therefore, it is important to differentiate between types of social support and include social support only in the framework for the desired outcome variables.

Further Understanding of Self-Efficacy Perception and Behavioral Barriers in Diabetes Prevention in Women With a History of GDM

This current study suggests two important factors that affect behavior, perception of self-efficacy and the combined "benefits exceed barriers" variable. The underlying assumption is that women with a history of GDM are rational individuals who can optimize their decision to exercise or eat healthfully by weighing the benefits and barriers simultaneously. In reviewing these studies, the authors report that even with the looming risk of developing overt diabetes later in life, women with a history of GDM are still unable to carry out lifestyle behaviors as recommended; this indicates that it is necessary to understand the motivators and the complexities of behavior change.

Self-efficacy can be achieved by mastery experiences, social modeling, social and verbal persuasion, and interpretation of physiological arousal (Bandura, 1997). Social modeling may work best if the individual modeling the behavior is similar in gender and physical traits as the subjects. It is recommended that any behavior intervention should consider these sources of efficacy support.

Exercise and diet behavior-specific self-efficacy in postpartum women has been reported by Hinton and Olson (2001). The population studied was an observational

cohort study of 498 healthy adult women attending a prenatal care program and followed until 1 year after delivery. In a multivariate regression analysis (r^2=20%), these women who reported higher exercise self-efficacy and the intent to exercise were exercising more one year postpartum. Reductions in food intake were significantly associated with higher diet self-efficacy, body satisfaction, weight acceptance, and a focus on thinness (r^2=7%). The authors suggested that exercise self-efficacy can be increased by aiming for realistic exercise goals, therefore providing the necessary mastery experience. Diet self-efficacy can also be increased by learning how to avoid over-eating under stress by demonstrated or modeled strategies. The present study also found that exercise self-efficacy was significantly related to a positive exercise outcome (exercise ≥ 30 min three or more days weekly and exercise to sweat three or more days weekly). Diet self-efficacy in the present study was also significantly related to self-reported consumption of the recommended amounts of high calorie food or beverage. In comparing these two studies, while the patient population in the present study was smaller, the results were similar. The patients were mailed a survey with phone interview as needed. However, the patients in the cited study had multiple interventions over the study period.

Kim et al. (2008) reported that self-efficacy and social support are related to physical activity in 228 surveyed women (mostly Caucasian, affluent, and well educated) with a history of GDM. Women reporting low social support and low self-efficacy had lower exercise and diet quality scores and a higher BMI. Stronger associations were observed between both self-efficacy, social support and exercise and between social support from family and friends and a healthier diet.

We have an established objective-oriented detailed class/workshop which is structured to increase diet and exercise self-efficacy with specific recommendations to improve pregnancy outcomes and reduce the risk for developing overt diabetes in the future. Our current study includes a detailed 2-hour class for participants at the time of diagnosis of GDM which is typically in the third trimester of pregnancy. Topics covered include review of risk factors for GDM; risks to the baby and mother; nutrition recommendations for GDM, a six-meal plan with specific timing for meals and snacks; exercise recommendations; blood glucose goals (includes a demonstration of a glucometer); criteria determining need for medication; how to avoid or postpone the development of type 2 diabetes; and planning for a future pregnancy (including screening postpartum at 6 to 12 weeks to determine whether glucose intolerance persists and yearly screening thereafter). Each educational workshop included evaluation of information recall ensuring that each patient understands the dietary concepts of what comprises a carbohydrate, protein/meat, vegetable, or fat and how to combine these. Dietary intervention is the key to successful optimization of glycemic control in patients diagnosed with GDM so it is essential for the patient to master this knowledge in order to make appropriate food choices. Additional instruction is provided on portions recommended and how to read a food label. This activity can provide efficacy mastery, social modeling, and social and verbal persuasion.

Differing from the existing literature as known, this study assessed barriers related to benefits by developing a new variable, “benefits exceed barriers”. This new variable was a significant predictor of all exercise and diet behaviors. Multiple studies in the literature have addressed how to overcome the barriers alone but have not

proposed that perceived benefits exceed perceived barriers. As stated earlier for social support, Peacock et al. (2014) reviewed studies with interventions to prevent type 2 diabetes in post GDM women and found that subjects need social support to overcome barriers which can include lack of childcare.

This current study is in line with the latest research on overcoming barriers to physical activities. As mentioned earlier, Jelsma, et al. (2017) suggest that a lifestyle intervention (two personal sessions and five follow-up phone calls) could reduce identified barriers (lack of energy and motivation) to physical activity. Their study reports significant improvement in social support, self-efficacy modification, and reducing barriers to desired physical activity and diet behavior over the six months' follow-up. This study showed similar results for the "benefits exceed barriers" variable (for exercise and diet), social support (for those reporting exercise to sweat only), and self-efficacy (for both exercise groups and choosing high calorie food/beverage in the recommended amounts) as predictors of lifestyle outcome behaviors. Benchmarking with the latest research increases the external validity of this study.

Comparison of Theoretical Framework, Data Collection Methods, and Analytical Approach With the Literature

Theoretical Framework

I utilized the proposed Expanded Health Belief Model and all of its variables: perceived susceptibility, perceived seriousness, perceived benefits and perceived barriers (results used to create the new variable, "benefits exceed barriers"), demographic variables, diabetes-related cues to action, specific ecological/environmental cues to action, self-efficacy, perceived threat, and whether the

outcome behavior of diet or exercise was performed or not (Figure 2). I also examined the theoretical framework with four models to assess the outcome, diet behavior, and five models to assess the outcome, exercise behavior (Tables 20, 21, 22, and 23). Models I, II, III, and IV were used to assess effect of predictor variables on both diet and exercise behavior: Model I (Health Belief Model), Model II (Health Belief Model + Self-efficacy), Model III (Health Belief Model + Environment or Social Support), and Model IV (Health Belief Model + Self-efficacy + Environment or Social Support). Model V (Health Belief Model + Self-efficacy + Environment or Social Support + No Child Care Issues) applied only to the outcome variable, exercise behavior.

Other studies have used the Health Belief Model to study health behaviors among women with GDM but have not used the expanded version and have not included self-efficacy (Tang, et al., 2015). Some studies have used only selected variables of the Health Belief Model. For example, Zehle et al. (2008), in evaluating dietary behavior, measured diet self-efficacy, social support, perceived barriers to eating healthfully, and lifestyle support in women with a history of GDM. Smith et al. (2005) only assessed barriers to physical activity, social support, and exercise self-efficacy in women with a history of GDM. None of the studies reviewed used the Health Belief Model in its entirety with the added variables, self-efficacy and specific ecological measures, as was implemented in the present study. A systematic review by Peacock et al. (2014) identified the limitations of using selected interventions, barriers, enablers, and predictors to delay or prevent diabetes in women with a history of GDM. These authors concluded that it is difficult for most women to adapt lifestyle recommendations into everyday behavior. They suggested utilizing the nurse midwife to support this effort in

women with education and engagement to identify specific barriers and changing behaviors to prevent the development of diabetes.

Data Collection Method

Oher studies utilized different approaches to data collection and some of these are described here. Tang et al. (2015) conducted semi-structured interviews with 23 women diagnosed with GDM to identify views on diabetes prevention efforts. Zehle et al. (2008) utilized a random sample of 226 women with a history of GDM from a telephone survey to evaluate their dietary behavior, self-efficacy, social support, perceived barriers to a healthy diet, and type of lifestyle support preferred. Smith et al. (2005) performed a telephone survey study on a random sample of 226 GDM women to assess physical activity, self-efficacy, social support, and perceived barriers to exercise. Peacock et al. (2014) in their review of 30 studies, report several types of interventions: randomization to intervention or placebo groups or various intervention groups, phone interviews, observational studies, semi-structured interviews, focus groups, and surveys mostly evaluating effects of physical activity, diet, or medication in prevention of diabetes. The published literature reports a wide range of approaches to data collection.

The present study focuses on one group of all women diagnosed with GDM in a local practice. The clinical data was extracted retrospectively by reviewing the medical records of these women. Additional measures were collected from the mailed surveys and by phone interviews. The review of the literature showed, to the best of our knowledge, that no patient survey was quite as comprehensive or as original as the one used in the present study, which assessed diet and exercise outcome behaviors, all the

Health Belief Model constructs, diet self-efficacy, exercise self-efficacy, diabetes-related and specific environmental cues to action, nutrition knowledge, and demographics.

Data Analysis

Tang et al. (2015) utilized qualitative analysis to code and identify themes from structured interviews with patients diagnosed with GDM. Zehle et al. (2008) utilized multiple linear regression modeling for a telephone survey of diet behavior and related variables of self-efficacy, barriers, social support, and type of lifestyle support preferred. Smith et al. (2005) used multiple logistic regression modeling to analyze their telephone survey results of physical activity and related variables of self-efficacy, barriers, and social support.

I used selected variables and results of a logistic regression analysis to predict whether the diet or exercise behavior was performed or not. As presented in previous chapters, the predictors and results were further framed within five Models, each of which was analyzed for significance. All the major variables of the Health Belief Model, diet and exercise self-efficacy, and the diabetes and ecological/environmental cues to action were utilized.

In considering the other approaches or methodologies described above, it would be helpful to utilize personal interviews or focus groups. These conversations could include an incentive to attend, such as reimbursement for travel, in order to elicit deeper perspectives from these patients to fully understand their diet and exercise behavior. Including a significant other may offer more understanding. In reviewing study techniques employed by Smith et al. (2005) and Zehle et al. (2008), it may be helpful to compare study participants to nonparticipants using medical record information such as

age, gravidity, parity, and insulin use to identify any difference between these two groups. However, the group who received the GDM education may be a more biased sample of more motivated patients who utilized the information received to modify their postpartum lifestyle.

Strengths and Limitations of This Study

Strengths of This Study

The study was original and utilized a comprehensive survey tool specifically created for this particular study. The theoretical framework was based on the multidimensional Health Belief Model but was expanded to include self-efficacy and specific ecological constructs, which have not been utilized in the same way in previous studies of the same theoretical model as in the present study. The study received strong institutional support from the clinic where the subjects received their prenatal care and the 2-hour GDM class education and subsequent pregnancy follow-up. I helped create the detailed handouts and booklets included in the educational material packet which was provided during the initial GDM class workshop. I was also an integral part of the diabetes educator team who provided the initial education, follow up, and continued reinforcement throughout the pregnancy to ensure a healthy outcome for both the mother and fetus. The importance of postpartum screening and lifestyle recommendations to lessen the risk for developing overt diabetes later in life was also strongly reinforced.

To motivate subjects in our follow-up survey and increase the response rate, multiple innovative ideas were utilized. For example, a group photo on the survey of the health care team in the MFM diabetes clinic, including the physician and diabetes

educators to enhance patient recall of good memories of the care they received while attending the clinic. The survey was personalized with little cartoon characters on lavender paper to increase appeal to the survey participants. Moreover, the survey utilized several reliable and valid instruments including specifically created questions to meet our study purposes. We created diverse sections of the survey with different font to provide visual appeal. I invited two expert committees of health care professionals to evaluate these questions and conducted a pilot study to check for potential issues before mailing the survey to all study subjects. A $10 gift card (choice of Food Lion, Farm Fresh, Macy's, or Target) was mailed to the participants who completed and returned the survey. The patient survey was thus strengthened in multiple ways to improve the response rate.

Finally, the most significant part of this study is the significance. Considering the increasing epidemic of diabetes in the U.S., women with a history of GDM are a particularly vulnerable group with a 40% to 60% chance of developing overt diabetes later in life (Kjos et al., 1990; Mestman, 1988). A healthy lifestyle is the front-line effort to decrease this risk for diabetes. It is important to understand the complex factors described here that influence the ability and motivation to initiate and sustain a healthy lifestyle in this population. This study provides valuable evidence for understanding this process and can be useful for peer researchers to develop effective education and support interventions for women with GDM.

Limitations of this Study

Due to limited resources and practicality, this study was unable to be conducted with a control group or with multiple data collection points. It was an ex post facto or

after the fact study, a retrospective analysis of prospectively collected data supplemented by a current survey (Ary et al., 1990). Although we made great efforts to maximize survey response rates, I recognize that an improved response rate would have significantly strengthened the validity and generalizability of the conclusions reached in this study. Although surveys were sent to all 595 former patients in the clinic who had recently been diagnosed and managed with GDM, only 153 surveys or 25.7% were completed and returned (by mail or phone interview), thus resulting in a relatively small sample size. However, the 25.7% response rate was similar to that reported in other studies the literature. For example, Watt, Simpson, McKillop, and Nunn (2002) reported a 33.3% response rate to a paper survey administered to students and that it was often better to conduct the survey after the education session. One possible reason for the relatively low response rate is the fact that in an effort to be comprehensive the survey was lengthy. The survey had 115 questions, which may have required 30 minutes or more for participants to complete. Moreover, the significant proportion of the population of patients of reproductive age living in the Hampton Roads Tidewater area are associated with the Navy and as such are prone to frequent relocations further impacting the response rate negatively.

In comparing the study sample to characteristics of the total number of patients seen for GDM at MFM during 2004 (*n*=722) and 2005 (*n*=695), the average composition for these two years was 53.5% Caucasian, 34% African-American, 6.5% Asian, 4% Hispanic, and 2% other. The study sample (responders) included a higher percentage of Caucasian women (75%), a lower percentage of African-American women (15.1%), a

higher percentage of Asian women (8.6%), and a lower percentage of Hispanic women (1.3%).

Overall, the women who responded to the survey announcement and completed the survey were older, Caucasian, married, had no more than two children on average, were more educated, had a higher household annual income, lived in Virginia Beach, and were insured for health care.

The clinic was a local practice in the Hampton Roads region of Virginia; therefore, the generalization of the results to the general population of women diagnosed with GDM during pregnancy is limited. Since most of the answers were self-reported, this could contribute to a social desirability bias. It is also difficult to measure self-selection bias, i.e. women with healthier lifestyles may have chosen to participate in this study and respond. Since this is a cross-sectional study, the results were correlational, not causal. The study was statistically a correlational study which shows only relationships or predictions, not causation. Finally, the study data was obtained 10 years prior to completion of the research; application to the current patient population may require further scrutiny.

Policy Implications

This study provides several implications to policy makers. Unfortunately, despite extensive education throughout pregnancy regarding the importance of postpartum screening for GDM and yearly thereafter to identify the persistence of recurrence of glucose intolerance, the proportion of patients complying with such testing is abysmal and has been generally estimated to be less than 20% in most clinics in the U.S. First, despite a very comprehensive diabetes education program, it is evident that we still

have much to learn about what motivates individuals to utilize the dietary and exercise recommendations they have learned while pregnant to establish more permanent and positive lifestyle changes. Postpartum data collection among women with a history of GDM is important to prevent diabetes. This fits the current trend to combat the epidemic of GDM, recurrent GDM, pre diabetes, and diabetes. H.R. 3658, the Gestational Diabetes Act or GEDI, was first introduced in 2015 (H.R. 3658, 2015). The bill proposed to amend the Public Health Service Act to direct the Centers for Disease Control and Prevention (CDC) to create multi-site research efforts to improve GDM data collection and research. The bill also directed the Department of Health and Human Services to promote postpartum testing and screening to prevent diabetes in women with a GDM history and to identify factors and health systems that affect GDM risk and development of diabetes in this population. The CDC has established programs to award grants that aim to reduce the incidence of GDM, its recurrence, and development of overt diabetes in these women (H.R. 3658, 2015). The CDC is working with state government and Indian tribal-based diabetes prevention and control efforts to carry out these objectives.

The second policy implication is to consider whether insurance programs should expand the coverage for prevention measures such as nutrition education and physical activity training in women with GDM. Medicare is initiating a Medicare Diabetes Prevention Program in 2018 to utilize and reimburse the activities covered by the CDC's managed National Diabetes Prevention Program (NDPP). This is an outcome of a series of successful randomized clinical trials known as the DPP since 2002 (Ely et al., 2017). In 2002, Congress authorized the CDC to manage this diabetes prevention program designed to provide education and support with a designated number of

structured group classes over time conducted in places such as a community YMCA or approved medical practice. This program is intended for those who have been diagnosed with pre diabetes or who are at high risk for developing type 2 diabetes. Women with a history of GDM would benefit from this intensive education and ongoing support from a recognized program in order to reduce the risk for both recurrent GDM and the development of diabetes later in life. Providing insurance coverage of these activities would motivate women with a history of GDM to take advantage of these programs.

Implications for additional policy development should include evidence-based best practices by health care providers to help reduce behavioral barriers and improve self-efficacy in this population of women in order to achieve outcomes of improved diet and exercise behaviors to prevent diabetes. This could include recognized standards of content for GDM education programs such as the educational material and workshops utilized in the current study. Unfortunately, despite the fact that GDM affects a growing proportion of pregnant patients every year reaching up to an estimated 20% in some patient populations, there are no published evidence-based standardized recommendations for what should be included in the education provided, how it should be imparted, and how long the patient should be followed in the postpartum period. Unfortunately, clinic resources, insurance reimbursement issues, and clinic staffing often determine the quality of the diabetes education and follow-up provided at any given clinic. Necessary components of this education in addition to managing present lifestyle behaviors to achieve target blood glucose values during the pregnancy, would include identifying barriers to improved lifestyle behavior to prevent diabetes with real

suggestions and coaching to problem solve any barriers. Mastery of self-efficacy to carry out these lifestyle behaviors could begin immediately during the education session by encouraging and supporting these women as they explain how they could specifically carry out these diet and exercise recommendations to prevent diabetes. This would include mastery, social modeling, and verbal persuasion, all techniques which could be put into action during these education sessions.

Future Research

Suggestions for future research would include surveying larger samples of patients over multiple geographic regions of the country to increase external validity. This would require collaborative efforts with other clinical practices. The data collection could begin during pregnancy to ensure an engaged study sample and be repeated every six months. Ideally, a longitudinal study design spanning for multiple years could evaluate the sustainability of these efforts and long-term effects on diet, exercise, and weight behaviors. A control group that doesn't receive the detailed GDM education could be added as a comparison group although, given the documented benefits of diabetes education in the population of patients diagnosed with GDM in reducing adverse perinatal outcomes, it may not be ethical to identify these patients and have them not receive any education. Alternatively, a control group of obese patients who were not diagnosed with GDM but who are also at significant risk for developing overt diabetes later in life, could be followed as a control group (who did not receive any dietary or exercise education). I recognize that it would not be as ideal as having a control group of women with GDM who did not receive any intervention, but it is a close second.. An experimental design could be applied to establish the causality between the

GDM education and changes in health outcomes in the target population. Following the groups long-term for at least 10 years period would provide more objective data to assess whether these interventions truly impact the incidence of developing overt type 2 diabetes later in life.

An online survey could be utilized to save time and be more convenient and efficient. Pedometers and other already existing apps to assess daily activity levels could be provided for more objective assessment of activity and caloric intake. The planners of such interventions could also use phone text technology to provide reinforcement of the education message throughout the duration of pregnancy and to also track why people opt out of text messages. It would be good to conduct several focus group sessions in order to get input from those individuals who could not participate in the study or who are unable to remain in the intervention group.

Considering an interdisciplinary approach could add a greater insight into why people may not make the more logical behavior choice given their knowledge of risks. For example, the theory of bounded rationality proposes that we are limited by information, time, and our own thought process when making a decision. Behavioral economics proposes that decision-making is influenced by individual psychology, emotions, social, and cognitive factors. Also, the individual may not always make the more logical choice based on utility or practicality; the individual's choice may be one of satisficing or doing what is acceptable at the time, even though she is well aware of the risks of her decision (Kahneman, 2003). Future research should also be completed sooner after data collection in order to avoid long intervals of time which could affect interpretation of the results. Referral to and collaboration with CDC- approved diabetes

prevention programs such as the local YMCA could help track progress in the area of individual lifestyle changes to prevent recurrent GDM and diabetes.

Conclusions

GDM is a public health problem with risks to both the unborn child and mother, affecting quality of life and cost. A mother with a history of GDM is also likely to experience recurrent GDM and has a 40% to 60% risk for developing overt diabetes in the following 5 to 20 years, providing an opportunity to offer education, awareness of a healthy lifestyle, and postpartum and yearly blood glucose screenings in order to avoid or at least postpone a diagnosis of diabetes.

Although pregnancy is a period in a women's life when she is most likely to become more motivated to make healthy lifestyle choices and to embrace recommendations which might positively impact her personal health during pregnancy and in the future, we recognize that multiple barriers contributing to effectively implementing behavioral changes, particularly ones that will extend into the postpartum period and beyond, do exist.

This study has also presented several theories of behavioral change to enable the provider and patient to understand that changing behaviors, even for the better, can be difficult to start and hard to maintain. It has been shown here that perceived susceptibility, marital status, social support, diabetes-related cue to action, perceived benefits and barriers, and perceived self-efficacy were significantly associated with either exercise or diet behavior in women with a history of GDM. Further research to identify which variables have the greatest impact on behavioral change is needed so

that we can develop policy and standards for effective programs to be implemented in the future.

The major contributions of this research are the comprehensiveness of utilization of the Health Belief Model with added constructs of self-efficacy and diabetes-related and specific ecological systems variables. We combined benefits and barriers into one variable, “benefits exceed barriers”. Final analysis showed that much of what we thought would be significant relationships were not, and ultimately we failed to reject many of the null hypotheses.

Given the above findings from the many studies reviewed as well as the current study, there are several conclusions that can be drawn from this discussion and recommendations that need to be made regarding our patients who either have GDM or have a history of GDM. We, as educators and health care providers, need to inform them of the risks for diabetes and help them embrace a healthy lifestyle. We must further develop innovative ways to educate the patients on how to reduce their risks for developing overt diabetes later in life. We can review in detail the benefits of a healthy lifestyle (diet, regular exercise, and maintaining a healthy weight) by encouraging them to seek support from family members and friends and help them increase their self-efficacy starting in the classroom. We can help them master the information by providing a non-threatening, interactive learning environment to enable them to master the information provided. Helping the patient set reasonable and attainable goals is essential. We can assist patients to identify their barriers to a lifestyle of activity, a healthy diet, and problem-solving. We need to make recommendations regarding on-going weight management postpartum as needed. Exploring options available using

technology to reach the patient and re-enforce the educational message provided is essential as we move into a new techno-savvy era.

The provider can encourage the patient to get the recommended 6 to 12-week postpartum screen in order to rule out persistent glucose intolerance. Given the fact that compliance with completing this testing has been reported to be so low, it follows that further resources should be allocated to ensure that postpartum testing for persistent glucose intolerance is completed. The patient also needs to be referred to a primary care provider for ongoing care and yearly blood glucose testing. The facility or clinic that educated the patient initially regarding GDM could offer a quarterly support group for ongoing education and encouragement. The interested patient could be provided with additional resources for ongoing education regarding health risk of diabetes in the community (e.g., YMCA and fitness centers) as well as on the web. If policy makers and insurance carriers recognize the benefits of ensuring postpartum screening and follow-up, clinical practices would be more likely to be reimbursed for providing such services and ultimately provide a positive impact on preventive health care in this patient population at high risk for developing overt diabetes.

Diabetes prevention and intervention, once the diagnosis is made, are challenging tasks. Targeting women with a history of GDM, following their index pregnancy, offers a unique opportunity to identify a patient population who is at significant risk for long-term health risks and who may be highly motivated to adopt healthy lifestyle changes to lessen this risk for developing diabetes later in life. Our challenge is to identify the most effective means to identify population specific barriers

to adopting healthy lifestyle changes so that we can make a greater impact in these patients' overall health to lessen the burden of overt diabetes for them later in life.

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APPENDIX A

Theoretical Constructs and Variables From Figure 2
Survey Items That Measure Them and Scoring

#	Theoretical Constructs (Variable Name)	Corresponding Survey Item	Scoring the Questions	Preparation of Constructs and Variables for Logistic Regression
Dependent Variables				
1	Healthfully Eating Index (HEI)	Questions A4-8 (yesterday and average)	QA4+QA5+QA6 +QA7+QA8 Divide by 5 = score for healthy eating index	1 point for each food group consumed in the recommended amount, maximum score of 5 represents a favorable diet; dichotomized to 0 or negative for a score of 3 or less and 1 or positive for a score of 4 or more.
	High Calorie Food Or Beverage (HICAL)	Question A9-12 (yesterday and average)	QA9+QA10+QA11 +QA12 Divide by 4 = score for intake of high calorie food or beverage	1 point for each food group consumed in the recommended amount, maximum score of 4 represents a favorable diet; dichotomized to 0 or negative for a score of 2 or less and 1 or positive for a score of 3 or more.
2	Exercise (EX)	Questions A1-3	QA1, QA2, QA3 Divide by 3	Levels of exercise are scored 0, 1, 2, 3, 4, or more than 4 days; the higher the score the more favorable the level of exercise. The responses will be dichotomized to 0 or negative for 0, 1, and 2 days and to 1 or positive for 3, 4, or more than 4 days of the level of exercise.

#	Theoretical Constructs	Corresponding Survey Item	Scoring the Questions	Preparation of Constructs and Variables for Logistic Regression
Independent Variables				
3	Perceived Susceptibility to Diabetes Subscale (PERSUS)	Questions B1-5	QB1+QB2+QB3 + QB4+QB5 Divide by 5	The responses for each subscale will be split between responses 1 to 3 (strongly disagree, disagree, and neutral) and responses 4 to 5 (agree and strongly agree) in order to form a dichotomous variable. Strongly disagree, disagree, and neutral responses will be assigned a value of 0 or negative, since they show lesser agreement with these beliefs. Agree and strongly agree responses will be assigned a value of 1 or positive, since they indicate a stronger agreement with these beliefs, except for diet and exercise barriers, they will be represented by responses 3 to 5 (neutral, agree, and strongly agree).
4	Perceived Seriousness of Diabetes Subscale (PERSER)	Questions B6-12	QB6+QB7+QB8 + QB9+QB10 +QB11+QB12 Divide by 7	
5	Perceived Benefits of Eating Healthfully Subscale (PERBENEAT)	Questions B13-18	QB13+QB14 +QB15+QB16 +Qb17+QB18 Divide by 6	
6	Perceived Barriers to Eating Healthfully Subscale (PERBAREAT)	Questions B19-24	QB19+QB20 +QB21+QB22 +QB23+QB24 Divide by 6	
7	Perceived Benefits of Exercise Subscale (PERBENEX)	Questions B25-30	QB25+QB26 +QB27+QB28 +QB29+QB30 Divide by 6	
8	Perceived Barriers to Exercise Subscale (PERBAREX)	Questions B31-36	QB31+QB32 +QB33+QB34 +QB35+QB36 Divide by 6	
9	Diet Self-Efficacy (DIETSE)	Questions C1-16	QC1+QC2+QC3 +QC4+QC5+QC6 +QC7+QC8+QC9 +QC10+QC11 +QC12+QC13 +QC14+QC15 +QC16 Divide by 16	Very little confidence or some confidence responses = 0 or negative and confidence, more confidence, or quite a lot of confidence responses = 1 or positive, since this indicates more diet self-efficacy. A higher score indicates more confidence or self-efficacy in being able to eat healthfully.

#	Theoretical Constructs	Corresponding Survey Item	Scoring the Questions	Preparation of Constructs and Variables for Logistic Regression
10	Exercise Self-Efficacy (EXSE)	Questions D1-16	QD1+QD2+QD3 +QD4+QD5+QD6 +QD7+QD8+QD9 +QD10+QD11 +QD12+QD13 +QD14+QD15 +QD16 Divide by 16	Very little confidence or some confidence responses = 0 or negative and confidence, more confidence, or quite a lot of confidence responses = 1 or positive, since this indicates more exercise self-efficacy. A higher score indicates more confidence or self-efficacy in being able to exercise.
11	Diabetes-Related Variables (Family History [FAMHX], Who Provided GDM Education [WHOED], How GDM Education Was Provided [HOWED])	Questions E2, 8-9	NA (Yes or No)	Question already dichotomized, who provided will be dichotomized to nurse = 0 and dietitian = 1, how provided will be dichotomized to individually = 0 and group = 1
12	Cues to Action (Diabetes-Related: Diagnosis of Diabetes [DM], Macrosomic Baby [MAC], Insulin Injections [INS])	Questions E1, 3-4,	NA (Yes or No)	Questions are already dichotomized

#	Theoretical Constructs	Corresponding Survey Item	Scoring the Questions	Preparation of Constructs and Variables for Logistic Regression
13	Cues to Action (Environment: Social Support for Eating Healthfully [SSEAT])	Question F1, 3	NA (Yes or No)	Questions are already dichotomized
14	Cues to Action (Environment: Social Support for Exercise [SSEX])	Question F2, 4	NA (Yes or No)	Questions are already dichotomized
15	Cues to Action (Environment: Community Support for Eating Healthfully [CSEAT])	Question F5-7	NA (Yes or No or NA)	Questions are already dichotomized
16	Cues to Action (Environment: Community Support for Exercise [CSEX])	Questions F8-12	NA (Yes or No) QF12 (Open-ended)	Questions are already dichotomized
17	Demographic Variables (Age [AGE], Race [RACE], Marital Status [MS], Education [ED], Income [INCM], Residence [RES], Insurance [INSUR])	Questions H1-8	NA	30 years or more = 0 and 29 years or less = 1, all categories/other = 0 and Caucasian = 1, all other categories = 0 and married = 1, high school or less = 0 and college education = 1, number of persons living in home and household income will be applied to formula to determine if poverty guidelines met = 0 and not met = 1, rural = 0 and urban/suburban = 1, no health insurance = 0 and health insurance = 1

APPENDIX B

PATIENT SURVEY FOR PILOT STUDY

(PHOTOGRAPH HERE)

We are interested in women like you with a history of gestational diabetes. This information will enable us to help other women. Please help us by completing this survey.
Your answers will be kept confidential. Thank you for your time.

Please complete and mail this survey by __

Everyone completing and returning this survey will receive one $10 gift certificate.

Please indicate your preference: Farm Fresh □ Food Lion □ Target □ Hecht's/macy's □

A. Your Lifestyle
***Tell us about how you exercise*. Please check [√] the correct box.**

1. In the past week, how many days did you do 30 minutes or more of physical activity (eg, walking briskly, vacuuming, gardening, jogging, swimming, biking, or dancing)?

□ 0 □ 2 □ 4
□ 1 □ 3 □ More than 4 days

2. In the past week, how many days did you work out enough to sweat (eg, aerobics, heavy yard work, cycle, or run)?

□ 0 □ 2 □ 4
□ 1 □ 3 □ More than 4 days

3. In the past week, how many days did you "work in" other types of exercise (eg, walk for 10 minutes, take the stairs, or park the car farther away)?

□ 0 □ 2 □ 4
□ 1 □ 3 □ More than 4 days

***Tell us about how you eat*. Please fill in the blank.**

For each of the food groups, please state how many servings you had yesterday and number of servings average per day over the past week.

Food Group	*Number of Servings?*	
	Yesterday	Average per day
4. Vegetables (like salads, broccoli, or squash) *A serving is:* *1 cup (the size of a woman's fist) raw or ½ cup cooked*	_____	_____
5. Fruit or Fruit Juice *A serving is:* *1 piece of fruit (about ½ cup) or melon wedge* *2 tablespoons dried fruit* *½ cup canned fruit or juice*	_____	_____
6. Cereals, Bread, Grains, or Starchy Vegetables *A serving is:* *½ cup cooked or ¾-1 cup dry cereal* *1 slice of bread or 1 small roll or 4-6 small crackers* *½ cup cooked pasta or rice* *½ cup cooked starchy vegetables (potatoes, corn)* *½ cup cooked beans/peas (kidney beans or peas)*	_____	_____
7. Milk and Dairy Products *A serving is:* *1 cup of milk, soy milk, or yogurt* *1 ½ ounces of cheese or 1/2 cup cottage cheese*	_____	_____
8. Meat, Chicken or Turkey, Fish, or Egg *A serving is "3 ounces" and is about:* *the size of a deck of cards or 1 cooked hamburger* *"1* ounce" *is*: *1 egg or 1 slice of thinly sliced ham* **for example, yesterday: 1 ounce for breakfast** **+ 3 ounces for lunch** **+ 6 ounces for supper** **= 10 ounces**	_____ Please give answer in ounces	_____ Please give answer in ounces

For each of the following foods, please state how many servings you had yesterday and number of servings average per day over the past week.

Food Group	*Number of Servings?*	
	Yesterday	Average per day
9. Fat (added when cooking or at the table) *A serving is:* *1-2 teaspoons of oil, mayonnaise, or margarine (1-2 tablespoons if diet) or* *1-2 tablespoons of salad dressing (2-4 tablespoons if diet)*		
10. Fried/High Fat Foods (such as a moderate serving of fried chicken [half of a breast], fried fish [deck of cards], or French fries [1 handful/small order], or pizza [2 slices])		
11. Sugared Drinks (1 can or small serving of soda, fruit drink, Kool-Aid, lemonade, or sport drink, eg, Gatorade)		
12. Snacks and Desserts (such as a moderate serving of chips [1 handful], chocolate or candy [1 bar or 3 pieces], ice cream [1/2 cup], cake or pie [1 slice], cookies [2 small], or donuts [1 each])		

13. Yesterday, how many meals did you skip?
___Meals skipped yesterday ___Meals skipped average per day over the past week.

B. Your Health Beliefs. **How strongly do you agree or disagree with the following statements? Please check [√] the box that best represents your belief.**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. It is extremely likely I will get diabetes in the future.	☐	☐	☐	☐	☐
2. I feel I will get diabetes in the future.	☐	☐	☐	☐	☐
3. There is a good possibility I will get diabetes in the next 10 years.	☐	☐	☐	☐	☐
4. My chances of getting diabetes are great.	☐	☐	☐	☐	☐
5. I am more likely than the average woman to get diabetes.	☐	☐	☐	☐	☐
6. The thought of diabetes worries me.	☐	☐	☐	☐	☐
7. When I think about diabetes, I become emotional.	☐	☐	☐	☐	☐
8. I am afraid to think about diabetes.	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9. Problems I would experience with diabetes would last a long time.	☐	☐	☐	☐	☐
10. Diabetes would threaten a relationship with my boyfriend, husband, or partner.	☐	☐	☐	☐	☐
11. If I had diabetes, my whole life would change.	☐	☐	☐	☐	☐
12. If I developed diabetes, I would live a shorter life.	☐	☐	☐	☐	☐
13. When I eat healthfully, I feel good about myself.	☐	☐	☐	☐	☐
14. When I eat healthfully, I don't worry as much about diabetes.	☐	☐	☐	☐	☐
15. Eating healthfully will allow me to postpone or prevent diabetes.	☐	☐	☐	☐	☐
16. If I eat healthfully during the next year, I will decrease my chances of getting diabetes and I will live longer.	☐	☐	☐	☐	☐
17. If I eat healthfully, I will decrease my chances of having complications if diabetes occurs.	☐	☐	☐	☐	☐
18. If I eat healthfully, I can control my weight and reduce my risk for diabetes.	☐	☐	☐	☐	☐
19. Eating healthfully doesn't "taste as good".	☐	☐	☐	☐	☐
20. Eating healthfully won't make a difference in my risk for diabetes.	☐	☐	☐	☐	☐
21. Eating healthfully will be difficult for me.	☐	☐	☐	☐	☐
22. Eating healthfully will take too much time.	☐	☐	☐	☐	☐
23. Eating healthfully will cost too much.	☐	☐	☐	☐	☐
24. I am not interested in eating healthfully.	☐	☐	☐	☐	☐
25. When I exercise I feel good about myself.	☐	☐	☐	☐	☐
26. When I exercise I don't worry as much about diabetes.	☐	☐	☐	☐	☐
27. Exercising will allow me to postpone or prevent diabetes.	☐	☐	☐	☐	☐
28. If I exercise during the next year, I will decrease my chances of getting diabetes and I will live longer.	☐	☐	☐	☐	☐
29. If I exercise I will decrease my chances of having complications if diabetes occurs.	☐	☐	☐	☐	☐
30. If I exercise, I can control my weight and reduce my risk for diabetes.	☐	☐	☐	☐	☐
31. I am too tired to exercise.	☐	☐	☐	☐	☐
32. Exercising won't make a difference in my risk for diabetes.	☐	☐	☐	☐	☐
33. Exercising will be inconvenient for me.	☐	☐	☐	☐	☐
34. Exercising will take too much time.	☐	☐	☐	☐	☐
35. Exercising will cost too much.	☐	☐	☐	☐	☐
36. I am not interested in exercising.	☐	☐	☐	☐	☐

C. Your Beliefs About How You Eat. **Beside each statement below, please circle how much confidence you have about performing it.**

1	2	3	4	5
Very Little Confidence		**Confidence**		**Quite a Lot of Confidence**

1. Reaching my ideal weight by eating healthy food.	**1**	**2**	**3**	**4**	**5**
2. Decreasing the amount of fat in my diet.	**1**	**2**	**3**	**4**	**5**
3. Staying on a healthy diet when I am busy or in a rush.	**1**	**2**	**3**	**4**	**5**
4. Staying on a healthy diet when no one at home is on it.	**1**	**2**	**3**	**4**	**5**
5. Staying on a healthy diet when I eat at a restaurant.	**1**	**2**	**3**	**4**	**5**
6. Staying on a healthy diet when I am not at home to eat.	**1**	**2**	**3**	**4**	**5**
7. Staying on a healthy diet on special occasions or holidays.	**1**	**2**	**3**	**4**	**5**
8. Knowing what foods I should eat on a healthy diet.	**1**	**2**	**3**	**4**	**5**
9. Cutting out unhealthy snacks during the day or evening.	**1**	**2**	**3**	**4**	**5**
10. Increasing the amount of fiber and vegetables in my diet.	**1**	**2**	**3**	**4**	**5**
11. Staying at my ideal weight once I have reached it.	**1**	**2**	**3**	**4**	**5**
12. Knowing how to cook healthy meals.	**1**	**2**	**3**	**4**	**5**
13. Preparing a healthy meal for myself when I eat alone.	**1**	**2**	**3**	**4**	**5**
14. Limiting the amount of carbohydrate I eat at a meal.	**1**	**2**	**3**	**4**	**5**
15. Knowing what food to buy at the store.	**1**	**2**	**3**	**4**	**5**
16. Decreasing the amount of sugar and sweets in my diet.	**1**	**2**	**3**	**4**	**5**

D. Your Beliefs About How You Exercise. **Beside each statement below, please circle how much confidence you have about performing it.**

1	2	3	4	5
Very Little Confidence		**Confidence**		**Quite a Lot of Confidence**

I could exercise…					
1. when tired.	**1**	**2**	**3**	**4**	**5**
2. during or following a personal crisis.	**1**	**2**	**3**	**4**	**5**
3. when feeling depressed.	**1**	**2**	**3**	**4**	**5**
4. when feeling anxious.	**1**	**2**	**3**	**4**	**5**
5. during bad weather.	**1**	**2**	**3**	**4**	**5**
6. when slightly sore from the last time I exercised.	**1**	**2**	**3**	**4**	**5**
7. when on vacation.	**1**	**2**	**3**	**4**	**5**
8. when there are competing interests (like my favorite TV show).	**1**	**2**	**3**	**4**	**5**
9. when I have a lot of work to do.	**1**	**2**	**3**	**4**	**5**
10. when I haven't reached my exercise goals.	**1**	**2**	**3**	**4**	**5**
11. when I don't receive support from my family/friends.	**1**	**2**	**3**	**4**	**5**
12. when I have not exercised for a prolonged period of time.	**1**	**2**	**3**	**4**	**5**
13. when I have no one to exercise with.	**1**	**2**	**3**	**4**	**5**
14. when my schedule is hectic.	**1**	**2**	**3**	**4**	**5**
15. when my exercise workout is not enjoyable.	**1**	**2**	**3**	**4**	**5**
16. In general, I believe I could exercise at my target heart rate three to five times per week for 30 to 40 minutes over the next 6 months.	**1**	**2**	**3**	**4**	**5**

E. Your health. **Please fill in the blank or check [√] the correct box.**

1. Have you been told that you have diabetes or high blood sugar? Yes ☐ No ☐

2. Do you have blood relatives who have diabetes? Yes ☐ No ☐

3. Have you delivered a baby that weighed 8 pounds 8 ounces or more? Yes ☐ No ☐

4. Did your pregnancy require insulin injections? Yes □ No □

5. Did your pregnancy require pills to control your blood glucose? Yes □ No □

6. Your weight now: _____pounds Your height: _____feet _____inches

7. Has your weight changed since your last delivery? Yes □ No □
If yes, please check one: □ gained _____pounds
□ lost _____pounds

8. Who provided your gestational diabetes education? Nurse □ Dietitian □ Don't know □

9. How was the education session provided? Individually □ In a group □

***F. Your environment*. Please circle Yes or No for the following questions or fill in the blank:**

1. Do you feel that you have family or friends who care that you eat healthfully?	Yes	No
2. Do you feel that you have family or friends who care that you exercise?	Yes	No
3. Do you know others (family or friends) who eat healthfully?	Yes	No
4. Do you know others (family or friends) who exercise?	Yes	No

Think about where you live and work and spend most of your time…

5. Are a variety of healthy foods available at your grocery store?	Yes	No	
6. Are a variety of healthy foods available at your work or school?	Yes	No	NA
7. Are a variety of healthy foods available at restaurants?	Yes	No	

Think about where you live and work and spend most of your time…

8. Are you able to exercise?	Yes	No	
9. Are exercise facilities available (gym/YMCA, walking/biking trails, etc)?	Yes	No	
10. Do you have exercise equipment in your home?	Yes	No	
11. Is it safe to exercise in your neighborhood?	Yes	No	
12. If you are not able to exercise, please explain why (for example, no child care):			NA

Keep going… you're almost finished!

G. Your Nutrition Knowledge. **Please circle all of the correct answers.**

1. Circle the 4 foods that are carbohydrates (carbs):
a. potato b. pasta c. orange d. milk e. steak f. chicken

2. Circle the 4 foods that are low in carbs :
a. pasta b. bread c. lettuce d. cucumber e. tomatoes f. broccoli

3. Circle the 3 foods that are low in fat:
a. sausage b. lean ham c. skim milk d. fried chicken e. 2% fat cheese

4. Circle the 2 foods that have more fiber:
a. instant cereal b. whole grain cereal c. instant potatoes d. whole potatoes with skin

5. What is a serving size of cooked potatoes, corn, or peas? (circle one answer)
a. 2 cups b. 1 ½ cups c. ½ cup

H. Important Information about you. **Please fill in the blank or check [√] the correct box.**

1. Age: _____ years

2. Ethnicity: Caucasian □ African American □ Hispanic □ Asian □
Other (please describe) _____

3. Marital status: Married □ Divorced □ Widowed □ Single □ Other □

4. Number of persons living in your home now: ____ Number of children under 18 years: ____

5. Please indicate your highest level of education:

Less than high school □ High school diploma/GED □ College degree □

6. Your annual household income: Less than $18,000 □ $18,000-36,000 □
$36,000-50,000 □ $50,000-75,000 □ $75,000-100,000 □ over $100,000 □

7. Where do you live: (city or county)_____
Is this: Rural (in the country) □ Urban (city) □ Suburban (immediately outside a city) □

8. Health insurance now: Private □ Tricare □ Medicaid □ No health insurance □ Other_____

PATIENT SURVEY FOR LARGER STUDY

(PHOTOGRAPH HERE)

We are interested in women like you with a history of gestational diabetes. This information will enable us to help other women. Please help us by completing this survey.
Your answers will be kept confidential. Thank you for your time.

Please complete and mail this survey by __

Everyone completing and returning this survey will receive one $10 gift certificate.

Please indicate your preference: Farm Fresh □ Food Lion □ Target □ Hecht's/macy's □

A. Your Lifestyle
***Tell us about how you <u>exercise</u>*. Please check [√] the correct box.**

1. In the past week, how many days did you do 30 minutes or more of physical activity (eg, walking briskly, vacuuming, gardening, jogging, swimming, biking, or dancing)?

□ 0 □ 2 □ 4
□ 1 □ 3 □ More than 4 days

2. In the past week, how many days did you work out enough to sweat (eg, aerobics, heavy yard work, cycle, or run)?

□ 0 □ 2 □ 4
□ 1 □ 3 □ More than 4 days

3. In the past week, how many days did you "work in" other types of exercise (eg, walk for 10 minutes, take the stairs, or park the car farther away)?

□ 0 □ 2 □ 4
□ 1 □ 3 □ More than 4 days

***Tell us about how you <u>eat</u>*. Please fill in the blank.** (other pages same as pilot study)

APPENDIX C

INTRODUCTORY FLIER FOR PILOT STUDY

Women who received care and education for gestational diabetes at Maternal-Fetal Medicine, EVMS, at Norfolk, Virginia Beach, or Newport News

(PHOTOGRAPH HERE)

We hope you are doing well. We are interested in women like you with a recent history of gestational diabetes. This is a research study and you do not have to participate. If you participate in our study you will receive a survey about your health, exercise, and diet. The survey will take about 20-30 minutes to complete. Responses will be kept confidential. The information will help us improve the way we provide health care for women before, during, and after pregnancy.

If you complete our survey and return it by __ you will receive a $10 gift certificate for Farm Fresh, Food Lion, Target, or Hecht's/macy's! You pick!

But first you must return this form in the stamped, self-addressed envelope provided in order to receive the survey!

___**YES I want to participate in this study** (I give you permission to mail me the survey, a reminder postcard, and to contact me by telephone in order to obtain the answers to the survey questions if the survey is not completed and returned by __)

My name_____

Street address_____

City_____State_____Zip Code_____Phone ( )_____

( )_____

___**NO I do not want to participate in this study** (please do not contact me)

You must return this form in the envelope provided if you wish to participate in the study. You will then receive the survey. If you return the completed survey by __ you will receive the $10 gift certificate. If you have any questions, please contact:

Phyllis Woodson (757-395-8900)
Tidewater Perinatal Center, Suite 305
1080 First Colonial Road
Virginia Beach, VA 23454

OR

Thank you!!!

Dr. Stacey Plichta (757-683-4989)
College of Health Sciences
Old Dominion University
Norfolk, VA 23529

INTRODUCTORY FLIER FOR LARGER STUDY

Women who received care and education for gestational diabetes at Maternal-Fetal Medicine, EVMS, at Norfolk, Virginia Beach, or Newport News

(PHOTOGRAPH HERE)

We hope you are doing well. We are interested in women like you with a recent history of gestational diabetes. This is a research study and you do not have to participate. If you participate in our study you will receive a survey about your health, exercise, and diet. The survey will take about 20-30 minutes to complete. Responses will be kept confidential.
The information will help us improve the way we provide health care for women before, during, and after pregnancy.

If you complete our survey and return it by __ you will receive a $10 gift certificate for Farm Fresh, Food Lion, Target, or Hecht's/macy's! You pick!

But first you must return this form in the stamped, self-addressed envelope provided in order to receive the survey!

___**YES I want to participate in this study** (I give you permission to mail me the survey, a reminder postcard, and to contact me by telephone in order to obtain the answers to the survey questions if the survey is not completed and returned by __)

My name_____

Street address_____

City_____State_____Zip Code_____Phone ( )_____
( )_____

___**NO I do not want to participate in this study** (please do not contact me)

You must return this form in the envelope provided if you wish to participate in the study. You will then receive the survey. If you return the completed survey by __ you will receive the $10 gift certificate. If you have any questions, please contact:

Phyllis Woodson (757-395-8900)
Tidewater Perinatal Center, Suite 305
1080 First Colonial Road
Virginia Beach, VA 23454

OR

Thank you!!!

Dr. Stacey Plichta (757-683-4989)
College of Health Sciences
Old Dominion University
Norfolk, VA 23529

APPENDIX D

SURVEY FLIER FOR PILOT STUDY

Women who received care and education for gestational diabetes at Maternal-Fetal Medicine, EVMS, at Norfolk, Virginia Beach, or Newport News

"Lifestyle Survey"

♦Enclosed please find a lifestyle survey about your health, diet, and exercise. The survey should take you about 20-30 minutes to complete.

♦**Please return the survey by __ in the enclosed stamped, self-addressed envelope.**

♦ Information from this survey is important since it will help us improve the way we provide health care for women before, during, and after pregnancy.

♦The information obtained will be kept confidential. The results of the study will be available upon request from Phyllis Woodson.

♦**If you complete this survey you will receive a gift certificate for $10 to Farm Fresh, Food Lion, Target, or Hecht's/macy's. You pick!** ***The entire survey must be completed and returned in order to receive the $10 gift certificate.***

♦If you have any questions, please contact::
Phyllis Woodson, MS, RD, CDE, Dietitian
Tidewater Perinatal Center
1080 First Colonial Rd, Suite 305, Virginia Beach, VA 23454
(757-395-8900) or woodsopm@evms.edu
PhD student, Health Services Research, Old Dominion University **OR**

Dr. Stacey Plichta, Associate Professor, Graduate Program Director
College of Health Sciences
Old Dominion University
Norfolk, VA 23529
(757-683-4989) or splichta@odu.edu

We look forward to hearing from you. Thank you for your help!

SURVEY FLIER FOR LARGER STUDY

Women who received care and education for gestational diabetes at Maternal-Fetal Medicine, EVMS, at Norfolk, Virginia Beach, or Newport News

"Lifestyle Survey"

♦Enclosed please find a lifestyle survey about your health, diet, and exercise. The survey should take you about 20-30 minutes to complete.

♦**Please return the survey by __ in the enclosed stamped, self-addressed envelope.**

♦Information from this survey is important since it will help us improve the way we provide health care for women before, during, and after pregnancy.

♦The information obtained will be kept confidential. The results of the study will be available upon request from Phyllis Woodson.

♦**If you complete this survey you will receive a gift certificate for $10 to Farm Fresh, Food Lion, Target, or Hecht's/macy's. You pick!** ***The entire survey must be completed and returned in order to receive the $10 gift certificate.***

♦If you have any questions, please contact::
Phyllis Woodson, MS, RD, CDE, Dietitian
Tidewater Perinatal Center
1080 First Colonial Rd, Suite 305, Virginia Beach, VA 23454
(757-395-8900) or woodsopm@evms.edu
PhD student, Health Services Research, Old Dominion University **OR**

Dr. Stacey Plichta, Associate Professor, Graduate Program Director
College of Health Sciences
Old Dominion University
Norfolk, VA 23529
(757-683-4989) or splichta@odu.edu

We look forward to hearing from you. Thank you for your help!

APPENDIX E

FOLLOW UP POSTCARDS FOR PILOT AND LARGER STUDY

Women who received care and education for gestational diabetes at Maternal-Fetal Medicine, EVMS, at Norfolk, Virginia Beach, or Newport News

Several weeks ago we mailed to you a survey about your health, diet, and exercise. If you have completed and returned this survey, THANK YOU! If we don't hear from you in two weeks, we may contact you by phone in order to obtain the responses to the survey questions.

It should take you about 20-30 minutes to complete the survey. The information you give to us will be kept confidential. Information from this survey is important since it will help us improve the way we provide health care for women before, during, and after pregnancy.

If you complete the survey and return it to us by __ (or answer the questions when we call you), you will receive a $10 gift certificate for Farm Fresh, Food Lion, Target, or Hecht's/macy's! You pick! Thank you in advance for completing and returning our survey. If you have any questions, please contact:

Phyllis Woodson (757-395-8900) or Dr. Stacey Plichta (757-683-4989)
1080 First Colonial Road, Suite 305 College of Health Sciences
Virginia Beach, VA 23454 Old Dominion University
Norfolk, VA 23529

Women who received care and education for gestational diabetes at Maternal-Fetal Medicine, EVMS, at Norfolk, Virginia Beach, or Newport News

Several weeks ago we mailed to you a survey about your health, diet, and exercise. If you have completed and returned this survey, THANK YOU! If we don't hear from you in two weeks, we may contact you by phone in order to obtain the responses to the survey questions.

It should take you about 20-30 minutes to complete the survey. The information you give to us will be kept confidential. Information from this survey is important since it will help us improve the way we provide health care for women before, during, and after pregnancy.

If you complete the survey and return it to us by __ or answer the questions when we call you), you will receive a $10 gift certificate for Farm Fresh, Food Lion, Target, or Hecht's/macy's! You pick! Thank you in advance for completing and returning our survey. If you have any questions, please contact:

Phyllis Woodson (757-395-8900) or Dr. Stacey Plichta (757-683-4989)
1080 First Colonial Road, Suite 305 College of Health Sciences
Virginia Beach, VA 23454 Old Dominion University
Norfolk, VA 23529

APPENDIX F

EXPERT COMMITTEE SURVEY ASSESSMENT FORM

Thank you for reviewing the attached survey. This survey seeks to assess the health behaviors of women with a recent history of gestational diabetes using the Health Belief Model (1). This survey is being conducted as part of the requirements of a PhD degree in the College of Health Sciences at Old Dominion University (ODU). The study participants will be former patients of the Diabetes in Pregnancy Program at Maternal-Fetal Medicine of Eastern Virginia Medical School (EVMS).

After your comments have been received and the survey is modified, it will be presented to the Institutional Review Boards at both EVMS and ODU and piloted with a small group of women. You may be asked to review further proposed changes in our survey based upon findings of the pilot study. The survey will then be mailed to the final target sample of participants. These individuals will vary in age, ethnicity, and education levels.

Please answer the following questions about the survey. We are interested in finding out how well you think each question or set of questions measures what we want it to measure.

A. Lifestyle

The first set of questions is meant to assess exercise and eating behaviors. Please refer to the survey and rate the extent to which you believe each question measures what it is intended to measure.

1. Tell us about how you exercise.

Are these questions a good measure of **recommended levels of exercise or activity**? Please refer to the survey and [√] the box that best represents how strongly you agree or disagree that each of the following questions is a good measure of exercise.

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		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Question 1	(30 minutes or more of activity)	☐	☐	☐	☐	☐
Question 2	(work out enough to sweat)	☐	☐	☐	☐	☐
Question 3	("work in" other types of exercise)	☐	☐	☐	☐	☐
Question 4	(TV, videos, DVD, or computer)	☐	☐	☐	☐	☐

Any suggestions for these questions?

2. Tell us about how you eat.
Are these questions a good measure of the **recommendations of the Dietary Guidelines/Food Guide Pyramid**? Please refer to the survey and [√] the box that best represents how strongly you agree or disagree that each of the following questions is a good measure of dietary behavior.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Question 5 (meals skipped)	☐	☐	☐	☐	☐
Question 6 (vegetables)	☐	☐	☐	☐	☐
Question 7 (fruits)	☐	☐	☐	☐	☐
Question 8 (cereal, bread, grain, starch)	☐	☐	☐	☐	☐
Question 9 (milk, dairy)	☐	☐	☐	☐	☐
Question 10 (meat, poultry, fish. egg)	☐	☐	☐	☐	☐
Question 11 (fat)	☐	☐	☐	☐	☐
Question 12 (fried food)	☐	☐	☐	☐	☐
Question 13 (sugared beverages)	☐	☐	☐	☐	☐
Question 14 (high calorie snacks, desserts)	☐	☐	☐	☐	☐
Question 15 (whole grains)	☐	☐	☐	☐	☐
Question 16 (skim, 1 % milk)	☐	☐	☐	☐	☐
Question 17 (alcohol)	☐	☐	☐	☐	☐

Any suggestions for these questions?

B. Your Health Beliefs

The second set of questions (B1-36) is adapted from existing scales that seek to measure the **constructs of the Health Belief Model** (perceptions of susceptibility to and seriousness of a chronic disease and perceptions of benefits of and barriers to healthy lifestyle behaviors in order to reduce the risk for a chronic disease). To what extent do you agree or disagree that these scales appear to measure those constructs in the context of diabetes? Please refer to the survey and [√] the box that best represents your belief about these scales.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Questions B1-5. To what extent do these items measure perceived susceptibility to type 2 diabetes?	☐	☐	☐	☐	☐
Questions B6-12. To what extent do these items measure perceived seriousness of type 2 diabetes?	☐	☐	☐	☐	☐
Questions B13-18. To what extent do these items measure perceived benefits of eating healthfully in order to reduce the risk for type 2 diabetes?	☐	☐	☐	☐	☐
Questions B19-24. To what extent do these items measure perceived barriers to eating healthfully in order to reduce the risk for type 2 diabetes?	☐	☐	☐	☐	☐
Questions B25-30. To what extent do these items measure perceived benefits of exercise in order to reduce the risk for type 2 diabetes?	☐	☐	☐	☐	☐
Questions B31-36. To what extent do these items measure perceived barriers to exercise in order to reduce the risk for type 2 diabetes?	☐	☐	☐	☐	☐

Any suggestions for these questions?

C. Your Beliefs About How You Eat

The third set of questions (C1-16) is adapted from an existing scale that seeks to measure an **individual's perception of self-efficacy or self-confidence in being**

able to eat healthfully. To what extent do you agree or disagree that this scale appears to measure dietary self-efficacy? Please refer to the survey and [√] the box that best represents your belief.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Questions C1-16. To what extent do these items measure perceived self-efficacy or confidence in being able to eat healthfully?	☐	☐	☐	☐	☐

Any suggestions for these questions?

D. Your Beliefs About How You Exercise

The fourth set of questions (D1-16) is adapted from an existing scale that attempts to measure an **individual's perception of self-efficacy or self-confidence in being able to exercise**. To what extent do you agree or disagree that this scale appears to measure exercise self-efficacy? Please refer to the survey and [√] the box that best represents your belief.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Questions D1-16. To what extent do these items measure perceived self-efficacy or confidence in being able to exercise?	☐	☐	☐	☐	☐

Any suggestions for these questions?

E. Your Health

The fifth set of questions seeks to measure the **study participant's risk for developing type 2 diabetes**. How strongly do you agree or disagree that each of the following questions is a good measure of risks for type 2 diabetes? Please refer to the survey and [√] the box that best represents your belief.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Question 1 (have diabetes or high BG)	☐	☐	☐	☐	☐
Question 2 (blood relatives with diabetes)	☐	☐	☐	☐	☐
Question 3 (GDM diagnosed more than once)	☐	☐	☐	☐	☐
Question 4 (delivered baby weighing ≥ 8.5 lbs)	☐	☐	☐	☐	☐
Question 5 (who provided GDM education)	☐	☐	☐	☐	☐
Question 6 (how was the education provided)	☐	☐	☐	☐	☐
Question 7 (insulin needed during GDM)	☐	☐	☐	☐	☐
Question 8 (oral meds needed during GDM)	☐	☐	☐	☐	☐
Question 9 (weight/height or BMI now)	☐	☐	☐	☐	☐
Question 10 (lbs gained since last delivery)	☐	☐	☐	☐	☐

Any suggestions for these questions?

F. Your Environment

The sixth set of questions seeks to measure the extent to which the study participant's social environment provides support for healthy eating and exercise.

1. How strongly do you agree or disagree that each of the following questions is a good measure of **social or environmental support for eating healthfully**? Please refer to the survey and [√] the box that best represents your belief.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Question 1 (family/friends caring about diet)	☐	☐	☐	☐	☐
Question 3 (family/friends eating healthfully)	☐	☐	☐	☐	☐
Question 5 (healthy foods at grocery store)	☐	☐	☐	☐	☐
Question 6 (healthy foods at work or school)	☐	☐	☐	☐	☐
Question 7 (healthy foods at restaurants)	☐	☐	☐	☐	☐

2. How strongly do you agree or disagree that each of the following questions is a good measure of **social or environmental support for exercising**? Please refer to the survey and [√] the box that best represents your belief.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Question 2 (family/friends caring about exercise)	☐	☐	☐	☐	☐
Question 4 (family/friends exercising)	☐	☐	☐	☐	☐
Question 8 (exercise facilities available)	☐	☐	☐	☐	☐
Question 9 (exercise safe in neighborhood)	☐	☐	☐	☐	☐
Question 10 (childcare available if needed)	☐	☐	☐	☐	☐
Question 11 (able to exercise)	☐	☐	☐	☐	☐
Question 12 (explain why if not able to exercise)	☐	☐	☐	☐	☐

Any suggestions for these questions?

G. Your Nutrition Knowledge

The seventh set of questions measures the **study participant's knowledge of nutrition**. How strongly do you agree or disagree that each of the following questions is a good measure of knowledge of nutrition? Please refer to the survey and [√] the box that best represents your belief.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Question 1 (carbohydrate foods)	☐	☐	☐	☐	☐
Question 2 (foods low in carbs)	☐	☐	☐	☐	☐
Question 3 (foods low in fat)	☐	☐	☐	☐	☐
Question 4 (foods that have more fiber)	☐	☐	☐	☐	☐
Question 5 (serving size of starch foods)	☐	☐	☐	☐	☐

Any suggestions for these questions?

H. Important Information About You

The eighth and last set of questions is meant to collect the **study participant's demographic information**. How strongly do you agree or disagree that each of the following questions is a good measure of demographic information? Please refer to the survey and [√] the box that best represents your belief.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Question 1 (age)	☐	☐	☐	☐	☐
Question 2 (ethnicity)	☐	☐	☐	☐	☐
Question 3 (marital status)	☐	☐	☐	☐	☐
Question 4a (residence: city, county)	☐	☐	☐	☐	☐
Question 4b (residence: rural, urban, suburb)	☐	☐	☐	☐	☐
Question 5 (health insurance)	☐	☐	☐	☐	☐
Question 6 (education)	☐	☐	☐	☐	☐
Question 7a (number of persons in home)	☐	☐	☐	☐	☐
Question 7b (number of children under 18)	☐	☐	☐	☐	☐
Question 7c (annual household income)	☐	☐	☐	☐	☐
Question 8 (employed)	☐	☐	☐	☐	☐

Any suggestions for these questions?

APPENDIX G

EXPERT EVALUATOR SURVEY ASSESSMENT FORM (SCORING)

Thank you for reviewing the attached survey questions. This survey seeks to assess the health behaviors of women with a recent history of gestational diabetes. This survey is being conducted as part of the requirements of a PhD degree in the College of Health Sciences at Old Dominion University (ODU). The study participants will be former patients of the Diabetes in Pregnancy Program at Maternal-Fetal Medicine of Eastern Virginia Medical School (EVMS).

You may be asked to review changes in our survey based upon findings of the pilot study. The survey will then be mailed to the final target sample of participants. These individuals will vary in age, ethnicity, and education levels.

Please answer the following questions about the survey. **We are interested in finding out how well you think each question or set of questions is scored**.

A. Lifestyle

These questions are meant to assess exercise and eating behaviors. Please refer to the survey and rate the extent to which you believe each question is scored appropriately.

1. Tell us about how you exercise.

All three levels of exercise are scored 0, 1, 2, 3, 4, or > 4 days; the higher the score the more favorable the level of exercise (1 point will be given for each day of exercise [1-5]). For example, an individual indicating 4 days of 30 minutes or more of activity would receive a score of 4, and an individual indicating 2 days of 30 minutes or more of activity would receive a score of 2.

For the logistic regression statistical test, the responses will be dichotomized to “0 or negative” for 0, 1, and 2 days of the described level of exercise and to “1 or positive” for 3, 4, or > 4 days of the described level of exercise.

Please refer to the survey and [√] the box that best represents how strongly you agree or disagree that each of the following questions is scored appropriately.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Question 1	(≥ 30 minutes of activity)	☐	☐	☐	☐	☐
Question 2	(work out enough to sweat)	☐	☐	☐	☐	☐
Question 3	(“work in” other exercise)	☐	☐	☐	☐	☐

Any suggestions for these questions or their scoring?

2. Tell us about how you eat.

Questions 4, 5, 6, 7, and 8 will receive 1 point for each food group consumed in the recommended daily amount according to the Food Guide Pyramid (3-5 servings of vegetables [no penalty for excess intake], 2-4 servings of fruit, 6-11 servings of starch and grains [will use 6-8 servings], 2-3 servings of milk [will use 2-4 servings since recommendations for milk and calcium intake is increasing], and 2-3 servings of meat or 4-7 ounces) with a maximum score of 5 representing a favorable diet or **healthy eating index score**. For example, an individual reporting an intake of 6 servings of vegetables, 2 servings of fruit, 7 servings of starch/grains, 1 serving of milk, and 8 ounces of meat will receive a score of 3 (1 + 1 + 1 + 0 + 0).

Questions 9, 10, 11, and 12 will receive 1 point for each food category consumed in the recommended amount, a **high calorie food or beverage score** of 4 representing a favorable diet. These foods should be consumed in limited amounts and a healthy diet may include some of these foods each day. It has been suggested that an individual consuming no more than 2 servings of added fat per meal (6 servings daily) and no more than 1 serving each of fried/high fat foods, sugared drinks, and high calorie snack on any one day, could still have a healthy diet. For example, an intake of 5 servings of added fat, 0 fried/high fat food, 0 sugared drinks, and 2 high calorie snacks will receive a score of 3 (1 + 1 + 1 + 0).

For the logistic regression statistical test, the responses for the **healthy eating index score** will be dichotomized to “0 or negative” for a score of 3 or less and “1 or positive” for a score of 4 or more. The responses for the **high calorie food or beverage score** will be dichotomized to “0 or negative” for a score of 2 or less and “1 or positive” for a score of 3 or more.

Please refer to the survey and [√] the box that best represents how strongly you agree or disagree that the following questions are scored appropriately.

.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Question 4 (vegetables)	☐	☐	☐	☐	☐
Question 5 (fruits)	☐	☐	☐	☐	☐
Question 6 (cereal, bread, grain, starch)	☐	☐	☐	☐	☐
Question 7 (milk, dairy)	☐	☐	☐	☐	☐
Question 8 (meat, poultry, fish. egg)	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Question 9 (fat)	☐	☐	☐	☐	☐
Question 10 (fried food)	☐	☐	☐	☐	☐
Question 11 (sugared beverage)	☐	☐	☐	☐	☐
Question 12 (high calorie snacks, desserts)	☐	☐	☐	☐	☐

Any suggestions for these questions or their scoring?

APPENDIX H

PHONE SCRIPT FOR PILOT AND LARGER STUDY

Survey of Women With a History of Gestational Diabetes
Phone Script For Survey Questions To Women Not Returning Mailed Survey

1. "May I speak to _____? Hello, my name is _____ and I am calling on behalf of Maternal-Fetal Medicine of Eastern Virginia Medical School in Norfolk. We sent you a survey in the mail about one month ago asking you questions about your diet and exercise habits. We are offering a $10 gift certificate to everyone who completes our survey (if anyone asks, the gift certificate is to Farm Fresh, Food Lion, Target, or Hecht's/macy's and the individual gets to select the store). Have you completed the survey?"

1a. If yes, "Thank you, _____ (call patient by name). Can you mail the survey to us in the stamped, self-addressed envelope provided you?" (If the patient doesn't have the envelope, the address to mail to is: Phyllis Woodson, Dietitian, Tidewater Perinatal Center, Suite 305, 1080 First Colonial Road, Virginia Beach, VA 23454.) Thank you so much for taking the time to complete the survey. It will help us to provide better care in the future to women like you with a history of gestational diabetes."

"Did you have any questions about the survey?"

If yes, answer the question(s) or refer the patient. "Let me give you the phone number for __, registered nurse, at Maternal-Fetal Medicine, 757-446-7900 (if health-related question) or Phyllis Woodson 757-395-8900 (if other or survey-related question)."

If yes or no, "Thank you, _____ (call patient by name), for providing this valuable information to us. Have a nice day (or evening) and please contact us if we can be of further help to you. Goodbye"

1b. If no (have not completed the survey), "Is this a good time for you to answer questions about your diet, exercise, and health beliefs? The answers to these questions will help us to provide better care to women like you with a history of gestational diabetes. Your answers will be confidential. It will only take about 25 minutes."

If no, "When would be a more convenient time to call you back?"
Date/Day_____ Time_____ Phone Number_____
"I will call you back at that time. I look forward to speaking with you again. Thank you so much for your time. In the meantime, if you have any questions, please contact Phyllis Woodson, Dietitian, at 757-395-8900. Have a nice day (or evening). Goodbye."

If yes, "Thank you for taking time to help us. Let's start."

A. "The first three questions are about how active you usually are." Read each of the questions as written. Record answers in the appropriate space on the survey.

"The next 13 questions are about how you usually eat." Read each of the questions and then ask, "How many servings did you eat yesterday. How many servings did you average per day over the past week?" Record answers in the appropriate space on the survey.

B. "The next set of questions are about your health beliefs and are very brief. Please tell me on a scale of 1 to 5 how strongly you disagree or agree with the following statements." Read each of the questions and then ask, "Do you strongly disagree, do you disagree, are you neutral, do you agree, or do you strongly agree?" Record answers in the appropriate space on the survey.

C. "The next set of questions are about your beliefs about how you eat. Please tell me on a scale of 1 to 5 how much confidence you have about performing each of these behaviors." Read each of the statements and then say, "A response of 1 means you have very little confidence, a response of 3 means you have confidence, and a response of 5 means you have quite a lot of confidence." Record answers in the appropriate space on the survey.

D. "The next set of questions are about your beliefs about how you exercise. Please tell me on a scale of 1 to 5 how much confidence you have about performing each of these behaviors." Read each of the statements and then say, "A response of 1 means you have very little confidence, a response of 3 means you have confidence, and a response of 5 means you have quite a lot of confidence." Record answers in the appropriate space on the survey.

E. "Please answer the following questions about your health." Read each of the questions as written. Record answers in the appropriate space on the survey.

F. "Please answer the following questions about the people in your life and where you live." Read each of the questions as written. Record answers in the appropriate space on the survey.

G. "Please answer the following questions about nutrition."
1. "Which 4 foods are carbohydrates (carbs)?" Read the choices.
2. "Which 4 foods are low in carbs?" Read the choices.
3. "Which 3 foods are low in fat?" Read the choices.
4. "Which 2 foods have more fiber?" Read the choices.
5. "What is a serving size of cooked potatoes, corn, or peas?" Read the choices.

Record answers in the appropriate space on the survey.

H. "Please answer the following questions." Read each of the statements in a question form. Record answers in the appropriate space on the survey.

When completed, "We really appreciate your taking the time to answer our questions. Please contact us (use same contact information provided above if needed) if we can be of any help to you. Would you like to receive a $10 gift certificate? Which store would you prefer, Farm Fresh, Food Lion, Target, or Macy's? _____Please give me your mailing address (ask for address only if the individual wants to receive the gift certificate):

_____

_____

All information we have obtained from you will be confidential. Thank you. Have a nice day (or evening). Goodbye."

APPENDIX I

MODIFICATIONS TO OUTCOME SCALES

Modifications to the Quick WAVE Screener

Of the 17 questions of the Quick WAVE Screener: A Tool to Address Weight, Activity, Variety, and Excess" (Soroudi et al., 2004), three questions addressing weight, weight gain, and weight perception were reduced to two questions assessing the individual's current weight and weight gained or lost in pounds since delivery; these questions were placed in section E of the survey, Your Health (see Questions E6 and E7). Since questions assessing activity and food behaviors were asked first in the survey, it was thought that questions inquiring about weight should be asked later in the survey, with other related health questions. Two questions regarding stress and subsequent eating responses were eliminated from the present survey. Two questions regarding the individual's worry that she will run out of food and if the individual's household runs out of money for food were also eliminated. The remaining questions were slightly modified as described below. These questions also include modified wording from a REAP (Rapid Eating and Activity Assessment for Patients) survey (Gans et al., 2002 [in press]) and from other surveys, REAP and WAVE: New Tools to Rapidly Assess/Discuss Nutrition with Patients (Gans et al., 2003), and WAVE: A Pocket Guide for a Brief Nutrition Dialogue in Primary Care (Barner et al., 2001).

Question A1, "In the past week, how many days did you do 30 minutes or more of physical activity (eg, walking briskly, vacuuming, gardening, jogging, swimming, biking, or dancing)?", is a modification of a similar question in Rapid Eating and Activity Assessment for Patients or REAP (Gans et al., 2003; Gans et al., 2002 [in press]). This

is a quick nutrition and activity assessment survey by a similar group of authors as the WAVE survey; the wording and examples provided in the present survey are slightly different in order to represent the activities of our patients. The REAP survey question, “In an average week, how often do you do less than 30 total minutes of physical activity 3 days a week or more? (Examples: walking briskly, gardening, golf, jogging, swimming, biking, dancing, etc.)”, was modified as described. The responses, “Usually/Often”, “Sometimes”, “Rarely/Never”, and “Does not apply to me”, were changed to “0”, “1”, “2”, “3”, “4”, and “More than 4 days”.

Question A2, “In the past week, how many days did you work out enough to sweat (eg, aerobics, heavy yard work, cycle, or run)?”, provides different examples than those in the otherwise identically worded question (sports, cycle, or run) in the Quick Wave Screener (Soroudi et al., 2004). It was thought that the wording changes would typify the activities of the GDM patients. The responses, “0”, “1”, “2”, “3”, “4”, and “More than 4 days”, are a modification of the originally worded “More than 4 times” .

The examples in Question A3, “In the past week, how many days did you ‘work in’ other types of exercise (eg, walk for 10 minutes, take the stairs, or park the car farther away)?”, differ from the examples in the Quick WAVE Screener, “walk for more than 15 minutes” and “take 6 or more flights of stairs” (Soroudi et al., 2004). These changes were made to capture the small, incremental efforts to exercise that were encouraged in the GDM education class. The responses to this question, “0”, “1”, “2”, “3”, “4”, and “More than 4 times”, were changed to “days”.

Questions A4 to 8 comprise the healthy eating index which assesses appropriate intake of the food groups as represented in the Food Guide Pyramid (vegetables, fruit,

grains, milk, and meat). These questions are in a table format with two columns indicating intake of the food groups, “Number of servings yesterday” and “Number of servings average per day over the past week”. Another column is used to describe each of these five food groups and provide examples of typical servings.

Question A4 assesses intake of vegetables: “Yesterday and average per day over the past week, how many servings of vegetables (like salads, broccoli, or squash) did you eat? A serving is: 1 cup (the size of a woman’s fist) raw or ½ cup cooked.” This question uses wording from the 2004 WAVE survey question, “Yesterday, how many times did you eat vegetables (excluding corn and potatoes)?” (Soroudi et al., 2004). The words, “excluding corn and potatoes”, were omitted and instead, examples of vegetables were provided. This question contains modified wording from the 2001 WAVE survey question, “A serving is: ½ cup of chopped raw or cooked vegetables or 1 cup of leafy raw vegetables”, and its responses, “Servings yesterday” and “Servings average per day over the past month” (Barner et al., 2001). It was decided to word most of the food intake questions in this manner (“Number of servings yesterday” and “Number of servings average per day over the past week”) in order to more accurately assess inadequate as well as excessive intake (see scoring).

Question A5, “Yesterday and average per day over the past week, how many servings of fruit or fruit juice did you have? A serving is: 1 piece of fruit (about ½ cup) or melon wedge, 2 tablespoons dried fruit, or ½ cup canned fruit or juice”, was derived from the WAVE survey question, “Yesterday, how many times did you eat fruits (excluding fruit juice)?” (Soroudi et al., 2004). The serving size examples and responses came from a similarly worded question in another WAVE survey, “Servings yesterday”

and “Servings average per day over the past month” (Barner et al., 2001). The serving size example of dried fruit was changed from 1/3 cup to 2 tablespoons dried fruit to more accurately represent the serving size of raisins, the more commonly described dried fruit example presented during the GDM class.

Question A6 assesses intake of grains and starchy vegetables: “Yesterday and average per day over the past week, how many servings of cereals, bread, grains, or starchy vegetables did you eat? A serving is: ½ cup cooked or ¾ -1 cup dry cereal, 1 slice of bread or 1 small roll or 4 to 6 small crackers, ½ cup cooked pasta or rice, ½ cup cooked starchy vegetables (potatoes, corn), or ½ cup cooked beans/peas (kidney beans or peas)”. The WAVE survey (Soroudi et al., 2004) did not assess starch intake beyond bran cereal or beans. The serving examples for this survey question were adapted from the WAVE survey (Barner et al., 2001) which offered serving size examples of 1 slice or 1 ounce of bread; ½ cup cooked rice, pasta, or cereal; or 1 ounce or ½ cup ready-to-eat cereal. The responses, “Servings yesterday” and “Servings average per day over the past week”, ae similar to this same WAVE survey.

Question A7, “Yesterday and average per day over the past week, how many servings of milk and dairy products did you have? A serving is: 1 cup of milk, soy milk, or yogurt or 1 ½ ounces of cheese or 1/2 cup cottage cheese”, is a reworded version of the WAVE survey question, “Yesterday, how many times did you have milk, soy milk, yogurt, cheese, or other dairy products” (Soroudi et al., 2004). The responses, “Servings yesterday” and “Servings average per day over the past week”, are similarly worded as another WAVE survey (Barner et al., 2001). The serving examples of 1 ½

ounces of cheese and 1/2 cup cottage cheese were added, since these are substitutions for calcium in milk recommended in the GDM class.

Question A8 assesses intake of protein foods: “Yesterday and average per day over the past week, how many ‘ounces’ of meat, chicken or turkey, fish, or egg did you eat? A serving is ‘3 ounces’ and is about the size of a deck of cards or 1 cooked hamburger and ‘1 ounce’ is: 1 egg or 1 slice of thinly sliced ham”. Responses are “Ounces yesterday” and “Ounces average per day over the past week”. This question is a modification of a similar question in the REAP survey, “In an average week, how often do you eat more than 6 ounces of meat, chicken, turkey or fish per day? 3 ounces of meat or chicken is the size of a deck of cards or one of the following: 1 regular hamburger, 1 chicken breast or leg (thigh and drumstick), or 1 pork chop” (Gans et al., 2003; Gans et al., 2002 [in press]). The responses of a similarly worded WAVE survey question, “Servings yesterday” and “Servings average per day over the past month” (Barner et al., 2001), were changed to assess number of ounces rather than servings consumed to more accurately assess intake. The rewording of this question also provides more examples of foods and portion sizes in order to accurately reflect intake. Finally, this question also offers a response example, “Yesterday, 1 ounce for breakfast + 3 ounces for lunch + 6 ounces for supper = 10 ounces”. Since the other questions in this section ask for number of servings, the statement, “Please give answer in ounces”, was placed in both of the response columns for this question.

Questions A9-12 comprise the intake of high calorie food or beverage. The Food Guide Pyramid recommends that these foods be consumed in small amounts. These four questions are asked in a similar format as the healthy eating index Questions A4-8.

The food categories (fat added to foods, fried foods, sugared drinks, and snacks and desserts) and serving examples, number of servings consumed yesterday, and number of servings consumed average per day over the past week, are each represented by a column to make responding easier.

Question A9 assesses intake of fats added to food during cooking or at the table: "Yesterday and average per day over the past week, how many servings of fat (added when cooking or at the table) did you eat? A serving is: 1 to 2 teaspoons of oil, mayonnaise, or margarine (1 to 2 tablespoons if diet) or 1 to 2 tablespoons of salad dressing (2 to 4 tablespoons if diet)". This question is a modification of a similar question from the REAP survey, "In an average week, how often do you add butter, margarine or oil to bread, potatoes, rice or vegetables at the table?" (Gans et al., 2003; Gans et al., 2002 [in press]). The responses to this REAP survey question, "Usually/Often", "Sometimes", "Rarely/Never", and "Does not apply to me", were changed to "Servings yesterday and "Servings average per day over the past week", similar to wording by Barner et al. (2001).

Question A10, "Yesterday and average per day over the past week, how many servings of fried foods (such as a moderate serving of fried chicken [half of a breast], fried fish [deck of cards], French fries [1 handful/small order], or pizza [2 slices]) did you eat?" is a modification of the REAP survey (Gans et al., 2003; Gans et al., 2002 [in press]) question, "In an average week, how often do you eat fried foods such as fried chicken, fried fish or French fries?" The REAP responses, "Usually/Often", "Sometimes", "Rarely/Never", and "Does not apply to me", were modified to obtain more accurate

estimations of intake, “Servings yesterday” and “Servings average per day over the past week”; wording is similar to that by Barner et al. (2001).

Question A11 assesses sweetened beverage intake: “Yesterday and average per day over the past week, how many servings of sugared drinks (1 can or small serving of soda, fruit drink, Kool-Aid, lemonade, or sport drink, eg, Gatorade) did you drink?” This question reflects minor changes in wording of the WAVE survey question, “Yesterday, how many sugared drinks like soda (excluding diet soda), fruit drinks/juice, lemonade, or sports drinks (eg, Gatorade) did you drink?” (Soroudi et al., 2004). The WAVE responses, “0”, “1”, “2”, “3”, “4”, and “More than 4 times”, were changed to “Servings yesterday” and “Servings average per day over the past week”; the wording is similar to that by Barner et al. (2001).

Question A12, “Yesterday and average per day over the past week, how many servings of snacks and desserts (such as a moderate serving of chips [1 handful], chocolate or candy [1 bar or 3 pieces], ice cream [1/2 cup], cake or pie [1 slice], cookies [2 small], or donuts [1 each]) did you eat?” is a modification of wording of the WAVE survey question, “Yesterday, how many times did you eat candy bars, french fries, potato chips, or other “junk food” (eg, cookies)?” (Soroudi et al., 2004). This modification in wording was intended to reflect intakes of high calorie foods, including snack foods and desserts. The responses to the WAVE survey question, “0”, “1”, “2”, “3”, “4”, and “More than 4 times”, were changed to “Servings yesterday” and “Servings average per day over the past week” in order to obtain more accurate estimations of intake; the wording is similar to that by Barner et al. (2001).

Question A13, “Yesterday, how many meals did you skip?”, is a quantified version of the REAP survey question, “In an average week, how often do you skip meals?” (Gans et al., 2003; Gans et al., 2002 [in press]). The frequency responses, “Usually/Often”, “Sometimes”, “Rarely/Never”, and “Does not apply to me”, were changed to “Meals skipped yesterday” and “Meals skipped average per day over the past week”. It is recommended that diet assessment of persons with diabetes or persons who are at risk for diabetes, include an evaluation of timing of meals and distribution of carbohydrate (Barner et al., 2001). The rewording of this question should give a more accurate estimation of the number of meals the individual skips.

APPENDIX J

GDM PRENATAL CARE AND EDUCATION PROTOCOL

Risk factors for GDM include: ≥25 years of age, obesity (BMI ≥30 kg/m^2), history of glucose intolerance or glucosuria ≥2+, history of gestational diabetes, family history of diabetes in first-degree relatives, membership in an ethnic/racial group at increased risk for diabetes (Hispanic-American, Native American, Asian-American, or African-American) (ADA, 2004), diagnosis of polycystic ovarian syndrome, or multi-fetal gestation. The American Diabetes Association recommends that screening be performed at 24-28 weeks if one or more risk factors exist.

The protocol for screening patients for glucose intolerance at MFM was as follows. High-risk patients were screened at the first prenatal visit and again at 24 to 28 weeks if the first screening was negative. Patients were considered high-risk if they had one or more of the already described risk factors. Moderate-risk patients were screened at 24 to 28 weeks of gestation if a member of one of the ethnic groups having increased incidence of diabetes without other risk factors. Low-risk patients were not screened if they met none of the above high or moderate-risk criteria and in addition had no history of macrosomia, stillbirth, or spontaneous abortion.

The laboratory procedure for screening for glucose intolerance included a 50 g oral glucose tolerance test (OGTT) followed by a venous plasma glucose test 1 hr post-challenge. If the result of this screen was ≥140 mg/dl, the patient was given a 100 g 3 hr OGTT, unless the 1 hr OGTT result was ≥190 mg/dl (these patients were diagnosed with GDM and the 3 hr OGTT was not necessary). The 3 hr OGTT test required consuming at least 150 g carbohydrate a day for three days. A diagnosis of GDM was

made based on interpretation of the 3 hr OGTT results according to the criteria of O'Sullivan and Mahan as modified by Carpenter and Coustan (Carpenter & Coustan, 1982). GDM was diagnosed if ≥2 values met or exceeded the following venous plasma glucose results: fasting, 95 mg/dl; 1 hr test, 180 mg/dl; 2 hr test, 155 mg/dl; and 3 hr test, 140 mg/dl (ADA, 2017). Once a patient was diagnosed with GDM, she was classified according to the criteria of White, as modified by Hare and White (1980). In this classification system, persons diagnosed with GDM were considered class A; A1 indicated diet-controlled and A2 indicated insulin was necessary to control blood glucose values.

Patients were categorized as full care (obstetrical and diabetes care), co-managed (for diabetes care), or consult (initial diabetes care only). All patients diagnosed with GDM were scheduled for a consultation with the physician/director of the Diabetes in Pregnancy Program. A registered nurse who was also a CDE completed an assessment of each patient. A physician completed a medical history and physical examination of each patient. The patient then attended a group session (two to four patients) of 2 hr duration or had an individual one-on-one consultation with a certified diabetes educator (registered dietitian or registered nurse). During this group session or individual consultation, information about GDM, medical nutrition therapy for GDM, and a demonstration in self-monitoring of blood glucose (SMBG) were presented. A reflectance meter for capillary testing of blood glucose at home was obtained for each patient (through our glucometer program or purchased if covered by their insurance carrier). Significant others were encouraged to attend the initial consultation.

The GDM education was thorough and based on standardized protocols developed by the Diabetes in Pregnancy Program at Eastern Virginia Medical School. It included the definition and causes of GDM, risk factors for GDM, risks to the mother and fetus/infant, the need for postpartum and yearly monitoring of blood glucose, and the necessary lifestyle changes needed in order to avoid recurring GDM and type 2 diabetes later in life.

The patients completed a personal food intake questionnaire so that her diet could be quickly and privately assessed by the registered dietitian or CDE. Medical nutrition therapy to manage the GDM with diet included an in-depth review of the meal plan that consisted of three meals and three snacks (American College of Obstetricians and Gynecologists, 2013; de Veciana et al., 1995; Moreno-Castilla, Mauricio, Hernandez, 2016) and carbohydrate counting (Daly, Barry, Gillespie, Kulkarni, & Richardson, 1995). Unless the mother was expecting twins, had a low pregravid weight, or was not gaining enough weight during the pregnancy, the meal plan consisted of 1800-2000 calories. If the mother had a multiple gestation, 300 calories per fetus were added to the meal plan. Extra calories were added according to individual need.

The carbohydrate, protein, and fat content of the recommended diet were 45%, 24%, and 31%, respectively. The ADA (2004) recommends that adequate calories and nutrients be consumed to achieve the needs of pregnancy and blood glucose goals. More general guidelines by this same organization for the individual with diabetes state that carbohydrate and fat should provide 80 to 90% of the total calories consumed. Other researchers (American College of Obstetricians and Gynecologists, 2013; Major, Henry et al., 1998) have reported improved postprandial (after meal) blood glucose

values with restricted carbohydrate intake (40% to 42% of total calories consumed). The diet protocol at MFM emphasizes a restricted carbohydrate content of the meal plan since this ensures better control of the postprandial blood glucose values; normalization of postprandial glucose values in patients with GDM has been shown to improve perinatal outcome (de Veciana et al., 1995). The actual percentages of carbohydrate provided at each meal or snack were as follows: 14%, 25%, and 18% at the morning, noon, and evening meals, respectively; and 12%, 12%, and 19% at the morning, afternoon, and evening snacks, respectively.

Sample meal plans were provided the patients. The carbohydrate counting approach to meal planning was explained to allow the patient not only more precision in determining carbohydrate intake but more flexibility in food selection. If the patient required insulin, carbohydrate counting allowed for better blood glucose control since the amount of rapid-acting insulin needed at meals is dependent upon actual carbohydrate intake. This carbohydrate intake in most cases was the key determinant of postprandial blood glucose values. The Food Exchange Lists (a publication by the ADA and the American Academy of Nutrition and Dietetics) and food label reading were reviewed in detail. Measuring cups and food models were used to demonstrate the very important component of portion control. Exercise (as recommended by physician) and stress management were encouraged for each patient.

A demonstration of how to use a reflectance meter for monitoring of capillary blood glucose at home was presented. The patients then demonstrated their proficiency by obtaining a blood sample in the office. The patients were instructed to monitor their blood glucose at home four times daily, fasting and one hour after breakfast, lunch, and

dinner. The target goals for blood glucose levels were 60 to 90 mg/dl (fasting) and ≤120 mg/dl (1 hr postprandial). The patients were given a logbook in which to record these blood glucose values as well as time, amount, and preparation method of all food/beverage consumed. The patients were instructed to follow this procedure of blood glucose monitoring for one week and then to call the office and report the results at that time. The diet plan was to be followed for the duration of the pregnancy. The importance of optimizing blood glucose control was explained to the patients. They were told that post glycemic control is associated with macrosomia or large birth weight, injury to the infant during delivery, and neonatal hypoglycemia. The risks to the mother and infant were thoroughly reviewed. Patients were advised that if in one week blood glucose values were not within the target range about 80% to 90% of the time, insulin or an oral agent (class A2) to control blood glucose would be necessary in addition to following the diet and monitoring blood glucose at least four times each day for the duration of the pregnancy. If in one week, blood glucose was successfully diet-controlled (class A1), blood glucose monitoring could be performed most likely just two days weekly for the duration of the pregnancy. The patient and CDE remained in close contact for purposes of modifying food intake and meal schedules to ensure optimum food intake, blood glucose control, and management of weight gain.

All patients reviewed a 20-minute video produced by a pharmaceutical company that illustrates the GDM management protocol of diet, blood glucose monitoring, exercise, and stress management during pregnancy. A complete educational packet was given to each patient. This packet contained a booklet reviewing GDM, the recommended meal plan, carbohydrate counting instructions, the Food Exchange Lists,

a blood glucose monitoring booklet, meter use instructions, and a stamped addressed postcard to be mailed to MFM after delivery with perinatal information for the purpose of updating the patient database. Appropriate forms were completed and signed (educational objectives-checklist form and class evaluation). The patients were given a pager number to contact the CDE by phone with blood glucose results one week after the initial consultation. A CDE contacted the patient by phone if the patient did not call one week after the consultation.

On-going documentation included thorough entries in the patient's medical record after each contact with the patient following the initial consultation, as well as in the GDM patient database.

APPENDIX K

TABLES FOR RESPONSES TO SURVEY QUESTIONS

Table K1

Exercise Behavior and Combined Scores

	n	M(SD)	% Saying ≥3 days weekly
	153		
Exercise Behavior Scores			
≥30 Min Physical Activity		2.90(1.40)	64.7
Work Out Enough to Sweat		1.80(1.48)	35.9
Work-in Other Exercise		2.89(1.62)	52.9
Combined Exercise Behavior Scores			
≥30 Min Physical Activity + Work Out Enough to Sweat + Work-in Other Exercise		2.53(1.13)	

Note. <3 is a low score and ≥3 is a high score.

Table K2

Diet Behavior

	n	M(SD)	%High Score
No. Servings and Score of Vegetables Average Per Day	152.0	2.18(1.10)	33.3
No. Servings and Score of Fruit/Juice Average Per Day	153.0	1.78(1.05)	57.5
No. Servings and Score of Cereals, Bread, etc Average Per Day	153.0	3.52(1.91)	11.8
No. Servings and Score of Milk Average Per Day	153.0	2.04(1.07)	66.0
No. Servings and Score of Meat, etc Average Per Day	152.0	6.95(3.53)	38.6
No. Servings and Score of Fat Average Per Day	152.0	2.39(1.32)	98.7
No. Servings and Score of Fried/High Fat Foods Average Per Day	152.0	1.01(0.93)	79.1
No. Servings and Score of Sugared Drinks Average Per Day	151.0	0.94(1.42)	73.2
No. Servings and Score of Snacks and Desserts Average Per Day	150.0	1.45(1.25)	60.1
No. Meals Skipped Average Per Day	146.0	0.58(0.68)	

Note. Score of <4 is a low score and a score of ≥4 is a high score (a higher score for high calorie food/beverage intake indicates a more desirable intake).

Table K3

Results for Healthy Eating Index and High Calorie Food/Beverage Intake Score

	n	Average Per Day M(SD)	% (High Score)
Scores and Dichotomized Results for:	153		
Healthy Eating Index		2.07(1.11)	9.8 (4 or 5)
Scores and Dichotomized Results for:			
High Calorie Food/Beverage Intake Score		3.11(1.00)	75.2 (3 or 4)

Note. Score of <4 is a Healthy Eating Index low score and a score of ≥4 is a high score.
Score of <3 is a High Calorie Food/Beverage Intake low score and a score of ≥3 is a high score (a higher score for High Calorie Food/Beverage Intake indicates a more desirable intake).

Table K4

Health Beliefs: Susceptibility and Seriousness

	n	M(SD)	%Strongly Disagree	%Disagree	%Neutral	%Agree	%Strongly Agree
Perceived Susceptibility							
Extremely likely I will get diabetes	152.0	3.03(1.12)	7.8	26.8	31.4	22.9	11.1
Feel I will get diabetes in the future	152.0	3.05(1.09)	7.8	24.2	32.0	26.8	9.2
Good possibility I will get diabetes in 10 yrs	152.0	3.01(1.14)	7.8	30.1	26.8	24.2	11.1
Chances of getting diabetes are great	153.0	3.22(1.19)	7.2	25.5	20.3	32.0	15.0
More likely than average woman to get diabetes	152.0	3.65(1.00)	3.3	11.8	18.3	50.3	16.3
Perceived Seriousness							
Thought of diabetes worries me	151.0	3.62(1.15)	5.2	15.7	13.7	42.5	22.9
When I think about diabetes I become emotional	153.0	2.58(1.09)	12.4	45.1	22.2	13.1	7.2
I am afraid to think about diabetes	152.0	2.55(1.16)	17.0	41.2	19.0	15.7	7.2
Problems with diabetes would last a long time	152.0	3.50(1.15)	5.2	17.6	19.0	38.6	19.6
Diabetes would threaten relationship with boyfriend, etc.	152.0	1.59(0.91)	59.5	28.8	7.2	2.0	2.6
If I had diabetes my whole life would change	153.0	3.20(1.23)	7.2	30.1	13.1	34.6	15.0
If I developed diabetes I would live a shorter life	153.0	2.82(1.15)	10.5	36.6	22.2	22.2	8.5

Note. Likert Scale.

Table K5

Perceived Benefits of and Barriers to Eating Healthfully

	n	M(SD)	%Strongly Disagree	%Disagree	%Neutral	%Agree	%Strongly Agree
Benefits of Eating Healthfully							
I feel good about myself	153	4.46(0.65)	0.7	0.7	2.6	43.8	52.3
I don 't worry about diabetes	152	3.99(0.96)	0.7	7.2	20.3	35.9	35.9
Will postpone or prevent diabetes	152	4.28(0.82)	1.3	2.0	9.8	41.2	45.8
Will decrease my chances of getting diabetes, live longer	153	4.12(0.87)	0.0	5.9	14.4	41.2	38.6
Will decrease my chances of having diabetes complications	152	4.31(0.73)	1.3	0.0	7.8	48.4	42.5
I can control my weight, reduce my risk for diabetes	153	4.46(0.61)	0.0	0.7	3.9	44.4	51.0
Barriers to Eating Healthfully							
Doesn't taste as good	153	2.75(1.23)	15.7	34.0	19.0	22.2	9.2
Won't make a difference in my risk for diabetes	153	1.71(0.83)	45.8	43.1	6.5	3.3	1.3
Will be difficult for me	153	2.61(1.14)	15.7	37.9	22.2	17.6	6.5
Will take too much time	151	2.32(0.98)	17.6	49.0	19.6	11.1	2.6
Will cost too much	153	2.55(1.11)	15.0	43.8	17.6	18.3	5.2
I am not interested in eating healthfully	153	1.54(0.69)	53.6	41.2	3.3	1.3	0.7

Note. Likert Scale.

Table K6

Perceived Benefits of and Barriers to Exercising

	n	M(SD)	%Strongly Disagree	%Disagree	%Neutral	%Agree	%Strongly Agree
Benefits of Exercising							
I feel good about myself	152	4.60(0.64)	0.0	1.3	3.9	32.7	62.1
I don 't worry as much about diabetes	151	3.80(0.97)	1.3	8.5	22.2	40.5	27.5
Will postpone or prevent diabetes	153	4.10(0.84)	2.0	1.3	15.0	48.4	33.3
Will decrease my chances of diabetes, live longer	153	4.08(0.84)	0.7	3.9	15.7	46.4	33.3
Will decrease my chances of diabetes complications	152	4.16(0.74)	1.3	0.0	12.4	53.6	32.7
I can control my weight, reduce my risk for diabetes	153	4.40(0.63)	0.0	1.3	3.9	48.4	46.4
Barriers to Exercising							
I am too tired to exercise	153	2.82(1.19)	15.7	26.8	25.5	24.2	7.8
Won't make a difference in my risk for diabetes	152	1.63(0.73)	50.3	38.6	9.2	2.0	0
Will be inconvenient for me	153	2.51(1.16)	22.2	33.3	19.0	22.2	3.3
Will take too much time	153	2.33(1.05)	21.6	44.4	15.7	16.3	2.0
Will cost too much	153	1.91(0.89)	35.3	47.1	9.8	7.2	0.7
I am not interested in exercising	153	1.65(0.82)	50.3	39.2	6.5	2.6	1.3

Note. Likert Scale.

Table K7

Scoring of Health Beliefs Scales

Perceptions	*n*	M*(*SD)	%High Score (1-5 Likert Scale)
	153		
Perceived Susceptibility		3.19(0.97)	23.5 (4-5)
Perceived Seriousness		2.84(0.76)	9.2 (4-5)
Perceived Benefits of Eating Healthfully		4.27(0.58)	74.5 (4-5)
Perceived Barriers to Eating Healthfully		2.25(0.70)	17.0 (3-5)
Perceived Benefits of Exercise		4.19(0.59)	71.2 (4-5)
Perceived Barriers to Exercise		2.14(0.70)	13.1 (3-5)

Note. Score of ≥4 is a high score for susceptibility, seriousness, benefits of eating healthfully, and benefits of exercise. Score of ≥3 is a high score for barriers to eating healthfully and barriers to exercise.

Table K8

Benefits Minus Barriers of Eating Healthfully and Exercising

Scale	*n*	M(SD)
	153	
Benefits of Eating Healthfully Minus Barriers to Eating Healthfully		2.02(1.02)
Benefits of Exercising Minus Barriers to Exercising		2.05(1.06)

Table K9

Self-Efficacy of Diet/Eating Healthfully

			Confidence Measured in Percent				
	n	**M(SD)**	**Very little**	**Little**	**Confidence**	**A lot**	**Quite a lot**
Reaching ideal weight by eating healthy food	153	3.20(1.22)	6.5	26.1	28.1	19.0	20.3
Decreasing the amount of fat in my diet	153	3.41(1.00)	2.6	15.0	35.9	31.4	15.0
Staying on a healthy diet when busy or in a rush	152	2.72(1.20)	18.3	25.5	31.4	15.7	9.2
Staying on a healthy diet when no one at home is on it	153	2.97(1.17)	13.1	18.3	39.2	17.6	11.8
Staying on a healthy diet when I eat at a restaurant	153	2.81(1.08)	13.1	23.5	39.2	17.6	6.5
Staying on a healthy diet when I am not at home	152	2.71(1.13)	15.7	28.1	33.3	15.7	7.2
Staying on a healthy diet on special occasions, holidays	153	2.22(1.14)	32.7	32.0	20.3	10.5	4.6
Knowing what foods I should eat on a healthy diet	153	3.82(1.12)	3.9	8.5	24.2	28.8	34.6
Cutting out unhealthy snacks during the day or evening	152	3.18(1.12)	5.9	21.6	35.9	21.6	15.0
Increasing amount of fiber and vegetables in my diet	153	3.57(0.97)	1.3	10.5	38.6	29.4	20.3
Staying at my ideal weight once I have reached it	153	3.25(1.16)	5.2	22.2	34.0	19.0	19.6
Knowing how to cook healthy meals	153	3.37(1.22)	9.2	13.1	32.0	23.5	22.2
Preparing a healthy meal for myself when I eat alone	152	3.44(1.14)	6.5	12.4	30.7	30.7	19.6
Limiting the amount of carbohydrate I eat at a meal	153	3.07(1.17)	11.1	18.3	35.9	21.6	13.1
Knowing what food to buy at the store	152	3.61(1.12)	5.9	8.5	28.8	32.7	24.2
Decreasing amount of sugar and sweets in my diet	153	3.20(1.23)	10.5	17.0	33.3	20.9	18.3

Note. Likert Scale.

Table K10

Self-Efficacy of Exercising

			Confidence Measured in Percent				
	n	**M(SD)**	**Very little**	**Little**	**Confidence**	**A lot**	**Quite a lot**
Exercise when tired	152	2.36(1.08)	23.0	36.8	26.3	9.2	4.6
Exercise during or following a personal crisis	153	2.57(1.29)	24.3	28.3	24.3	11.8	11.2
Exercise when feeling depressed	153	2.61(1.28)	22.4	30.9	21.1	15.1	10.5
Exercise when anxious	153	2.95(1.26)	15.8	21.1	28.3	21.7	13.2
Exercise during bad weather	153	2.76(1.23)	17.8	25.7	30.3	15.1	11.2
Exercise when slightly sore from the last time I exercised	153	3.16(1.13)	7.9	18.4	37.5	21.7	14.5
Exercise when on vacation	152	2.60(1.18)	19.7	30.3	28.3	13.8	7.9
Exercise when competing interests	153	2.98(1.07)	8.6	21.7	43.4	15.8	10.5
Exercise when a lot of work to do	153	2.32(1.12)	26.3	35.5	22.4	11.2	4.6
Exercise when exercise goals not reached	152	3.14(1.01)	6.6	15.1	45.4	23.0	9.9
Exercise when no support from family/friends	151	2.99(1.12)	9.2	23.7	36.8	19.1	11.2
Exercise when no exercise for prolonged period of time	150	2.88(1.08)	9.2	29.6	33.6	19.7	7.9
Exercise when no one to exercise with	152	3.22(1.19)	8.6	17.1	36.8	18.4	19.1
Exercise when schedule is hectic	152	2.32(1.10)	23.7	41.4	19.7	9.9	5.3
Exercise when exercise workout is not enjoyable	150	2.36(1.11)	24.3	36.2	22.4	13.2	3.9
Exercise at target heart rate 3-5 times weekly, 30-40 min over the next 6 months	151	3.13(1.17)	6.6	24.3	36.2	15.1	17.8

Note. Likert Scale.

Table K11

Eating Healthfully and Exercise Self-Efficacy Scores

	n	M(SD)	%High Score (1-5 Likert Scale)
Eating Healthfully Self-Efficacy	153	3.16(0.79)	60.1 (3-5)
Exercise Self-Efficacy		2.77(0.83)	34.9 (3-5)

Note. Score of ≥3 is a high self-efficacy score for eating healthfully and exercise.

Table K12

Your Health and Nutrition Knowledge

	n	M(SD)	%Yes	%Dietitian	%Nurse	%Group	%Individual
Your Health							
Do you have diabetes	152		9.2				
Blood relatives with diabetes	151		72.8				
Delivered a baby weighing ≥ 8.5 lb	153		26.8				
Pregnancy required insulin injections	153		9.8				
Pregnancy required pills to control blood glucose	152		16.3				
Pregnancy required meds	153		24.2				
Average BMI (overweight is ≥ 25.00)	150	28.35(6.86)					
Weight changed since last delivery	148		83.7				
Mean change in lb (SD)	148	-3.91(21.92)					
Lost at least 20 lb since last delivery	148		26.1				
Provider of gestational diabetes education	153			37.9	62.1		
Type education session	153					86.9	13.1
Nutrition Knowledge							
Percent Scoring ≥80 correct (maximum score = 22)	152	20.51(2.20)	91.5				

Table K13

Your Environment

	n	%Yes
Family/friends care that you eat healthfully	153	88.9
Family/friends care that you exercise	153	87.6
Family/friends who eat healthfully	153	90.2
Family/friends who exercise	153	86.3
Healthy foods available at grocery store	153	99.3
Healthy foods available at work or school[1]	153	33.3
Healthy foods at restaurants	151	81.5
Able to exercise	152	90.8
Exercise facilities available (eg gym/walking trails)	153	85.6
Exercise equipment at home	153	41.2
Safe to exercise in neighborhood	152	91.4
Not able to exercise due to child care issues	153	26.8

APPENDIX L

HYPOTHESES TEST RESULTS

Health Belief Model Constructs (Susceptibility, Seriousness, Benefits, and Barriers)

1.a. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to eat healthfully.

1.a.1. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis was rejected. There was no significant relationship (Table 9).

1.a.2. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis was rejected. There was no significant relationship (Table 9).

1.b. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to exercise.

1.b.1. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 8).

1.b.2. Individuals who have a greater perception of susceptibility to diabetes will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 8).

1.b.3. Individuals who have a greater perception of susceptibility to diabetes will be

significantly more likely to “work-in” other types of exercise three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 8).

2.a. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to eat healthfully.

2.a.1. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis was rejected. There was no significant relationship (Table 9).

2.a.2. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis was rejected. Those with higher beliefs of seriousness scored lower or consumed more high calorie foods.

2b. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to exercise.

2.b.1. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 8).

2.b.2. Individuals who have a greater perception of seriousness of diabetes will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 8).

2.b.3. Individuals who have a greater perception of seriousness of diabetes will be

significantly more likely to "work-in" other types of exercise three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 8).

3.a. Individuals who have a greater perception of benefits of eating healthfully will be significantly more likely to eat healthfully.

3.a.1. Individuals who have a greater perception of benefits of eating healthfully will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis was rejected. There was no significant relationship (Table 9).

3.a.2. Individuals who have a greater perception of benefits of eating healthfully will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis was rejected. There was no significant relationship (Table 9).

3.b. Individuals who have a greater perception of benefits of exercising will be significantly more likely to exercise.

3.b.1. Individuals who have a greater perception of benefits of exercising will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 8).

3.b.2. Individuals who have a greater perception of benefits of exercising will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 8).

3.b.3. Individuas who have a greater perception of benefits of exercising will be significantly more likely to "work- in" other types of exercise three or more days a

week.

This hypothesis was rejected. There was no significant relationship (Table 8).

4.a. Individuals who have a greater perception of barriers to diet will be significantly less likely to eat healthfully.

4.a.1. Individuals who have a greater perception of barriers to diet will be significantly more likely to have a lower score on the Healthy Eating Index.

This hypothesis was rejected. There was no significant relationship (Table 9).

4.a.2. Individuals who have a greater perception of barriers to diet will be significantly more likely to have a lower score for intake of high calorie food or beverage.

This hypothesis was rejected. There was no significant relationship (Table 9).

4.b. Individuals who have a greater perception of barriers to exercise will be significantly less likely to exercise.

4.b.1. Individuals who have a greater perception of barriers to exercise will be significantly less likely to do 30 min or more of physical activity three or more days a week.

This hypothesis was rejected. There was a significant relationship (Table 8).

4.b.2. Individuals who have a greater perception of barriers to exercise will be significantly less likely to work out enough to sweat three or more days a week.

This hypothesis was rejected. There was a significant relationship (Table 8).

4.b.3. Individuals who have a greater perception of barriers to exercise will be significantly less likely to “work-in” other types of exercise three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 8).

4.c. Individuals who have a greater perception of benefits of minus barriers to diet will be significantly more likely to eat healthfully.

4.c.1. Individuals who have a greater perception of benefit of minus barriers to diet will be significantly more likely to have a higher score on the Healthy Eating Index.

We failed to reject this hypothesis. There was a significant relationship (Table 9).

4.c.2. Individuals who have a greater perception of benefit of minus barriers to diet will be significantly more likely to have a higher score for intake of high calorie food or beverage.

We failed to reject this hypothesis. There was a significant relationship (Table 9).

4.d. Individuals who have a greater perception of benefits of minus barriers to exercise will be significantly more likely to exercise.

4.d.1. Individuals who have a greater perception of benefits of minus barriers to exercise will be significantly more likely to do 30 min or more of physical activity three or more days a week.

We failed to reject this hypothesis. There was a significant relationship (Table 8).

4.d.2. Individuals who have a greater perception of benefits of minus barriers to exercise will be significantly more likely to work out enough to sweat three or more days a week.

We failed to reject this hypothesis. There was a significant relationship (Table 8).

4.d.3. Individuals who have a greater perception of benefits of minus barriers to exercise will be significantly more likely to “work-in” other types of exercise three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 8).

Self-Efficacy Constructs (Diet and Exercise)

5.a. Individuals who have higher diet self-efficacy will be significantly more likely to eat healthfully.

5.a.1. Individuals who have higher diet self-efficacy will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis was rejected. There was no significant relationship (Table 10).

5.a.2. Individuals who have higher diet self-efficacy will be significantly more likely to have a higher score for intake of high calorie food or beverage.

We failed to reject this hypothesis. There was a significant relationship (Table 10).

5.b. Individuals who have higher exercise self-efficacy will be significantly more likely to exercise.

5.b.1. Individuals who have higher exercise self-efficacy will be significantly more likely to do 30 min or more of physical activity three or more days a week.

We failed to reject this hypothesis. There was a significant relationship (Table 10).

5.b.2. Individuals who have higher exercise self-efficacy will be significantly more likely to work out enough to sweat three or more days a week.

We failed to reject this hypothesis. There was a significant relationship (Table 10).

5.b.3. Individuals who have higher exercise self-efficacy will be significantly more likely to “work-in” other types of exercise three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 10).

Diabetes-Related Cues to Action

6.a. Individuals requiring medication during pregnancy will be significantly

more likely than individuals not requiring medication to eat healthfully.

6.a.1. Individuals requiring medication during pregnancy will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis was rejected. There was no significant relationship (Table 12).

6.a.2. Individuals requiring medication during pregnancy will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis was rejected. There was no significant relationship (Table 12).

6.b. Individuals requiring medication during pregnancy will be significantly more likely than individuals not requiring medication to exercise.

6.b.1. Individuals requiring medication during pregnancy will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 11).

6.b.2. Individuals requiring medication during pregnancy will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 11).

6.b.3. Individuals requiring medication during pregnancy will be significantly more likely to “work-in” other types of exercise three or more days a week.

We failed to reject this hypothesis. There was a significant relationship (Table 11).

7.a. Individuals who have delivered a macrosomic infant will be significantly more likely than individuals who have not delivered a macrosomic infant to eat healthfully.

7.a.1. Individuals who have delivered a macrosomic infant will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis was rejected. There was no significant relationship (Table 12).

7.a.2. Individuals who have delivered a macrosomic infant will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis was rejected. There was no significant relationship (Table 12).

7.b. Individuals who have delivered a macrosomic infant will be significantly more likely than individuals who have not delivered a macrosomic infant to exercise.

7.b.1 Individuals who have delivered a macrosomic infant will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 11).

7.b.2. Individuals who have delivered a macrosomic infant will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 11).

7.b.3 Individuals who have delivered a macrosomic infant will be significantly more likely to “work-in” other types of exercise three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 11).

8.a. Individuals who have a family history of diabetes will be significantly more likely than individuals who have no family history of diabetes to eat healthfully.

8.a.1. Individuals who have a family history of diabetes will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis was rejected. There was no significant relationship (Table 12).

Fewer individuals with a family history of diabetes scored high on this index.

8.a.2. Individuals who have a family history of diabetes will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis was rejected. There was no significant relationship (Table 12).

8.b. Individuals who have a family history of diabetes will be significantly more likely than individuals who have no family history of diabetes to exercise.

8.b.1. Individuals who have a family history of diabetes will be significantly more likely to do 30 min or more of physical activity three or more days a week.

We failed to reject this hypothesis. There was a significant relationship (Table 11).

8.b.2. Individuals who have a family history of diabetes will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 11).

8.b.3. Individuals who have a family history of diabetes will be significantly more likely to “work-in” other types of exercise three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 11).

9.a. Individuals subsequently diagnosed with diabetes post pregnancy will be significantly more likely to eat healthfully.

9.a.1. Individuals subsequently diagnosed with diabetes will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis was rejected. There was no significant relationship (Table 12).

9.a.2. Individuals subsequently diagnosed with diabetes will be significantly more likely to have a higher score for intake of high calorie food or beverage.

We failed to reject this hypothesis. There was a significant relationship (Table 12).

9.b. Individuals subsequently diagnosed with diabetes post pregnancy will be significantly more likely to exercise.

9.b.1. Individuals subsequently diagnosed with diabetes will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 11).

9.b.2. Individuals subsequently diagnosed with diabetes will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 11).

9.b.3. Individuals subsequently diagnosed with diabetes will be significantly more likely to "work-in" other types of exercise three or more days a week.

This hypothesis was rejected. There was no significant relationship (Table 11).

Ecological/Environmental Cues to Action

10.a. Individuals who have family or friends who care that they eat healthfully will be significantly more likely than those who do not have this social support to eat healthfully.

10.a.1. Individuals who have family or friends who care that they eat healthfully will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis was rejected. There was no significant relationship (Table 14).

10.a.2. Individuals who have family or friends who care that they eat healthfully will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis was rejected. There was no significant relationship (Table 14).

10.b. Individuals who have family or friends who care about their exercise

will be significantly more likely than those who do not have this social support to exercise.

10.b.1. Individuals who have family or friends who care about their exercise will be significantly more likely to do 30 min or more of physical activity three or more days a week.

We failed to reject this hypothesis. There was a significant relationship (Table 13).

10.b.2. Individuals who have family or friends who care about their exercise will be significantly more likely to work out enough to sweat three or more days a week.

We failed to reject this hypothesis. There was a significant relationship (Table 13).

10.b.3. Individuals who have family or friends who care about their exercise will be Significantly more likely to "work-in" other types of exercise three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

11.a. Individuals who know family or friends who eat healthfully will be significantly more likely than those who do not have this social support to eat healthfully.

11.a.1. Individuals who know family or friends who eat healthfully will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis is rejected. There was no significant relationship (Table 14).

11.a.2. Individuals who know family or friends who eat healthfully will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis is rejected. There was no significant relationship (Table 14).

11.b Individuals who know family or friends who exercise will be significantly more likely than those who do not have this social support to exercise.

11.b.1. Individuals who know family or friends who exercise will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

11.b.2. Individuals who know family or friends who exercise will be significantly more likely to exercise to sweat three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

11.b.3. Individuals who know family or friends who exercise will be significantly more likely to "work-in" other types of exercise three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

12. Individuals who report that healthy foods are available at the grocery store will be significantly more likely than those who do not have this community support to eat healthfully.

12.a.1. Individuals who report that healthy foods are available at the grocery store will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis is rejected

12.a.2. Individuals who report that healthy foods are available at the grocery store will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis is rejected.

13. Individuals who report that healthy foods are available at work or school will be significantly more likely than those who do not have this community support to eat healthfully.

13.a.1. Individuals who report that healthy foods are available at work or school will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis is rejected. There was no significant relationship (Table 14).

13.a.2. Individuals who report that healthy foods are available at work or school will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis is rejected. There was no significant relationship (Table 14).

14. Individuals who report that healthy foods are available at restaurants will be significantly more likely than those who do not have this community support to eat healthfully.

14.a.1. Individuals who report that healthy foods are available at restaurants will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis is rejected. There was no significant relationship (Table 14).

14.a.2. Individuals who report that healthy foods are available at restaurants will be significantly more likely to have a higher score on high calorie food/beverage intake.

This hypothesis is rejected. . There was no significant relationship (Table 14).

15. Individuals who report that exercise facilities are available in their environment will be significantly more likely than those who do not have this

community support to exercise.

15.a.1. Individuals who report that exercise facilities are available will be significantly more likely to do 30 min or more of physical activity three or more days a week.

We failed to reject this hypothesis There was a significant relationship (Table 13).

15.a.2. Individuals who report that exercise facilities are available will be significantly more likely to work out enough to sweat three or more days a week.

We failed to reject this hypothesis There was a significant relationship (Table 13).

15.a.3. Individuals who report that exercise facilities are available will be significantly more likely to "work-in" other types of exercise three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

16. Individuals who report that exercise is safe in their environment will be significantly more likely than those who do not have this community support to exercise.

16.a.1. Individuals who report that exercise is safe will be significantly more likely to do 30 min or more of physical activity three or more days a week.

We failed to reject this hypothesis. There was a significant relationship. (Table 13).

16.a.2. Individuals who report that exercise is safe will be significantly more likely to work out enough to sweat three or more days a week.

We failed to reject this hypothesis. There was a significant relationship. (Table 13). .

16.a.3. Individuals who report that exercise is safe will be significantly more likely to "work-in" other types of exercise three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

17. Individuals who report child care issues (for example, no child care) will

be significantly less likely than those who do not have this support to exercise.

17.a.1. Individuals who report child care issues will be significantly less likely to do 30 min or more of physical activity three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13). However, there was a significant relationship between those individuals reporting no child care issues and 30 mins or more of physical activity three or more days a week.

17.a.2. Individuals who report child care issues will be significantly less likely to work out enough to sweat three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13). However, there was a significant relationship between reporting no child care issues and working out enough to sweat three or more days a week (Table 13).

17.a.3. Individuals who report child care issues will be significantly less likely to "work in" other types of exercise three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

Diabetes-Related Variables

18.a. Individuals who received GDM education from the dietitian will be significantly more likely than individuals who received GDM education from the nurse to eat healthfully.

18.a.1. Individuals who received GDM education from the dietitian will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis is rejected. There was no significant relationship (Table 14).

18.a.2. Individuals who received GDM education from the dietitian will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis is rejected. There was no significant relationship (Table 14).

18.b. Individuals who received GDM education from the dietitian will be significantly more likely than individuals who received GDM education from the nurse to exercise.

18.b.1. Individuals who received GDM education from the dietitian will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

18.b.2. Individuals who received GDM education from the dietitian will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

18.b.3. Individuals who received GDM education from the dietitian will be significantly more likely to “work-in” other types of exercise three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

19.a. Individuals who received GDM education in a group setting will be significantly more likely than individuals who received individual GDM education to eat healthfully.

19.a.1. Individuals who received GDM education in a group setting will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis is rejected. There was no significant relationship (Table 14).

19.a.2. Individuals who received GDM education in a group setting will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis is rejected. There was no significant relationship (Table 14).

19.b. Individuals who received GDM education in a group setting will be significantly more likely than individuals who received individual GDM education to exercise.

19.b.1. Individuals who received GDM education in a group setting will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

19.b.2. Individuals who received GDM education in a group setting will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

19.b.3. Individuals who received GDM education in a group setting will be significantly more likely to "work-in" other types of exercise three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 13).

Socio-Demographic Variables

20.a. Older individuals will be significantly more likely than younger individuals to eat healthfully.

20.a.1. Older individuals will be significantly more likely to have a higher score on

the Healthy Eating Index.

This hypothesis is rejected. There was no significant relationship (Table 7).

20.a.2. Older individuals will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis is rejected. There was no significant relationship (Table 7).

20.b. Older individuals will be significantly more likely than younger individuals to exercise.

20.b.1. Older individuals will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

20.b.2. Older individuals will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

20.b.3. Older individuals will be significantly more likely to “work- in” other types of exercise three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

21.a. An individual’s ethnicity will not be significantly related to compliance with the recommendation to eat healthfully.

21.a.1. An individual’s ethnicity will not be significantly related to the Healthy Eating Index score.

This hypothesis is rejected. There was no significant relationship (Table 7).

21.a.2. An individual’s ethnicity will not be significantly related to the high calorie food or beverage intake score.

This hypothesis is rejected. There was no significant relationship (Table 7).

21.b. An individual's ethnicity will not be significantly related to compliance with the recommendation to exercise.

21.b.1. An individual's ethnicity will not be significantly related to doing 30 min or more of physical activity three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

21.b.2. An individual's ethnicity will not be significantly related to working out enough to sweat three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

21.b.3. An individual's ethnicity will not be significantly related to "working-in" other types of exercise three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

22.a. Individuals who are married will be significantly more likely than individuals who are not married to eat healthfully.

22.a.1. Individuals who are married will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis is rejected. There was no significant relationship (Table 7).

22.a.2. Individuals who are married will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis is rejected. There was no significant relationship (Table 7).

22.b. Individuals who are married will be significantly more likely than individuals who are not married to exercise.

22.b.1. Individuals who are married will be significantly more likely to do 30 min

or more of physical activity three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

22.b.2. Individuals who are married will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

22.b.3. Individuals who are married will be significantly more likely to "work-in" other types of exercise three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

23.a. Individuals who have health care insurance will be significantly more likely than individuals who have no health care insurance to eat healthfully.

23.a.1. Individuals who have health care insurance will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis is rejected. There was no significant relationship (Table 7).

23.a.2. Individuals who have health care insurance will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis is rejected. There was no significant relationship (Table 7).

23.b. Individuals who have health care insurance will be significantly more likely than individuals who have no health care insurance to exercise.

23.b.1. Individuals who have health care insurance will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

23.b.2. Individuals who have health care insurance will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

23.b.3. Individuals who have health care insurance will be significantly more likely to "work-in" other types of exercise three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

24.a. Individuals who have more education will be significantly more likely than individuals who have less education to eat healthfully.

24.a.1. Individuals who have more education will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis is rejected. There was no significant relationship (Table 7).

24.a.2. Individuals who have more education will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis is rejected. There was no significant relationship (Table 7).

24.b. Individuals who have more education will be significantly more likely than individuals who have less education to exercise.

24.b.1. Individuals who have more education will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

24.b.2. Individuals who have more education will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

24.b.3. Individuals who have more education will be significantly more likely to "work-in" other types of exercise three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

25.a. Individuals who have a higher income will be significantly more likely than individuals who have a lower income to eat healthfully.

25.a.1. Individuals who have a higher income will be significantly more likely to have a higher score on the Healthy Eating Index.

This hypothesis is rejected. There was no significant relationship (Table 7).

25.a.2. Individuals who have a higher income will be significantly more likely to have a higher score for intake of high calorie food or beverage.

This hypothesis is rejected. There was no significant relationship (Table 7).

25.b. Individuals who have a higher income will be significantly more likely than individuals who have a lower income to exercise.

25.b.1. Individuals who have a higher income will be significantly more likely to do 30 min or more of physical activity three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

25.b.2. Individuals who have a higher income will be significantly more likely to work out enough to sweat three or more days a week.

This hypothesis is rejected. There was no significant relationship (Table 4).

25.b.3. Individuals who have a higher income will be significantly more likely to "work-in" other types of exercise three or more days a week.

We failed to reject this hypothesis. There was a significant relationship (Table 4)

Multivariate Analyses

Tables 20 to 23 show the logistic regression models including the significant predictors of diet and exercise behaviors or outcomes noted by *p*-values. The diet or healthy eating behaviors include the healthy eating score and high calorie food and

beverage score. The exercise behaviors include 30 min or more physical activity three or more days weekly and exercise to sweat three or more days weekly. The final diet and exercise scores were dichotomized into high and low scores prior to entry into the logistic regression analysis. The independent variables representing these models include health beliefs, health beliefs and self-efficacy, health beliefs and environmental support, and health beliefs and self-efficacy and environmental support. Child care issues are included only for the exercise outcome models. All predictor variables were also dichotomized prior to entry in the logistic regression analysis unless they were already dichotomized initially, for example yes and no questions.

Multivariate hypotheses and results of logistic regression analysis:

(Model I) The odds of performing healthy lifestyle preventive behaviors (eating healthfully and exercising) will be explained by **perceived susceptibility to diabetes, perceived seriousness of diabetes, perceived benefits of minus barriers to healthy lifestyle behaviors to prevent diabetes, diagnosis of diabetes**, **family history of diabetes**, and **socioeconomic variables of age, ethnicity, marital status, and education.**

Table 20 shows two significant predictors of exercise ≥30 min three or more days weekly: benefits minus barriers ($p<.001$) and family history ($p<.05$).

Table 21 shows significant predictors for exercise to sweat three or more days weekly, marital status ($p<.05$) and benefits minus barriers ($p<.001$). Table 22 shows that there were no significant predictors for healthy eating. Table 23 shows only one significant predictor for high calorie food/beverage intake, benefits minus barriers ($p<.05$).

(Model II) The odds of performing healthy lifestyle preventive behaviors (eating healthfully and exercising) will be explained by **perceived susceptibility to diabetes, perceived seriousness of diabetes, perceived benefits of minus barriers** to healthy lifestyle behaviors to prevent diabetes, diagnosis of diabetes, family history of diabetes, **self-efficacy**, and socioeconomic variables of age, ethnicity, marital status, and education.

Table 20 shows significant predictors for exercise ≥30 min three or more days weekly, benefits minus barriers (p<.01), family history (p<.05), and self-efficacy (p<.01). Table 21 shows three significant predictors for exercise to sweat three or more days weekly, benefits minus barriers (p<.01), self-efficacy (p<.001), and marital status (p<.05).

Table 22 shows that there was only one significant predictor for healthy eating, benefits minus barriers (p<.05) but this model was not significant.
Table 23 shows one significant predictor for high calorie food/beverage intake (p<.01), diet self-efficacy.

(Model III) The odds of performing healthy lifestyle preventive behaviors (eating healthfully and exercising) will be explained by **perceived susceptibility to diabetes, perceived seriousness of diabetes, perceived benefits of minus barriers** to healthy lifestyle behaviors to prevent diabetes, diagnosis of diabetes, family history of diabetes, **environmental support**, and socioeconomic variables of age, ethnicity, marital status, and education.

Table 20 shows the significant predictor variable for exercise ≥30 min or more three or more days weekly, benefits minus barriers (p<.01). Table 21 shows the two

significant predictors for exercise to sweat three or more days weekly, marital status (p<.05) and benefits minus barriers (p<.001). Table 22 shows there were no significant predictors for healthy eating. Table 23 shows one significant predictor for high calorie food/beverage intake, benefits minus barriers (p<.05).

(Model IV) The odds of performing healthy lifestyle preventive behaviors (eating healthfully and exercising) will be explained by **perceived susceptibility to diabetes, perceived seriousness of diabetes, perceived benefits of minus barriers** to healthy lifestyle behaviors to prevent diabetes, diagnosis of diabetes, family history of diabetes, **self-efficacy, environmental support,** and socioeconomic variables of age, ethnicity, marital status, and education.

Table 20 shows three significant predictors for exercise ≥30 min three or more days weekly, susceptibility (p<.05), benefits minus barriers (p<.01), and self-efficacy (p<.01). Table 21 shows three significant predictors for exercise to sweat three or more days weekly, benefits minus barriers (p<.05), self-efficacy (p<001), and marital status (p<.05). Table 22 shows that there was only one significant predictor for healthy eating, benefits minus barriers (p<.05). Table 23 shows one significant predictor for high calorie food/beverage intake, diet self-efficacy (p<.01).

(Model V) The odds of performing healthy lifestyle preventive behaviors (eating healthfully and exercising) will be explained by **perceived susceptibility to diabetes, perceived seriousness of diabetes, perceived benefits of minus barriers** to healthy lifestyle behaviors to prevent diabetes, diagnosis of diabetes, family history of diabetes, **self-efficacy, environmental support and no child care issues,** and socioeconomic variables of age, ethnicity, marital status, and education.

Table 20 shows three significance predictors for exercise ≥ 30 min three or more days weekly, susceptibility ($p < .05$), benefits minus barriers ($p < .05$), and exercise self-efficacy ($p < .01$).

Table 21 shows three significant predictors for exercise to sweat three or more days weekly, benefits minus barriers ($p < .05$), self-efficacy ($p < .001$), know family/friends who exercise ($p < .05$), and marital status ($p < .05$).

In summary, the outcome variable, healthy eating, was represented by four models, none were significant, and the predictors were weak. High calorie food/beverage average intake was represented by four models, all were significant and Model II (health beliefs and self-efficacy) and Model IV (health beliefs and self-efficacy and environmental variables) approached moderate strength in predicting this behavior.

Exercise ≥ 30 mins three or more days weekly was represented by five models. All were significant, and three of the models showed moderate strength in prediction (health beliefs and self-efficacy, health beliefs and self-efficacy and environmental support, and health beliefs and self-efficacy and environmental support and no child care issues). Exercise to sweat three or more days weekly was represented by five models and all were significant. Two of the models, Model IV, health beliefs and self-efficacy and environmental support, and Model V, health beliefs and self-efficacy and environmental support and child care issues, showed the most strength of all the models studied. Model II, health belief and self-efficacy, was moderate in strength.

Overall, these models show that health beliefs alone are a weak predictor of diet and exercise behaviors. Adding self-efficacy and key environmental variables increase the prediction and strength for these outcome behaviors.

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EDUCATION

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EMPOYMENT EXPERIENCE

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-**Perinatal Nutrition Specialist**, Maternal-Fetal Medicine, Dept OB-GYN, EVMS, Norfolk, VA (Sept 1995-2018)
-**Chief Clinical Dietitian**, Virginia Beach General Hospital, Virginia Beach, VA (Oct 1986-Aug 1990)
-**Director/Nutritionist**, WIC (Women, Infant, & Children Supplemental & Nutrition Education Program), Onslow Co Health Dept, Jacksonville, NC (Jan 1983-Jul 1986)
-**Extension Home Economist**, Virginia Tech Agricultural Extension Service, Prince William Co, Manassas, VA (Dec 1981-Jul 1982)
-**Director, Home Economist**, EFNEP (Expanded Food & Nutrition Education Program), OSU Agricultural Extension Service, Comanche Co, Lawton, OK (Dec 1978-June 1981)
-**Instructor/Adjunct Faculty** (22 nutrition-related courses), Tidewater Community College: Norfolk, Virginia Beach, Chesapeake, Portsmouth, VA (Jan 1991-Dec 1998)

PROFESSIONAL/COMMUNITY SERVICE LEADERSHIP

-**Co-Chairman**, 3-day Annual Meeting, Virginia Academy of Nutrition & Dietetics, 2010, 2015
-**State Delegate**, American Academy of Nutrition & Dietetics (2013-2015)
- **President**, Virginia Academy of Nutrition & Dietetics (2006-2007)
-American Association of Diabetes Educators: **Ex Officio Member of BOD** (2007-2008); **Chair-Elect/Chair, Chapter Presidents Council; Chair, Chapter Support Committee** (2006-2009); Eastern Virginia Association of Diabetes Educators, **President (**2005-2006**)**
-**Member**, Virginia Diabetes Task Force/Coalition/Council (1998-present)

PUBLICATIONS

-Woodson, P. M. & Ritchey, S. J. (1979). Effect of maternal alcohol consumption on fetal brain cell number and cell size. *Nutrition Reports International*, 20(2), 225-228.
-Woodson, P. M. (2018). Medical nutrition therapy for adults with diabetes and related topics. In R. Khardori, D. C. Lieb, & J. Ullal (Eds.), *Clinical Focus Series Diabetes Mellitus* (pp. 16-25). New Delhi, India: Jaypee The Health Sciences Publisher.