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THE EFFECTS OF NUTRITION AND PHYSICAL ACTIVITY EDUCATION ON KNOWLEDGE AND GLYCEMIC CONTROL AMONG PERSONS WITH TYPE 2 DIABETES

by

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EVIDENCE-BASED PRACTICE PROJECT REPORT

Submitted to the College of Nursing

of Valparaiso University,

Valparaiso, Indiana

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For the degree of

DOCTOR OF NURSING PRACTICE

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DEDICATION

Dag Hammarskjold once said, “Life only demands from you the strength that you possess. Only one feat is possible; not to run away.” True strength and support from those whom matter most to me, made my dreams finally become reality. I would like to dedicate this to my children, McKenzi and Nolan, my parents, and my best friend, Lena Modieh, for being supportive and helping me to reach my dreams. I am without words that could describe how truly grateful and fortunate to have each of you in my life.

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I would like to thank Dr. Brandy for being the calm, sound voice driving my sanity through this project. I am thankful to have had an amazing advisor through one of the greatest milestones of my life. I would also like to thank Dr. Easa Ghoreishi for believing in me and supporting me through my project and journey. Lastly, I would like to thank the staff at the clinical site where my project was performed.

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ABSTRACT

Diabetes affects millions of people worldwide. Approximately 29.1 million people or 9.3% of the United States population has diabetes (Centers for Disease Control (CDC), 2014). Diabetes was the seventh leading cause of death in the United States in 2010 and is projected by the World Health Organization (WHO) to be the seventh leading cause of death globally by 2030. The purpose of this evidence-based project was to provide nutrition and physical activity education in an effort to improve diabetes knowledge and glycemic control among persons with type 2 diabetes. Hemoglobin A1c levels and Diabetes Knowledge Test scores were compared from the pre-intervention phase of nutrition and physical activity education to the post-intervention phase three months later. For this project, Stetler's Model was employed as the theoretical framework to support implementation of the EBP, and Pender's Health Promotion Model (HPM) was used to guide the intervention. Participants were recruited from a private, primary care office in Lake County, Indiana. Seventeen participants (n=17) were recruited and completed the intervention phase of this project. Data was analyzed using the Wilcoxon signed-rank test. Results demonstrated a statistically significant increase in diabetes knowledge among participants three months following the intervention (z-score=-2.546, $p<0.05$). However, due to several factors including health maintenance compliance from the participants or their healthcare providers, changes in glycemic control among the participants were able to be determined in only two participants. The findings suggest that implementation of diabetes education in primary care practice can improve diabetes knowledge.

CHAPTER 1

INTRODUCTION

BACKGROUND

Diabetes affects millions of people worldwide. Diabetes is projected by the World Health Organization (WHO) to be the seventh leading cause of death globally by 2030. On a national level, approximately 29.1 million people or 9.3% of the United States population aged 20 years or older have diabetes (Centers for Disease Control (CDC), 2014). Diabetes is currently the leading cause of kidney failure and is also associated with several serious complications including heart disease, stroke, blindness, and lower limb amputations (CDC, 2014). Additionally, diabetes lowers life expectancy by up to fifteen years and increases the risk of heart disease by two to four times. Furthermore, all populations are at risk of developing diabetes; however, certain populations are at greater risk than others.

Due to the increased mortality and morbidity associated with diabetes, many organizations including the American Diabetes Association (ADA) and the American Academy of Clinical Endocrinologists (AACE) have established guidelines for health care providers in an effort to attain glycemic control in patients with diabetes. The ADA (2014) and AACE (2011) guidelines have recommended education on nutrition and physical activity as part of lifestyle interventions for diabetes management. Research has shown that an increase in physical activity and maintaining a balanced, healthy diet can prevent complications from type 2 diabetes and improve blood glucose levels for persons with type 2 diabetes (WHO, 2015).

STATEMENT OF PROBLEM

In a national effort to address the alarming trends and problems associated with diabetes, the United States Department of Health and Human Services (USDHHS)

established Healthy People 2020 goals. The Healthy People 2020 goals aim to reduce the disease and economic hardship associated with diabetes and to improve the quality of life for those who have or who are at risk for diabetes. Healthy People is a federal program that reflects input from a diverse group of individuals and organizations to establish science-based, ten year national objectives to improve the health of all Americans (HealthyPeople, 2014). According to Healthy People 2020, from 2005 to 2008, 17.9% of adults aged 18 years of age or older with diagnosed diabetes had a hemoglobin A1c value greater than 9%, 53.9% percent had a hemoglobin A1c value less than 7%, and only 56.8% reported ever receiving formal education about diabetes in 2008. Specific Healthy People 2020 objectives correlating to the previously mentioned statistics include: reducing the number of persons with diabetes with a hemoglobin A1c value greater than 9% by 10% nationally; to increase the proportion diabetes persons with a hemoglobin A1c value of less than 7% by 10% nationally; and to increase the number of individuals diagnosed with diabetes who receive formal education by 10%. With the Healthy People 2020 goals in mind, health care providers can modify their care to encompass enhanced quality care standards to assist in meeting the target goals and to improve the diabetes management of their patients.

While the impact of diabetes on a global and national level is well noted, the problem is also apparent on a regional level. In 2010, an estimated 462,000 people aged 18 years or older were diagnosed with diabetes in Indiana (CDC, 2011). The number of individuals diagnosed with diabetes each year in Indiana is steadily increasing. This could be attributed to an increased awareness of diabetes and enhanced screening measures by healthcare providers to identify persons with the disease or the worsening lifestyle behaviors by individuals, resulting in the development of type 2 diabetes. With these statistics and trends, further interventions and improvements are needed on an outpatient care setting to reach Healthy People 2020 goals. Because a need for diabetes

education intervention was identified on a regional level, the clinical agency selected for this evidence-based practice project was a private, primary care office in Lake County, Indiana where a significant portion of the patient population has prediabetes or even type 2 diabetes. The primary care physician of the clinical agency noted a need for diabetes education for his patients with diabetes due to poor glycemic control; therefore, an effective education intervention was required.

Significant research has been conducted on diabetes prevention and management, resulting in evidence-based clinical practice guidelines for use by health care providers. It is essential for primary care providers to follow the evidence-based clinical practice guidelines established by the ADA and AACE in order to improve the quality of care and education provided to their diabetic population. Significant changes and interventions must be established within their practices to improve glycemic control and diabetes knowledge, including initial and ongoing diabetes education during office visits with their patients.

PURPOSE OF EBP PROJECT

The purpose of this evidence-based practice project was to provide nutrition and physical activity education in an effort to improve diabetes knowledge and glycemic control among persons with type 2 diabetes. The PICOT question addressed was: “What is the effect of nutrition and physical activity education on knowledge and glycemic control among individuals with type 2 diabetes during a three month period?”.

SIGNIFICANCE OF THE PROJECT

As type 2 diabetes is associated with increased mortality and many complications including: heart disease, stroke, hypertension, blindness, diabetic retinopathy, kidney disease, neuropathy, and nontraumatic lower limb amputations if poorly managed; thus, intervention and preventative measures are needed. The total

estimated cost of care for Americans with diabetes in 2012 was $245 billion dollars. The cost of care for Americans with diabetes is astronomical compared to other diseases and conditions. For instance, an estimated $36.5 billion dollars is spent annually for individuals who have had a stroke and $108.9 billion dollars annually for individuals with coronary heart disease (CDC, 2014). In 2008, the cost of care for adults with obesity was $147 billion dollars (CDC, 2014). Due to the significant societal cost of diabetes care and the increased mortality and morbidity, primary care providers need to be aware of the best clinical practice recommendations for management of diabetes in order to maximize the health of this population, and in turn, this may also reduce the total annual cost of care for diabetes and the other conditions previously mentioned.

The goal of this evidence-based practice project was to improve diabetes knowledge and glycemic control through the provision of nutrition and physical activity education. The implementation of nutrition and physical activity education to persons with type 2 diabetes can assist them in making better educated choices regarding meals and physical activity levels; thus, it can potentially improve their overall diabetes knowledge and glycemic control.

CHAPTER 2

THEORETICAL FRAMEWORK AND REVIEW OF LITERATURE

The purpose of Chapter 2 is to present and evaluate the theoretical framework, the evidence-based practice model, and to appraise the literature pertaining to this evidence-based practice project. Nola Pender's Health Promotion Model (HPM) was selected as the theoretical framework for this evidence-based practice project. Implementation of the project will be guided by the Stetler Model which will assist in addressing the PICOT question for this evidence-based practice project. The PICOT question is: What is the effect of nutrition and physical activity education on knowledge and glycemic control among individuals with type 2 diabetes during a three month period?". The process for the search, selection, and critical appraisal of the literature will also be discussed based on the established PICOT question.

Theoretical Framework

Overview of Pender's Health Promotion Model (HPM). The HPM is an "attempt to depict the multidimensional nature of persons interacting with their interpersonal and physical environments as they pursue health" (Pender, Murdaugh, & Parsons, 2006, p. 50). While working on her doctoral dissertation, Nola Pender examined how people make decisions. Her research resulted in her initial version of the HPM in 1982. The HPM assimilates numerous constructs from the Health Belief Model, Expectancy Value Theory, and Social Cognitive theories in order to "explain and predict how the complex interaction among perceptual and environmental factors influences the health-related choices that people make" (Sheenan, 2006, p. 457). With health promotion being the central concept to this theory, it has been utilized as a framework to promote many behaviors including: dieting; physical activity; vaccinations; oral hygiene; and smoking cessation. This theory has the potential to be applicable to any health

behavior which a threat is not proposed as the main motive for the behavioral change (Pender et al., 2006). The HPM presumes that: individuals actively seek to control their own behavior; individuals interact within their environment to transform over time; individuals are influenced across the lifespan by healthcare professionals who comprise a portion of the interpersonal environment; and individuals require self-initiated rearrangement of person-environment interactive patterns to facilitate behavior change (Sitzman & Eichelberg, 2004). The HPM considers individual characteristics and experiences, behavior specific cognitions and affect, and the behavioral outcomes of an individual in order analyze and determine the best methods to achieve better health; thus, this model proves its utility in supporting the evidence-based practice project. The HPM consists of three major propositional groups and several variables and concepts contributing to the health-promoting behavior. Further delineation of each major propositional group and related concepts to this evidence-based practice project will be discussed.

Individual characteristics and experiences propositional group. The first propositional group is the individual characteristics and experiences. This group includes prior related behavior and personal factors. The purpose of this propositional group is to consider the unique characteristics and experiences of the individual that will affect their subsequent actions. Depending on the targeted health behavior, the individual's characteristics and experiences may allow for the HPM to attain variables that are significant to the health behavior (Pender et al., 2006).

Prior related behavior. Prior related behavior is proposed to directly and indirectly influence the likelihood of engaging in health promoting behaviors. The direct effects of prior related behavior pertain to habit formation and habit strength. Habit formation is a predisposition of the individual to participate in a behavior automatically but with little thought to how the action was executed. Habit strength relates to the intensity of a

behavior that builds with each time the behavior occurs, and it is enhanced by the focused, repetitive practice of the behavior (Pender et al., 2006). For persons with diabetes, habit formation and habit strength may be related to glycemic control and meals. For instance, habit formation can occur when the health care provider instructs the individual to check his blood sugar before breakfast, lunch, dinner, and bedtime. With the habit formation, the individual may initially forget to check his blood sugars and may need reminders to perform this task. Over time and habit formation, the individual will consistently check his blood sugar and will not need reminders. Habit strength will then build with habit formation because the individual will check his blood sugar as ordered regardless of his expectation of a given blood sugar value.

The prior behavior is also proposed to indirectly effect the health-promoting behavior through perceptions of self-efficacy, benefits, barriers, and activity-related affect (Pender et al., 2006). For a person with diabetes, his perception of self-efficacy to prick his finger with a needle to obtain a blood sugar may determine completion of the task. Increased self-efficacy to check his own blood sugar may produce benefits of task performance, resulting in better glycemic control and compliance with diabetes management. Decreased self-efficacy to check blood sugar may produce barriers such as unwillingness to perform the task. In order to achieve effective glycemic control, the individual must overcome the impediment and successfully engage in checking his blood sugar. Each time the individual engages in checking his blood sugar, he will experience positive or negative emotions or affect. The affect is mentally stored and is recovered when he considers checking his blood sugar. Therefore, if he had positive or negative experiences when checking his blood sugar, he will tend to remember this each time it is performed. This is also known as activity-related affect.

Personal factors. The second concept within this propositional group is personal factors. The personal factors are the biological, psychological, and sociocultural aspects of the individual that are considered prognostic of a given behavior and influence the nature of healthy nutrition and increased physical activity among type 2 diabetic individuals. For this evidence-based practice project, age, strength, aerobic capacity, mobility, current health status, education, and meal preferences will be considered through questioning in order to highlight specific physical activities or meal selections pertinent to persons with diabetes.

Behavior-specific cognitions and affect propositional group. The second propositional group is the behavior-specific cognitions and affect. Variables within this group were previously discussed in relationship to prior-related behaviors and include: perceived benefits to action; perceived barriers to action; perceived self-efficacy; and activity-related affect. Variables within this propositional group are considered a critical core for intervention. Previously, these variables were discussed for the purpose of understanding how they shape behavior-specific cognitions and affects; however, during this stage, the variables are subject to modification. Therefore, the APN will attempt an intervention to change a variable in order to promote the healthy behavior. Further discussion of the variables will pertain to their significance during the evidence-based practice project.

Perceived benefits to action. Perceived benefits to action motivate behaviors by establishing a plan to commit to a particular behavior in order to receive the expected benefits. Benefits of the commitment to maintain healthy nutrition and increase physical activity will be identified during the education intervention of the evidence-based practice project. Established benefits to committing to these behaviors include improved knowledge about diabetes and improved glycemic control. Weight loss, reduction in

current diabetic medication therapy, decreased risk of infection, and improved healing are also potential identified benefits to action.

Perceived barriers to action. Perceived barriers to action influence decision-making behavior directly and indirectly through perceived hurdles or mental blocks with acceptance of the given behavior. During the educational intervention, perceived barriers to healthy nutrition and increased physical activity will be addressed through dialogue. Anticipated perceived barriers include: financial concerns, fear of experiencing hypoglycemia, physical limitations, lack of a support system or resources to answer questions, or lack of knowledge. As with perceived benefits, the barriers will be discussed through dialogue, and an appropriate intervention will be recommended. The persons with diabetes will be provided resources to reference or contact for questions or concerns in order to further address the barriers.

Perceived self-efficacy. Perceived self-efficacy pertains to one's belief in his capability he possesses to organize and execute a given behavior. Perceived self-efficacy is influenced by perceived barriers to action. Therefore, if persons with diabetes perceive they can exercise daily and eat healthy at all times, their perceived barriers to action are decreased due to higher self-efficacy with performance of the targeted behavior. Perceived self-efficacy may be discussed during the dialogue portion with the educational intervention of this project; however, perceived self-efficacy will not be specifically measured.

Activity-related affect. Activity-related affect is the subjective feeling occurring before, during, or after an activity related to the behavioral event (Pender et al., 2006). The affects associated with the behavior demonstrate an emotional response that is either positive or negative. The affect is then stored as a memory and recovered while considering to participate in the given behavior. Activity-related affect acts to influence health through self-efficacy and commitment to a plan of action. Thus, if the individual

with diabetes feels good about eating healthy and being physically active, his self-efficacy will increase and further positive affect will ensue.

Interpersonal Influences and Situational Influences Propositional Group. The third propositional group of the HPM is the interpersonal influences and situational influences. Interpersonal influences pertain to norms, social support, and modeling. Norms are standards or expectations of a behavior. Social support is having emotional encouragement by friends, family, or others when needed, and modeling is acquiring a given behavior through observation of others. Family, peers, and health care providers often demonstrate interpersonal influences on health promoting behaviors. Norms, social support, and modeling affect an individual's tendency to participate in health-promoting behaviors. There are three interpersonal influence variables that contribute to the health-promoting behavior including: situational influences; commitment to a plan of action; and immediate competing demands and preferences.

Situational influences. Situational influences involve perceptions of options available, demand characteristics, and aesthetic features of the environment, and can aid or obstruct the given behavior.

Commitment to a plan of action. The commitment to a plan of action initiates the behavioral occurrence. The commitment drives the individual into and through the behavior unless competing demands or preferences occur that cannot be avoided or resisted (Pender et al., 2006). Commitment to the plan of action in the HPM implies "(a) commitment to carry out a specific action at a given time and place and with specified persons or alone, irrespective of competing preferences; and (b) identification of definitive strategies for eliciting, carrying out, and reinforcing the behavior" (Pender et al., 2006, p. 56). However, commitment without associative strategies may prevent achievement in the health-promoting behavior.

Immediate competing demands and preferences. The last variables of interpersonal influences are the immediate competing demands and preferences. Competing demands are alternative behaviors where individuals possess low control due to their environment such as work schedules or financial constraints. Competing preferences are alternative behaviors where individuals possess significant control such as what the individual's wants to eat. Possessing a strong commitment to a plan of action may prevent competing demands and preferences from affecting the outcome of a health-promotion behavior. For example, a person with diabetes may struggle to engage in the behaviors of healthy nutrition and increasing physical activity if family and peers do not encourage the behavior; therefore, the individual may perceive the necessary changes as cumbersome and disengage. However, a person with diabetes who joins a support group and plans all meals may avoid feeling pressured or tempted from pursing the healthier behavior.

Health-promoting behavior. The final action outcome of the HPM is the health-promoting behavior. The expected results of the health-promoted behavior are for the individual to realize positive health outcomes will increase other healthy behaviors and/or replace the unhealthy behaviors that exist (George, 2011). Advanced practice nurses (APNs) must understand the relationship of the patient's adaptation of health promoting behaviors to varying factors. It is significant for the APN to recognize possible cues for health promoting and preventative actions as well as addressing any barriers to change.

Application of HPM to Evidence-Based Practice Project. The foundation of the HPM and its underlying assumptions were fundamental for its applicability as a theoretical framework for this evidence-based practice project. The HPM served to guide the development and implementation of this project in an effort to influence intended health promoting actions by the targeted population, thus increasing their well-being.

Pender's HPM has been utilized extensively in research regarding physical activity and diet and nutrition health promotion. Pender et al. (2006) has encouraged increased physical activity and promotion of healthy eating habits across the lifespan, even for those with chronic health conditions as it contributes to a healthier outcome and higher level of functioning.

Nutrition and physical activity education serve as the interventions to promote healthy behaviors for this project. Pender et al. (2006) suggests strategies for promoting and improving these behaviors through increasing level of knowledge, providing education packets and counseling, and utilizing integrated approaches supported by evidence. During the intervention portion of this project, the HPM will also facilitate opportunities to answer questions, address perceived benefits and barriers to action, and additional influences that hinder health promotion. The multidimensional nature of the HPM truly allows for the opportunity to obtain optimal health promotion, especially for the targeted population for this project.

Strengths and Limitations. Strengths of the HPM pertain to its applicability across an array of settings and populations spanning from the young and the old to the well and the ill. It has been utilized extensively in research and clinical practice, and it provides a holistic nursing focus. Limitations of this model pertain to its use with certain populations such as those who are cognitively impaired or who are unable to speak (Sheenan, 2006). The lack of appropriate communication makes the variables difficult to measure as well as presents problems with committing to a plan of action to engage in a health-promoting behavior; therefore, during implementation of this project, specific exclusion criteria to obtain the targeted population will be considered.

Evidence-Based Practice Model of Implementation

The Stetler Model. The Stetler Model served as a guide to implement this evidence-based practice project. The Stetler Model provided step-by-step instructions for

integrating research into practice and is practitioner-oriented based (Melnyk & Fineout-Overholt, 2011). During each stage, the practitioner utilized critical thinking and decision making to establish applicability of the research findings into practice. This five-stage model assisted in organizing and providing application of existing research-based knowledge into practice for individuals with type 2 diabetes.

Preparation. The first step of this model is to prepare by establishing and affirming a priority need. Often, clinical questions will be asked during this stage in a PICOT format. The PICOT question for this evidence-based practice project is: What is the effect of nutrition and physical activity education on knowledge and glycemic control among individuals with type 2 diabetes during a three month period?". With the PICOT question established, this project manager was able to search most relevant and best evidence pertaining to the desired project and proceed to the next stage of the Stetler Model.

Validation. Validation is established through systematically critiquing each article and synthesizing and summarizing the evidence relating to the identified need (Melnyk & Fineout-Overholt, 2011). For this project, 16 articles were selected as being both valuable and applicable to this project. The articles will later be critiqued to describe their quality, reliability, and credibility.

Comparative Evaluation/Decision Making. This stage is essential in determining the utility and feasibility of the findings to practice. During this stage, analysis of the risks, resources, and readiness of the target population will be considered. For this project, analysis of the setting, selected education tools, method of education delivery, perception of the clinic staff, and time availability for the patient will be considered to determine its desirability and feasibility.

Transition/Application. The transition stage involves translating the findings into a plan and implementing it. During this phase, nutrition and physical activity education

will be provided to individuals with type 2 diabetes, and their knowledge and glycemic control will be evaluated to establish a potential relationship between the factors.

Evaluation. The final stage is evaluation, and it involves analysis of the plan in order to determine the degree of implementation and establish if the goals utilizing evidence were met (Melnyk & Fineout-Overholt, 2011). This project manager anticipates that the Stetler Model will aid in guiding the desired change of increased knowledge and improved glycemic control for the type 2 diabetics who will participate from the clinical practice.

Strengths and Limitations. Strengths to the use of the Stetler Model for this evidence-based practice project pertain to its design which supports and enhances the use of research findings by the individual practitioner in clinical practice. The Stetler Model promotes the finding and use of best evidence and also enables examination of both the products and the process of research. The examination of the products and the process of research is essential for this evidence-based practice project to determine research findings and implications for future research. Limitations to the use of the Stetler Model in this evidence-based practice project may pertain to poor knowledge or skill for research utilization; thus, it could potentially result in the inappropriate or effective use of evidence-based practice (Stetler, 2001). However, formal education on research utilization, availability of education tools and resources, and the referral this researcher to a clinical advisor with expertise in research utilization to oversee this project will assist in minimizing this limitation.

Literature Search

The initial step of establishing evidence-based practice is identifying the PICOT question. The second step to answering the clinical question is searching for relevant evidence. A search was conducted through utilization of databases and with assistance of the research librarian to find the most relevant evidence. A literature search of

Cumulative Index to Nursing and Allied Health (CINAHL), Cochrane Database of Systematic Reviews, MEDLINE, Joanna Briggs Institute, and National Guideline Clearinghouse was conducted using various combinations of the keywords and various combinations with Boolean operators. The keywords included: glycemic control or type 2 diabetes mellitus; nutrition; physical activity; and knowledge. Search limiters applied included: scholarly, peer-reviewed journals; those printed in English; and research articles. Titles and available abstracts were reviewed to determine applicability to the proposed evidence-based practice project, and available full texts were examined to determine appropriate content. Inclusion criteria included: written in English and published between January 1997-May 2014. In order to be considered for review, the research article had to pertain to type 2 diabetes and discuss the following: use of nutrition or physical activity education to improve glycemic control and/or knowledge; use of hemoglobin A1c to measure glycemic control; or use of a specified test to measure knowledge. Exclusion criteria included: qualitative studies; studies that included children, adolescents, or pregnant women; studies that did not include a baseline hemoglobin A1c within the last three months to measure glycemic control; and studies that focused on type 2 diabetes prevention. Table 2.1 summarizes this search.

Table 2.1

Review of Literature for Glycemic Control and Knowledge

Search Engine	Total Results	Full Text Articles Reviewed	Relevant to Project	Selected for Project	Cite Chased Articles Reviewed	Cite Chased Articles Selected
CINAHL	345	15	10	6	2	1
Cochrane	135	4	3	2	0	0
Joanna Briggs	34	1	0	0	0	0
MEDLINE	60	3	2	0	0	0
National Guideline Clearinghouse	165	6	5	2	2	2

The review of the abstracts and full text articles led to cite chasing of the articles' references for possible research utilization. Cite chasing of four articles or guidelines led to the selection of two articles.

A second search of CINAHL, MEDLINE, Proquest, and Academic Search Premier of the Diabetes Knowledge Test was conducted using keywords: Diabetes Knowledge Test and glycemic control or knowledge. Search limiters were English language, published between January 1998 to May 2014, scholarly, peer reviewed, and research articles. Inclusion criteria included use of the Diabetes Knowledge Test in the study or measured the validity and reliability of the Diabetes Knowledge Test. Exclusion criteria included its use pertaining to children or utilization of a knowledge test other than the Diabetes Knowledge Test. Table 2.2 summarizes the search.

Table 2.2

Review of Literature for Diabetes Knowledge Test

Search Engine	Total Results	Full Text Articles Reviewed	Relevant to Project	Selected for Project.
CINAHL	15	5	4	1
Academic Search Premier	19	1	0	0
MEDLINE	24	4	2	2
Proquest	76	2	0	0

Saturation of the literature was achieved at 16 articles. All articles were appraised using the John Hopkins Nursing Research Evidenced-Base Practice Appraisal Rating Scale (JHNEBP). The purpose of this tool is to categorize the sources in a hierarchical manner according to the strength and quality of the evidence provided. Further detail regarding the JHNEBP and level of evidence present among the sources will be discussed.

Levels of Evidence

In order to evaluate the strength and quality of evidence for each article selected, the John Hopkins Nursing Research Evidenced-Base Practice Appraisal Rating Scale (JHNEBP) was utilized. There is one tool for research evidence appraisal and one tool for non-research evidence appraisal. The strength of the evidence for the research evidence appraisal is rated from level one to level three, and the strength of evidence for non-research evidence appraisal is rated from level four to level five. Level one consists of experimental studies, randomized control trials (RCT), and meta-analysis of RCTs. Level two consists of quasi-experimental studies. Level three consists of non-experimental studies, qualitative studies, and meta-syntheses. Level four consists of clinical practice guidelines and systematic reviews. Lastly, level five consists of expert opinions, case studies, and literature reviews (American Nurses Association (ANA), 2015).

In addition to the level of evidence, the quality of evidence is rated using letter grades of A, B, or C. A quality rating of “A” is high quality. A quality rating of “B” is good quality, and a quality rating of “C” is low quality or major flaws. The quality rating is the same for the research and non-research evidence when utilizing the JHNEBP. However, the non-research evidence appraisal possesses a separate quality rating scale for expert opinions. Expert opinions rated as high quality for demonstrating clearly evident expertise. Expert opinions rated as good quality expertise are demonstrated as being credible, and low quality expertise is demonstrated as being ambiguous. Evidence selected for this project is summarized in Table 2.3.

Table 2.3

Evidence Appraisal Using JNHEBP Research Appraisal

Author(s)/Year	Level of Evidence/Quality
Michigan Quality Improvement Consortium (MQIC) (2013)	Level IV/B Good

Shaya, Gbarayor, Laird, Winston, & Saunders (2011)	Level III/B Good
Nield et al., (2007)	Level IV/A High
Thomas, Elliot, & Naughton (2006)	Level IV/A High
Miller, Edwards, Kissling, & Sanville (2002)	Level I/A High
Christensen, Steiner, Whalen, & Pfister (2000)	Level III/B Good
Norris, Engelgau, & Narayan (2001)	Level IV/B Good
Fan & Sidani (2009)	Level I/A High
Agurs-Collins, Kumanyika, Ten Have, & Adams-Campbell (1997)	Level I/A High
Panja, Starr, & Colleran (2005)	Level III/B Good
Fitzgerald et al. (1998)	Level II/A High
Norris, Lau, Smith, Schmed, & Engelgau (2002)	Level I/A High
Ellis et al. (2002)	Level I/A High
American Associate of Clinical Endocrinologists (AACE) (2011)	Level IV/A High
American Diabetes Association (ADA) (2014)	Level IV/A High
Riethof et al. (2012)	Level IV/A High

Appraisal of Relevant Evidence

Impact of diabetes education on knowledge and/or glycemic control. The fundamental concept of diabetes management is maintaining one's glucose levels within a targeted range. In order for glycemic control to occur for persons with diabetes, health care providers must provide education that is most beneficial in managing their condition and optimizing their glycemic control. Research reveals that diabetic education can positively impact knowledge and/or glycemic control for persons with type 1 and type 2 diabetes (Agurs-Collins et al., 1997; Christensen et al., 2000; Ellis et al., 2004; Fan & Sidani, 2009; Miller et al., 2002; MQIC, 2013; Norris et al., 2001; Norris et al., 2002;

Panja et al., 2005; & Riethof et al., 2012). Through implementation of diabetes education, persons with type 2 diabetes can acquire information that serves as an intervention to improve knowledge, specific behaviors, and ultimately glycemic control. A summarization of the evidence can be found in Appendix A.

Ellis et al. (2004) performed a meta-analysis of RCTs in order to examine and characterize the effect of diabetes education on HbA1c levels for persons with diabetes. All RCTs selected were required to include educational interventions, pre and post-intervention HbA1c values, and a post-intervention HbA1c value measured at least twelve weeks following the intervention. Interventional teaching methods included: didactic teaching; goal setting with negotiation; dictated goal setting; situational problem solving; cognitive reframing; and "other" unique teaching methods which were not clearly defined by Ellis et al. (2004). Using meta-regression, a total of 28 educational interventions from 21 RCTs were analyzed among 2,439 adults with diabetes. The content of education included: dietary content; self-taught monitoring of blood glucose; basic diabetes knowledge; medication adherence; psychosocial topics; and various additional topics which were not clearly identified by Ellis et al. (2004). A fixed effects meta-analysis of the net glycemic change was employed to approximate the effects of glycemic control in relation to diabetes education (test for heterogeneity Q=14, d.f.=19, P=0.78).The results showed statistical significance with a net change of -0.486 (-0.923, -0.049) regarding glycemic effects on patient education in diabetes for studies that measured post-intervention HbA1c values at 24 weeks. Utilizing random effects meta-analysis for changes in glycemic control from the baseline HbA1c, statistical significance was noted with a drop between the baseline HbA1c value and at the 12, 24, and 52 week time interval among the intervention group (-1.238(-1.665, -0.811), -0.892(-1.428, -0.356), and -1.544(-2.26, -0.828), respectively). An estimate of between study variance with heterogeneity (τ^2) of 0.92 was found to be significant. Face-to-face interventions

utilizing cognitive reframing teaching or included exercise content demonstrated a greater decrease in post-intervention HbA1c. Meta-regression of glycemic change from baseline resulted in the following: τ^2=0.68 for face-to-face delivery; τ^2=0.73 for cognitive reframing technique; and τ^2=0.80 for inclusion of exercise content; thus, approximately 27%, 21%, and 14% of heterogeneity can be attributed between intervention difference and delivery methods, respectively. The findings revealed that patient education improved HbA1c among persons with diabetes. Face-to-face delivery, cognitive reframing teaching method, and exercise content were found to be influential in enhancing glycemic control; however, the amount of time for the intervention provided did not determine its success. A weakness of this meta-analysis may pertain to the inability to clearly define and describe each intervention which could have attributed to unidentified effects on glycemic control for both control and intervention groups. Additionally, the quality of the specific interventions methods employed was not the same; therefore, the results may be biased towards insignificance.

Fan and Sidani (2009) conducted a meta-analysis of the effectiveness of diabetes self-management education (DSME) interventions. DSME interventions were assessed in 50 RCTs for adults with type 2 diabetes. Data were extracted to assess the intervention elements in relationship to knowledge, self-management behaviors, and metabolic control outcomes. The following were identified as the interventional elements divided within six categories including: type of DMSE intervention (educational, behavioral, psychological, and mixed); teaching methods (didactic, interactive, and mixed); strategies for delivery (written, online/web-based, video, face-to-face, phone contact, and mixed); format (one-on-one/individual, group, and mixed); number of topics addressed during the intervention; and the dose of DSME (number of sessions, length of sessions, duration of intervention; and delivery of booster sessions). Weighted mean effect sizes (ES) were utilized to demonstrate the degree of relevancy of the

interventional element to the outcome. The knowledge outcome was found to have the greatest ES of 1.29 among the intervention elements compared to self-management behavior (ES=0.36) and metabolic control (ES=0.51) outcomes. The results demonstrate that face-to-face delivery strategy (ES=1.44) and the provision of a mixed instruction format (ES=2.99) are most effective in improving knowledge within their interventional element category. Behavioral interventions were found to have the greatest ES (ES=0.92) for self-management behavior outcomes, while mixed teaching methods have the greatest ES (ES=0.69) on metabolic outcomes within their interventional element categories. Fan and Sidani (2009) were unable to find a consistent pattern for delivery strategies across the outcomes. Similar to Ellis et al. (2004), Fan and Sidani (2009) noted face to face format methods to be most effective for glycemic control enhancement, and they also did not find an association between increased sessions or longer duration of sessions and enhanced diabetes self-management behaviors. Strengths of this meta-analysis pertained to its larger number of RCTs included and the examination of multiple interventions and outcomes.

In order to evaluate the efficacy of diabetes self-management education on HbA1c levels, Norris et al. (2002) examined the effect of baseline HbA1c, follow-up interval, and intervention features on HbA1c from 31 RCTs in their meta-analysis. A total of 4,263 adults with type 2 diabetes were included. Meta-analysis of the characteristics showed heterogeneity (Q) was significant (p<0.05) at immediate follow up. The mean decrease of HbA1c among the intervention group was 0.76%(95% CI 0.34-1.18) at immediate follow up (n=2056); 0.26% at one to three months of follow up (n=922); and 0.26% at greater than four months of follow up (n=1,892). Statistical significance was also identified between glycemic control and total contact time between patient and educator through meta-regression. Total contact time was reported in fifteen studies, where HbA1c measurements were decreased by 0.04%(95% CI, 0.01-0.08) for every

additional contact hour. Findings from the meta-analysis support improvement in glycemic control with increased contact, differing from the findings of previous meta-analyses discussed, and immediate follow up after receiving diabetes self-management education demonstrated improved glycemic control. Additionally, while Norris et al. (2002) identified a decrease in the benefit from the intervention one to three months after the intervention was ceased, clinical significance was not established. The generalizability of these findings were limited to clinical settings and to lifestyle and knowledge interventions based on the characteristics of the RCTs examined and utilized for this meta-analysis.

Norris et al. (2001) conducted a systematic review of 72 studies in order to evaluate the effectiveness of self-management training for persons with type 2 diabetes. Only RCTs were selected for this systematic review, and studies were selected only if all or most participants had type 2 diabetes, were older than 18 years of age, and the if effects of the educational components could be examined separately in studies where multiple interventions were used. Heterogeneity was identified with the studies in respect to patient population, outcomes assessed, education interventions, generalizability, and study quality. The findings demonstrated short-term improvement (<6months) in relationship of diabetes self-management training and knowledge, glycemic control, accuracy and frequency of self-management blood glucose (SMBG), and reporting dietary habits. Norris et al. (2001) suggest that education interventions that support collaboration with the patient will be more likely to increase glycemic control than didactic interventions. Interventions that involved more frequent reinforcement, involved patient participation and collaboration with provider, and utilized a longer follow up also demonstrated increased effectiveness in glycemic control enhancement. Norris et al. (2001) were also unable to establish a correlation of improved glycemic control to measured changes in knowledge and additionally found several variations among

physical activity levels and interventions. The utilization of a large number of studies and RCTs strengthened this systematic review as many generalizations can be made. However, while all studies utilized for this systematic review were identified and described, a weakness was noted with the organization of the studies. Due to poor organization of the studies within the systematic review, it was difficult to identify the number of overall participants included.

As with Ellis et al. (2004), Christensen et al. (2000) found an improvement between pre and post HbA1c levels after participants received patient education; however, unlike Ellis et al. (2004), Christensen et al. (2004) found patient education regarding medical nutrition therapy to be influential in enhancing glycemic control. Using a retrospective study, Christensen et al. (2000) revealed a significant difference between mean pre-education HbA1c levels and mean post-education HbA1c levels, regardless of age, sex, level of education, type of diabetes, or body mass index. With a sample size of 102 participants with type 1 or type 2 diabetes, Christensen et al. (2000) performed a retrospective chart review to determine the influence of medical nutrition therapy (MNT) and diabetes self-management by a dietician in decreasing HbA1c levels. A total of 15 persons with type 1 diabetes and 87 persons with type 2 diabetes who were diagnosed with diabetes for 6 months or longer were included within the study. The patients had a minimum of two sessions with the dietician for MNT, and during this time, patients established specific, individualized goals to improve glycemic control. Additionally, patients had to complete a self-rating of their understanding of diabetes topics using a Likert scale to determine if a relationship existed between diabetes control and self-perceived mastery of a skill. Christensen et al. (2000) utilized paired t-tests to compare HbA1c levels before and after education, correlation calculations to establish demographic components with glycemic control, and analysis of variance (ANOVA) to determine variances between HbA1c levels and the type of diabetes and sex of the

patient. Significant improvement of HbA1c levels were noted for persons with type 1 diabetes (mean pre-education HbA1c of 9.24% ± 1.75 with *t*=8.74 to mean post-education HbA1c of 7.97% ± 1.29, *P* < 0.005) and persons with type 2 diabetes (mean pre-education HbA1c of 9.35% ± 2.12 to mean post-education HbA1c of 7.70% ± 1.53, *P* < 0.000). A significant statistical difference was also noted between mean pre-education HbA1c levels (9.32% ± 2.06) and mean post-education HbA1c levels (7.74% ± 1.48, *P* < 0.001, 95% CI = 1.22-1.94). Furthermore, the perception of understanding of diabetes between pre and post education scores improved after the education sessions for medical nutrition therapy (MNT) and diabetes self management but was not statistically significant.

A RCT conducted by Miller et al. (2002) sought to evaluate the impact of nutrition education on glycemic control among persons with type 2 diabetes who are 65 years of age and older. A total of 98 persons were recruited and randomly assigned to a control or experimental group. The control group (n=45) received “usual care”, while the participants in the experimental group (n=47) received six 2-hour group education sessions over ten weeks regarding key principle diabetes interventions. A pre and post-test control group design was utilized and measured HbA1c, fasting blood glucose, and serum lipids. Six individuals did not complete the posttest data collection and were excluded from the study. Paired t-tests were employed to assess change between pre and post-test, and a two-sample t tests were employed to compare post-test groups. With statistical significance defined as $\propto$=0.05 for all tests, statistical significance was only identified with HbA1c values at the post-test among the experimental group (P=0.005), demonstrating a decreased mean HbA1c level to <7.0%. No statistical differences between genders for glycemic control were noted. As with Christensen et al. (2000), Miller et al. (2002) concluded that nutrition education is necessary for this population and can also contribute to enhanced glycemic control; however, a weakness

pertaining to both studies was that the participants were most Caucasian, limiting the generalizability of the information across diverse populations.

Nutrition and physical activity interventions for glycemic control. Evidence-based clinical practice guidelines assist providers with best evidence and quality information for utilization into daily practice. There are many available clinical practice guidelines for diabetes management in persons with type 2 diabetes. The AACE released their most recent clinical practice guidelines in 2011. The purpose of the guidelines is to serve as an evidence-based resource for providers caring for persons with diabetes. The guidelines address criteria necessary to diagnose a person with type 2 diabetes, preventative strategies, target HbA1c goals, important education strategies, medication therapy, and lifestyle interventions. In order to assist with maintaining and improving glycemic control, the AACE (2011) recommends that therapeutic lifestyle management discussion occur between the provider and patient at diagnosis and throughout the lifetime for all persons with diabetes. The AACE (2011) describes therapeutic lifestyle management to include medical nutrition therapy and prescribed physical activity. In order to accommodate for the patient's restrictions and goals, the AACE (2011) recommendations individualized medical nutrition therapy and physical activity plans for each patient. Additionally, physical activity programs should also begin slow and gradually build based on the individual (AACE, 2011).

The ADA (2014) evidence-based clinical practice guidelines were also developed to serve as a resource for healthcare providers caring for persons with diabetes. The ADA (2014) guidelines share similarities to the AACE (2011) guidelines for addressing diagnosis criteria and diabetes management. The ADA (2014) recommends individualized medical nutrition therapy for persons with type 1 and type 2 diabetes as it can result in decreased HbA1c levels. Recommendations for physical activity are outlined as performing at least 150 minutes a week of moderate intensity aerobic activity

over at least three days a week; however, the ADA (2014) recommendations do not address alternatives for the physical activity recommendations if restrictions are present.

In an attempt to achieve significant management outcomes for persons with type 1 and type 2 diabetes, the Michigan Quality Improvement Consortium (MQIC) released evidence-based clinical practice guidelines in a 2013 updated version. MQIC develops guidelines affecting a significant portion of the general population, based on evidence-based practice recommendations in an effort to improve the quality of care provided to individuals in Michigan (MQIC, 2013). The original MQIC guidelines for management of diabetes mellitus were developed in 2000, but the MQIC has established specific dates to review their most recent version of the guidelines in order to base the future guidelines on the most recent evidence-based literature. The MQIC (2013) guidelines address key management areas including: evaluation of assessments and laboratory tests and management and treatment such as education, counseling, and medical treatment. MQIC (2013) guidelines recommend the provision of individualized education to teach the importance of maintaining a healthy diet and regular physical activity. Furthermore, plans should be made between the individual and a collaborative team or diabetic educator to assess knowledge and self-management skills and create strategies to make changes in health behaviors including nutrition management and physical activity (MQIC, 2013).

Representing the Institute of Clinical Systems Improvement (ICSI), Riethof et al. (2012) authored clinical practice guidelines to assist with diagnosis and management for type 2 diabetes in adults. Therapeutic lifestyle interventions are heavily addressed within these guidelines especially in relation to nutrition and physical activity. The guidelines emphasize the initial and ongoing nutrition education and therapy for persons with type 2 diabetes to reduce hyperglycemia and hypertension as well as improve dyslipidemias. Nutrition therapy is designed to improve metabolic outcomes through alterations in

nutrient consumption and lifestyle habits. Collaboration with the individual by a registered dietician or clinician with nutrition therapy knowledge is recommended to devise and implement a nutrition plan. Riethof et al. (2012) suggest additional nutritional education for persons with type 2 diabetes in an individual or group setting. Riethof et al. (2012) also identify physical activity as benefiting persons with type 2 diabetes by improving glycemic control, enhancing insulin sensitivity, improving cardiac status, and improving lipid profiles. Similar to the AACE (2011) and ADA (2014), Riethof et al. (2012) recommend physical activity to be performed for at least 150 minutes per week with moderate intensity activity along with inclusion of resistance training if not contraindicated. Provisions were included for those who may have contraindications that would prevent moderate intensity activity or inactive individuals who need to initiate increased physical activity. Differing from all other guidelines discussed within this chapter, Riethof et al. (2012) address alternatives such as increasing activity level by ten minutes each through use of stairs rather than an elevator, parking a vehicle and walking farther to the destination than usual parking habits, or walking to do errands.

Switching from guidelines that recommend practice to systematic reviews that often support a guideline implementation, Nield et al. (2007) examined 1,467 persons with type 2 diabetes in a systematic review in order to assess the effects of various types and frequency of dietary advice among persons with diabetes. A total of 18 studies were included within this systematic review, and the studies shared similar interventions that grouped dietary advice versus dietary advice plus behavioral approaches. Findings showed that there was not enough high quality data regarding the efficacy of dietary treatments for type 2 diabetes; however, Nield et al. (2007) coincidentally found that implementation of exercise improved HbA1c at six and twelve months follow up from the baseline HbA1c. Nield et al. (2007) conclude that the best way to promote enhanced glycemic control among persons with type 2 diabetes is through exercise and a reduced

energy diet. The findings are consistent with the established guidelines mentioned. Weaknesses to this systematic review pertained to the inability to conclude satisfaction with a specific dietary advice intervention due to the lack of available data.

Through utilization of a systematic review to assess the effects of exercise among 377 persons with type 2 diabetes, Thomas et al. (2006) found that exercise interventions significantly improved HbA1c levels in the intervention groups in comparison to the control groups. The findings are consistent with guideline recommendations from the AACE (2011), ADA (2014), MQIC (2013), Riethof et al. (2012), and Nield et al. (2007). Thomas et al. (2006) compared fourteen studies that examined exercise versus no exercise intervention. Minimal heterogeneity was noted, and variation of exercise intensities demonstrated improvement in glycemic control which was found to be inconclusive by Norris et al. (2011). In addition, Thomas et al. (2006) suggested that exercise can assist in sustaining glycemic control over longer periods of time; however, exercise prescriptions that include a variety of activities may increase exercise compliance over longer periods of time.

In a RCT conducted by Agurs-Collins et al. (1997), a weight loss and exercise program intervention demonstrated effectiveness in improving blood pressure and glycemic control among 64 African-Americans with type 2 diabetes. With 32 persons in each group, the intervention group completed twelve weekly group sessions, six bi-weekly group sessions, and one individual education session over twelve weeks, and the control group received one education session focused on glycemic control and additional mailings about nutrition. HbA1c levels and serum lipid samples were drawn at baseline, three months, and six months. At three months post intervention, significance was noted with a decrease in the HbA1c in the intervention group ($P<0.01$), and at six months post intervention, a significant decrease in HbA1c was noted among men ($P<0.01$) and women ($P<0.001$) within the intervention group. Agurs-Collins et al. (1997)

was the only study that identified a significance in the decrease in HbA1c in specific relationship to men and women. Additional significant ($P<0.05$) and improved changes were noted with physical activity, and nutritional knowledge at three months post-intervention among the intervention group. Surprisingly, compared to other literature, Agurs-Collins et al. (1997) did not find HbA1C levels to necessarily correlate with diet, knowledge, or weight. Strengths to this RCT pertain to the consistency of participation by subject with the intervention, and the participant characteristics that enhance the generalizability of the findings.

The Diabetes Knowledge Test. The Diabetes Knowledge Test was developed by the Michigan Diabetes Research Training Center (MDRTC) which is a multidisciplinary unit with the University of Michigan. MDRTC is funded by the National Institute of Diabetes and Digestive and Kidney Diseases/National Institute of Health. The purpose for the development of the Diabetes Knowledge Test was to gauge the general knowledge of diabetes. For persons with diabetes who use insulin, the entire 23-item test is utilized; however, for those who do not use insulin, only the first 14 items of the test would apply. This test has been utilized in many studies in order to evaluate diabetes knowledge, and diabetes knowledge scores have also been evaluated for correlation to glycemic control. The Diabetes Knowledge Test has also been evaluated for its validity and reliability.

Fitzgerald et al. (1998) sought to determine the validity and reliability of the Diabetes Knowledge Test. Using a community population receiving diabetes care from various providers and another population receiving diabetes care from a local health department to complete the Diabetes Knowledge Test, Fitzgerald et al. (1998) evaluated the reliability of each sample using Cronbach's coeffiecient α. Both samples were found to be reliable with $\alpha \geq 0.70$. To establish validity, Fitzgerald et al. (1998) assessed each sample test separately depending on which Diabetes Knowledge Test was completed.

Fitzgerald et al. (1998) utilized the Bon-ferroni adjustment for multiple statistical tests (P=0.01) for analysis variance for scores by diabetes type and treatment, scores by educational level, and scores by education level received. Differences between the three categories were then determined using the Tukey-Kramer honestly significant difference test (global P=0.05). Fitzgerald et al. (1998) found that the general test and the insulin-use subscale are reliable with an $\alpha \geq 0.70$ for both, and the reliability estimates were found to be similar for both sample populations. In regards to validity, persons with type 1 diabetes were found in both sample populations to have a higher score than persons with type 2 for the general test, and in both sample groups, scores increased with education level and in relation to receipt of diabetes education (Fitzgerald et al.,1998). Thus, this proves its validity and reliability. The findings also suggest this test can be utilized in a variety of settings and among a variety of patient populations.

Correlation between education, knowledge, and glycemic control. As previously discussed, the literature shows that diabetes self-management education can contribute to increased glycemic control among persons with type 2 diabetes, and specific education regarding nutrition and physical activity interventions are beneficial to glycemic control as well. It is also important to understand the relationship between diabetes education, knowledge, and glycemic control.

Seeking to explore the influence of an educational intervention for persons with diabetes regarding knowledge and their understanding, Shaya et al. (2011) examined Diabetes Knowledge Test scores of 622 patients with type 1 or type 2 diabetes. The test was administered at baseline and every six months for two years. Shaya et al. (2011) found that those exposed to education programs had higher knowledge scores than those who receive usual care, and educational programs are the most significant and predictive factor for score improvement. Furthermore, both insulin and non-insulin users

were found to have knowledge score improvement over time with the most significant improvement noted at six month follow up (Shaya et al., 2011).

While Shaya et al. (2011) only sought to evaluate education intervention and knowledge correlation, Panja et al. (2005) conducted a correlational study to determine if a relationship exists between knowledge and glycemic control. Using the Diabetes Knowledge Test, knowledge scores obtained from 77 persons with type 2 diabetes demonstrated an inverse relationship with HbA1c levels. Panja et al. (2005) utilized a regression analysis of HbA1c values with the total number of correct answers for the first fourteen questions of the Diabetes Knowledge Test in order to establish a predictor variable. Stepwise regression was then employed to determine the individual contributions of the questions. Panja et al. (2005) examined individual responses from specific test questions to determine if a relationship existed between a correct response and lower HbA1c levels. The average number of questions answered correctly was 8.5 ± 2.3 for the first fourteen questions, and the mean HbA1c value was 8.05±1.6. With utilization of regression analysis, an inverse relationship was demonstrated between HbA1c values and the number of questions answered correctly ($r=-0.337$, $p=0.003$). Questions 1, 3, and 9 pertain to knowledge regarding diet and exercise, and the results demonstrated that individuals who answered these items correctly were found to have lower HbA1c levels ($p<0.001$). Panja et al. (2005) further suggested that stressing the importance of treatment and improvement in diabetes knowledge may further enhance glycemic control and reduce risks of diabetes related complications.

Construct Evidence-Based Practice

With the basis of the appraised literature established, the proposed evidence-based practice project formed the foundation of the suggested best practice. Furthermore, the appraised literature provided the underpinning to answer the clinical question. These details will be further discussed in the next sections.

Synthesis of Critically Appraised Literature

Findings from the appraised literature have contributed to the understanding of the implications of glycemic control and knowledge for persons with type 2 diabetes. Diabetes education is utilized to provide essential information and has been found to positively impact both knowledge and glycemic control for this population (Agurs-Collins et al., 1997; Christensen et al., 2000; Ellis et al., 2004; Fan & Sidani, 2009; Miller et al., 2002; MQIC, 2013; Norris et al., 2001; Norris et al., 2002; Panja et al., 2005; & Riethof et al., 2012). Diabetes education has a direct correlation to increased knowledge, and increased knowledge positively effects glycemic control (Panja et al., 2005; & Shaya et al., 2011). Diabetes education delivered through a face-to-face format and with patient participation and collaboration was found to be most beneficial for glycemic control enhancement (Ellis et al. 2004; Fan & Sidani 2009; & Riethof et al. 2012). Additionally, a general consensus regarding the most effective type of interventions, teaching methods employed, or length of education sessions was unable to be reached among the researchers.

Many of the clinical practice guidelines and researchers specifically support the provision of nutrition and physical activity interventions in order to aid glycemic control for persons with type 2 diabetes (AACE, 2011; ADA, 2014; Agurs-Collins et al.,1997; MDIC, 2012; Nield et al., 2007; Riethof et al., 2012; & Thomas et al., 2006). The general consensus for nutrition and physical activity interventions is that it should be individualized and specific to the person and should be provided on an ongoing basis. For persons with contraindications to specific physical activity regimen, efforts should be pursued on a smaller scale that will increase physical activity without compromising the individual's health status. Lastly, a physician, APN, or diabetes educator who can provide education and assist in formulating strategies and a plan of action should provide the nutrition and physical activity education to persons with type 2 diabetes.

Best Practice Recommendations

After synthesis of the literature, the best practice recommendation is to provide nutrition and physical activity education to persons with type 2 diabetes through a face-to-face delivery method. Utilization of an education tool that is parallel to clinical practice guideline recommendations and accommodates modifications necessary for some persons will be employed. In order to assess knowledge, it was determined that the Diabetes Knowledge Test can be utilized for this population. Instructions will be provided on how to administer and manually score the test. Additionally, HbA1c levels can be obtained before and after intervention through standard of care in order to determine the effectiveness of the intervention. Through this intervention, it is anticipated that glycemic control and knowledge regarding type 2 diabetes will improve for this population.

Answering the Clinical Question

Data collected during the review of literature produced the best practice recommendation and assisted with answering the clinical question: What is the effect of nutrition and physical activity education on knowledge and glycemic control among individuals with type 2 diabetes during a three month period? Through implementation of the evidence-based practice project, more relevant data essential to answering the clinical question will be provided.

CHAPTER 3

IMPLEMENTATION OF PRACTICE CHANGE

The translation stage of the Stetler Model was the fourth stage. This stage involves translating the findings into a plan and implementing it. Chapter three will discuss how the evidence was translated into action in order to answer the PICOT question: What is the effect of nutrition and physical activity education on knowledge and glycemic control among individuals with type 2 diabetes during a three month period?".

Participants and Setting

A local primary care office was the setting for this evidence-based practice project. Many of the patients presenting the primary care office each day have type 2 diabetes and require ongoing education to assist with managing the disease according to the clinical agency. Inclusion criteria included persons with type 2 diabetes who presented to the primary care office for medical care and who also spoke English. Participants who did not have type 2 diabetes, were pregnant, were eighteen years of age or younger, or had cognitive or mental impairments that resulted in their inability to make personal informed decisions regarding their care were excluded from participation in this project. The project manager read the informed consent in its entirety to any persons with type 2 diabetes who were illiterate or had a visual impairment that impacted their ability to read the informed consent. Additionally, eligible participants were required to sign an informed consent for electing to participate in this evidence-based practice project (see Appendix B).

Outcomes

Diabetes knowledge and glycemic control were the two major outcomes evaluated during this evidence-based practice project. Utilization of the Diabetes Knowledge Test served to assess the knowledge outcome before and after delivery of

the intervention. Glycemic control was also evaluated and analyzed by obtaining HbA1c levels before and after delivery of the intervention.

Intervention

Individualized educational sessions were held at the primary care office during the time the participant waited in the examination room to be seen by the primary care physician. At the beginning of the session, the participant was introduced to the project and provided with an informed consent document. The project manager was available to review the informed consent document, answer any questions from potential participants, and have the participant sign the consent form. After thoroughly reviewing the document, participants were provided a copy of the informed consent. At this time, a demographics questionnaire was collected regarding participant's gender, age, race, number of years diagnosed with type 2 diabetes, and methods of glycemic control such as oral medication, insulin, or lifestyle adjustments. This questionnaire was only collected one time. A separate document requested the participant to fill out his/her name, address, and health care provider managing his/her diabetes. The purpose of collecting the participant's name, address, and health care provider information was to mail a letter regarding the individual's participation in the evidence-based practice project to the health care provider. A letter was only mailed if the health care provider managing the participant's type 2 diabetes was not the physician at the project site. It was important to ensure that the participant's health care provider managing the participant's type 2 diabetes was aware of their participation because increasing diabetes knowledge may help to improve diabetes control, thus possibly leading to a change in the required medications to manage the condition. Separate documents including the thank you letter and post-intervention Diabetes Knowledge Test were mailed to the participant three months after the educational intervention. Additional details are discussed below.

After answering all of the questions from the potential participant and the informed consent document was signed, the Diabetes Knowledge Test was administered which served as the pre-intervention test to provide a measurement of baseline diabetes knowledge. Family or friends who were present with the participant were permitted to stay during the pre-intervention test administration and individualized educational session; however, they were asked not to assist the participant with answering questions for the pre-intervention test as it can skew the data. Immediately after the pre-test is completed, the participant received an approximate ten minute face-to-face education discussion on nutrition and physical activity by the project manager (see Appendix H for an outline of education provided and discussed topics). Additionally, family and friends who were present were allowed to ask questions during this time; however, the focus was on the participant. Questions or situations that did not pertain to the participant's type 2 diabetes management, type 2 diabetes disease process, or are outside of the scope of this evidence-based practice project were deferred to the appropriate source such as a family doctor, etc. The education provided to the participant was based on information from the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Diabetes Information Clearinghouse (NDIC), National Institutes of Health, and the U.S. Department of Health and Human Services (USDHHS). A total of two education pamphlets supported by these organizations was provided to reinforce the discussed topics (see Appendix L). After completion of the face-to-face intervention, the participant was provided a folder with a copy of the education material, a copy of the informed consent, and lastly, an information and introduction sheet regarding the project manager (see Appendix C).

The second outcome measured for this evidence-based practice project was management of blood glucose, otherwise known as glycemic control. There are different ways to measure glycemic control for an individual with diabetes. Most commonly,

individuals with diabetes self monitor their blood glucose at home using a personal glucometer to check it at different times of the day such as in the morning or before meals. This requires the individual to remember to check their blood glucose as directed by their health care provider and subject themselves to frequent needle sticks to obtain a blood specimen to measure their blood glucose level. Another way to measure glycemic control for individuals with diabetes is through a blood test that is able to measure the average blood glucose level over the last 120 days called a glycosylated hemoglobin (HbA1c). The benefit to this blood test is that it allows the healthcare provider to examine how well the patient is doing overall in order to make adjustments to therapy; however, this does not mean that the patient will be exempt from self monitoring their blood glucose levels on a daily basis.

As prescribed therapy and patient compliance may differ on an individual basis for self-monitoring blood glucose levels, the most appropriate measure to gauge glycemic control for participants is through the HbA1c test. As the participants have type 2 diabetes, it is standard of care for their primary care provider to routinely order for a HbA1c level to be drawn at least every six months in order make clinical decisions or therapeutic changes with their care. In cases of poor glycemic control, primary care providers can order HbA1c levels to be drawn as often as every three months until glycemic control is obtained (ADA, 2014). Pre-intervention HbA1c levels were obtained from the participant's medical record based on the last charted HbA1c level. A pre-HbA1c level was documented if it was collected within the last three months. If a pre-HbA1c level is unavailable or outside of the necessary time frame, the participant was still provided with the educational intervention in order to allow the participant the opportunity to increase their knowledge. Pre-and post Diabetes Knowledge Tests were administered and evaluated for knowledge enhancement; however, for these participants, the project manager was unable to measure and analyze glycemic control

due to a lack of necessary data. The project manager did not ask, inquire, or suggest a HbA1c level be ordered or drawn to the participant or primary care physician for any reason.

Approximately three months post-intervention, a thank you letter and a post-intervention Diabetes Knowledge Test was mailed to the participant with a pre-stamped and pre-addressed envelope included for return (see Appendix D, Appendix K). Post-intervention HbA1c levels were obtained at three months post intervention from the participant's medical record at the primary care office, if available, following standard of care guidelines as previously mentioned. Participants were tracked through a coding system linked to their name through an assigned identification number in order to better protect patient confidentiality. The significance of the coding system linked between their name and assigned number was to ensure accurate data collection and analysis for participants who completed both pre-and post interventions.

Planning

The basis for this project began with a discussion of the proposed evidence-based practice project with the primary care physician who agreed to support the implementation of the clinical practice recommendation. Collaboration with the primary care physician took place in order to establish dates and times for the interventions to occur. Prior to implementing the clinical practice recommendation, office staff who are registered nurses (RNs), licensed practical nurses (LPNs), or medical assistants (MAs) were provided with the same educational intervention provided to participants, a copy of the education pamphlets, an explanation of the evidence-based practice project, and directions of how to contact the project manager in an approximate 20 minute meeting (see Appendix E). Office staff were advised to refer all questions by participants regarding this evidence-based practice project to the project manager via email or cell phone number or to the participant's doctor if it involved more specific questions or

concerns regarding their individualized diabetes management. Participants were advised that a formal letter would be sent to their healthcare provider managing their disease, if other than the primary care physician, regarding their participation in this evidence-based practice project in case changes in their diabetes management was warranted (see Appendix J).

Permission to use, administer, and score the Diabetes Knowledge Test was provided by the Michigan Diabetes Research and Training Center (MDRTC) and was clearly identified on the MDRTC website. Permission to use, distribute, and duplicate the two education tools selected from The National Diabetes Information Clearinghouse (NDIC) was also identified on the tools.

Recruiting Participants

Participants were recruited using a convenience sample. Participants were asked by the staff nurse if they were interested in participating in an evidence-based practice project and receive a brief education session during their wait time to see their physician. Potential participants were identified by staff based on their age and type of diabetes. Nursing staff alerted the project manager of potentially interested participants. Once participants were placed in examination rooms, the project manager verified and obtained participant consent and provided the education intervention at that time. The project manager hoped to recruit a minimum of 15 participants into this evidence-based practice project. In order to do so, the project manager spent four days at the primary care office recruiting participants.

Data

Measures and their reliability. In order to measure data for analysis, the following instruments were utilized: pre and post-knowledge test using the Diabetes Knowledge Test and pre-and post HbA1c levels. Additionally, demographics were collected using a questionnaire at the beginning regarding participant's, sex, age, race,

number of years diagnosed with type 2 diabetes, and methods of glycemic control such as oral medication, insulin, or lifestyle adjustments. (see Appendix F). Reliability of the Diabetes Knowledge Test was supported by the study conducted by Fitzgerald et al. (1998) which was previously discussed. Due to the strength of the study Fitzgerald et al. (1998) conducted to assure reliability, the MDRTC provides and cites the reliability table created by Fitzgerald et al. (1998) to demonstrate the reliability of every item on the Diabetes Knowledge Test. Additionally, reliability of the glycemic control was demonstrated through utilization of HbA1c testing. As participants may forget to check daily or more frequent blood sugars, use different glucometers, or forget to provide a list of the blood sugar readings collected at home, utilization of the HbA1c to measure glycemic control was conducted. Utilization of the HbA1c allowed for evaluation of glycemic control over the past three months at one specific time. Measurement of glycemic control at one point in time before and three months after intervention rather than multiple times increased its reliability by reducing various errors arising from potentially inaccurate or poorly calibrated, personal glucometers.

Collection. There were a variety of means employed in order to collect data for the evidence-based practice project. Informed consent was obtained before providing the pre-intervention Diabetes Knowledge Test or any education. The project manager collected data from the pre-and post-intervention tests and obtained HbA1c levels from participant medical records. The participant's address and health care provider who manages his/her diabetes was obtained in order for the participant to complete the post-intervention knowledge test (see Appendix G). The post-intervention Diabetes Knowledge Test and a letter thanking the participant for participating was mailed to the participant three months after the educational intervention, and at that time, post-intervention HbA1c levels were obtained from the participant's medical record.

Data Collection Revisions

Due to poor return initially of the post-intervention Diabetes Knowledge Test, a change from the original project data collection plan was requested and approved by the Valparaiso University Institutional Review Board (IRB). The participants who had not responded after the initial three-month post intervention period were mailed another copy of the post-intervention Diabetes Knowledge Test five months post intervention. Included with the post-intervention Diabetes Knowledge Test was a reminder letter for its completion, and participants were notified that they may receive a reminder phone call in a few days (see Appendix J). Participants were advised that when they received the phone call, they would be permitted to complete the post-intervention Diabetes Knowledge Test over the phone. Contact telephone numbers were obtained from their medical records for the individuals who had not returned the initial post-intervention Diabetes Knowledge Test. The phone call took place five days after mailing the post-intervention Diabetes Knowledge Test for the second time. Additionally, a second phone call was placed two days after the first phone call if the participant did not answer or return the initial phone call.

Management and analysis. The influence of education regarding nutrition and physical activity education and its effect on knowledge and glycemic control was measured using the Diabetes Knowledge Test and HbA1c levels which served as pre- and post intervention tests. Pre-intervention HbA1c levels were accepted if collected within four weeks of the intervention, and post-intervention HbA1c levels were accepted if collected within four weeks of the three months post-intervention Diabetes Knowledge Test. Results of the pre and post-intervention tests were compared to determine if change occurred. Wilcoxon's signed-rank test was used to compare pre and post-education HbA1c levels and Diabetes Knowledge Test scores for each participant.

Protection of the Human Subjects

As with any clinical practice recommendation, guaranteeing the protection of human subjects was both essential and mandatory. For this evidence-based practice project, several methods were employed to protect the subjects and their rights. Prior to initiation in planning this evidence-based practice project, the project manager completed training through the National Institutes of Health that included education on the Belmont report which stressed protection of human subjects and their rights. Along with completion of the training, the proposed evidence-based practice project was reviewed and approved by the IRB at Valparaiso University and the healthcare facility prior to implementation of the clinical practice recommendation. Methods to minimize risks to participants were developed. Informed consent was provided to all participants with emphasis of no penalty or deviation from standard of care would occur due to declining to participate or withdrawing from the project at any time. Participants were encouraged to contact the project manager with any questions or concerns via email. Confidentiality was employed and maintained through the use of a coding system for the intervention tests. A key for the coding, the Participant Address and Health Care Provider forms, intervention tests, demographic questionnaires, and informed consent forms were secured in a locked box once completed. Specific details are described below.

In order to maintain confidentiality, coding was employed utilizing an assigned ordinal number sequence and correlating the assigned number to the participant's name. After the informed consent was signed, the participant was assigned a number which was written in the top right hand corner of their demographics questionnaire, Participant Address and Health Care Provider form, informed consent, and pre-and post-intervention Diabetes Knowledge Test. In a separate black composition notebook served as the coding key, the participant's assigned number was written and correlated to their name. The project manager kept a separate document on hand that only listed the

participant's assigned number without the participant's name and boxes to mark participant completion and the scores/values of pre-and post intervention tests for this project. The purpose of the separate document was to maximize participant confidentiality but also assist in accurate data collection and analysis. As mentioned before, the black composition notebook, the informed consents, intervention tests, demographic questionnaires, and the Participant Address and Health Care Provider forms will remain in a secured, locked box. When post-intervention HbA1c levels were needed, the project manager requested the HbA1c levels from the primary care physician by the participant's name. The primary care physician obtained and provided the HbA1c levels verbally to the project manager via face-to-face interaction. The post-intervention HbA1c levels were written on the separate document that only contained the participants' assigned numbers and intervention scores/values as previous mentioned. Once all of the data was collected or the project time frame ended, the black composition notebook, Participant Address and Health Care Provider forms, intervention tests, demographic questionnaires, and informed consents were be stored and will remain secured in a locked box for three years.

CHAPTER 4

FINDINGS

The purpose of this EBP project was to improve diabetes knowledge and glycemic control through the provision of nutrition and physical activity education. To assess the effectiveness of the diabetes education provided, the HbA1c levels and diabetes knowledge scores for the persons with type 2 diabetes in the pre-intervention group were compared to the post-intervention group.

Participant Characteristics

Baseline data for this EBP project were collected using a pre-intervention Diabetes Knowledge Test and measuring HbA1c values at pre-intervention. Pre-intervention Diabetes Knowledge Test scores and available HbA1c values were compared to post-intervention Diabetes Knowledge Test scores and available HbA1c values. Through evaluation of the data, it was the goal of the project manager that the HbA1c levels and diabetes knowledge scores would improve after the implementation of the nutrition and physical activity education, thus demonstrating the intervention was effective.

Size. A total of 17 participants were recruited and participated in the pre-intervention portion of this EBP project. Regardless of available or recent HbA1c levels upon initiation of the pre-intervention, participants were included and educated as they could still complete the diabetes knowledge portion of this EBP project.

Characteristics. Demographic data was collected from all participants (n=17). Nine participants completed the post-intervention Diabetes Knowledge Test. Only two participants had recent HbA1c level results available, one of whom also completed the post-intervention Diabetes Knowledge Test. The sample consisted of persons with type 2 diabetes ages 40 to 75, who presented to the primary care office in August 2014. The

mean age was 56.7 years. The mean number of years diagnosed with type 2 diabetes was 7.8 years with a range from 1 to 20 years. Of the group, 11 participants or 64.7% were Caucasian, 3 participants or 17.6% were African American, and 3 participants or 17.6% were Hispanic. See Table 4.1 for demographic data.

Table 4.1

Demographic Data of Participants at Pre- and Post-test Intervention

	Pre-test Intervention	Gender Male:Female	Post-test Intervention	Gender Male:Female
Caucasian	11	6:5	8	3:5
Hispanic	3	3:0	1	1:0
African-American	3	1:2	0	0:0
Total Participants	17	10:7	9	4:5

Changes in Outcomes

Statistical Testing. Statistical analyses of the data collected were performed to answer the PICOT question: “What is the effect of nutrition and physical activity education on knowledge and glycemic control among individuals with type 2 diabetes during a three month period?”. An analysis was performed in order to make comparisons between pre-and post-intervention diabetes knowledge scores using the Wilcoxon signed-rank test. The Wilcoxon signed-rank test, a nonparametric test, was selected because the sample was not normally distributed, as eight participants did not complete the post-intervention test. Through utilization of the Wilcoxon signed-rank test, one is able to determine if there is a statistical difference in the scores obtained by the same individuals at different points in time.

Available pre- and post intervention HbA1c levels were reviewed and noted; however, a data analysis was not performed due to a very small sample available (n=2).

Due to a small sample size, the reliability of the pre- and post intervention tests were not calculated. A more thorough examination of the implications regarding the nutrition and physical activity education will be discussed in Chapter 5.

For the pre-intervention test, all participants (n=17) correctly answered item 13 which addressed decreased risk of heart disease related to consumption of foods lower in fat. Item 19 addressed frequent check-ups with a doctor to detect early signs of diabetes complications and was the second highest scored item (n=16). The most commonly missed item (n=4) was item 2 which addressed the length of time a HbA1c test measured blood glucose levels. Item 5 addressed the most adequate method for testing the level of blood glucose via urine and/or blood, and it was the second most commonly missed item (n=5). Items 17 and 18 were specific to individuals who are insulin dependent, The findings for the total pre-intervention item test scores and the item topic can be seen Tables 4.2.

Table 4.2

Total Pre-Intervention Item Test Scores and Item Topics

Item Number and Topic	Total Pre-Intervention Item Test Score	Percentage Correct (%)
Q1 Quality of diabetes diet	15/17	88.24%
Q2 Understanding HbA1c measurement	4/17	23.53%
Q3 Measuring carbohydrates	10/17	58.82%
Q4 Measuring fat content	8/17	47.06%
Q5 Adequate testing of blood glucose level	5/17	29.41%
Q6 Food raising blood glucose level	8/17	47.06%
Q7 Treating low blood glucose with food	9/17	52.94%
Q8 Olive oil effecting cholesterol	15/17	88.24%

Q9 Exercise effecting blood pressure	15/17	88.24%
Q10 Exercising effecting blood glucose	15/17	88.24%
Q11 Blood glucose levels related to infection	11/17	64.71%
Q12 Shoe size and foot ulcer prevention	8/17	47.06%
Q13 Low fat foods and heart disease	17/17	100%
Q14 Symptoms of neuropathy	15/17	88.24%
Q15 Associated conditions with diabetes	5/17	29.41%
Q16 Measuring blood glucose when sick	11/17	64.71%
Q17 Effects of insulin on blood glucose levels	5/6	83.33%
Q18 Taking insulin and skipping meals	3/6	50%
Q19 Regular check ups and detecting diabetes complications	16/17	94.12%
Q20 Check ups and prevention of diabetes complications	12/17	70.59%

Although there were only nine post-intervention tests completed, most items scored improved, one item remained unchanged, and only a few items had a small decrease from the previous pre-intervention score. The most improved item with 65% improvement was item 2 pertaining to the length of time a HbA1c test measured blood glucose levels, followed by item 3 with a 41% improvement which compared carbohydrate content of foods from two different food groups. Additionally, items 4, 5, 6, 11, 15, and 16 demonstrated a greater than 20% improvement from pre-intervention to post-intervention. Item 13 addressed decreased risk of heart disease related to consumption of foods lower in fat and was correctly answered by all participants (n=9). Items 19 and 20 which addressed use of doctors appointments to detect and/or prevent diabetes complications scored slightly lower in the post-test intervention. Item 14 was

the only item with a notable decrease. Item 14 addressed symptoms of neuropathy, and overall, the post-test score for this item was about 21% worse than in the pre-intervention test.

Table 4.3

Total Post-Intervention Item Test Scores and Item Topics

Item Number and Topic	Total Pre-Intervention Item Test Score	Percentage Correct (%)
Q1 Quality of diabetes diet	9/9	100%
Q2 Understanding HbA1c measurement	8/9	88.89%
Q3 Measuring carbohydrates	9/9	100%
Q4 Measuring fat content	6/9	66.67%
Q5 Adequate testing of blood glucose level	5/9	55.56%
Q6 Food raising blood glucose level	6/9	66.67%
Q7 Treating low blood glucose with food	6/9	66.67%
Q8 Olive oil effecting cholesterol	9/9	100%
Q9 Exercise effecting blood pressure	8/9	88.89%
Q10 Exercising effecting blood glucose	9/9	100%
Q11 Blood glucose levels related to infection	8/9	88.89%
Q12 Shoe size and foot ulcer prevention	4/9	44.44%
Q13 Low fat foods and heart disease	9/9	100%
Q14 Symptoms of neuropathy	6/9	66.67%
Q15 Associated conditions with diabetes	5/9	55.56%
Q16 Measuring blood glucose when sick	8/9	88.89%
Q17 Effects of insulin on blood glucose levels	3/3	100%

Q18 Taking insulin and skipping meals	2/3	66.67%
Q19 Regular check ups and detecting diabetes complications	8/9	88.89%
Q20 Check ups and prevention of diabetes complications	6/9	66.67%

Significance.

Glycemic control. Of the seventeen participants, only two participants had pre- and post-intervention HbA1c levels available within the specified time range. Available HbA1c levels needed to be collected within four weeks of the pre-intervention and four weeks of the post-intervention. One participant demonstrated an improvement from a pre-intervention HbA1c of 5.9 to post-intervention HbA1c of 5.8. The other participant demonstrated an improvement from a pre-intervention HbA1c of 11.4 to a post-intervention HbA1c of 10.0. Due to a very small number of available HbA1c levels, additional analysis of this data was not conducted.

Diabetes Knowledge. The mean of the pre-Diabetes Knowledge Test was 12.23 with a range of 9.00 (*sd*=2.33), and the mean of the post-Diabetes Knowledge Test was 14.89 with a range of 4.00 (*sd*=1.36). Of the nine participants who completed the post-intervention Diabetes Knowledge Test, eight individuals scored higher on the post-test and one scored the same. The Wilcoxon signed-rank test was run for statistical analysis of the pre-and post intervention scores. The z-score can reveal if there is or is not a statistically significant difference between intervention scores. Based on the results, the z-score was -2.55, and this value was significant at $p<.05$. Therefore, the results of this project demonstrate that the provision of diabetes education on nutrition and physical activity can increase diabetes knowledge in individuals with type 2 diabetes.

CHAPTER 5

DISCUSSION

The purpose of this EBP project was to determine if nutrition and physical activity education improves glycemic control and diabetes knowledge among persons with type 2 diabetes. Based on a comprehensive review of the literature, improved diabetes knowledge can enhance glycemic control among persons with type 2 diabetes. The use of identical pre-intervention and post-intervention Diabetes Knowledge Tests and HbA1c measurement allowed for comparison of diabetes knowledge and glycemic control. The results from this EBP project suggest that diabetes education in a primary care setting can improve diabetes knowledge. Due to a lack of available HbA1c levels by participants, changes in glycemic control related to increased diabetes knowledge were unable to be determined.

Explanation of Findings

Data for this project was collected using available HbA1c levels and the Diabetes Knowledge Test to serve as a pre-and post intervention test. Using the pre-intervention test as a baseline, data were analyzed using IBM SPSS Statistics 22. An available HbA1c level collected within four weeks of the intervention was also obtained. Outcomes evaluated glycemic control and diabetes knowledge. The data collected from pre-intervention Diabetes Knowledge Tests and HbA1c levels was compared to post-intervention Diabetes Knowledge Tests and HbA1c levels to determine whether application of diabetes education would increase diabetes knowledge and therefore increase glycemic control.

Pre-intervention knowledge and glycemic control. All 17 participants demonstrated a lack of diabetes knowledge as evidenced by a lack of a perfect score on the pre-intervention Diabetes Knowledge Test by any participant. Additionally, none of

the participants had an available HbA1c level that was within normal limits or within a range that meant their diabetes was controlled.

Post-intervention knowledge and glycemic control. Only nine participants completed the post-intervention Diabetes Knowledge Test, and two participants, one of which completed the post-intervention Diabetes Knowledge Test and one who did not, had available HbA1c levels. Eight of the nine participants who completed the post-intervention Diabetes Knowledge Test demonstrated improvement in their test scores. One of the participants scored the same. Similar to the outcomes found in the literature, implementation of diabetes education can improve diabetes knowledge over a period of time (Fan & Sidani, 2009; Panja et al., 2005; and Shaya et al., 2011). The lack of available HbA1c levels deems the change in glycemic control after the intervention to be inconclusive. However, based on current literature, one could anticipate that the provision of diabetes education could yield an improvement in glycemic control (Agurs-Collins et al., 1997; Christensen et al., 2000; Ellis et al., 2004; Fan & Sidani, 2009; Miller et al., 2002; MQIC, 2013; Norris et al., 2001; Norris et al., 2002; Panja et al., 2005; & Riethof et al., 2012).

Mean scores of outcomes. Following analysis of the data, a statistically significant difference was noted between diabetes knowledge before and after the intervention, as measyred by the Diabetes Knowledge Test scores. The mean overall score improved from a pre-intervention score of 12.2353 with a range of 9.00 (*sd*=2.332) to the post-intervention score of 14.8889 with a range of 4.00 (*sd*=1.364). This improvement demonstrates an increase in diabetes knowledge following the education intervention. The mean scores of the HbA1c levels were not calculated due to a very small number of available HbA1c levels.

Evaluation of the Applicability of the Theoretical and EBP Framework

The Stetler Model and the HPM led to the development, implementation, and analysis of this evidence-based practice project. The HPM served as a theoretical basis for this project, and the Stetler Model served to guide implementation and evaluation of this evidence-based practice project.

Pender's Health Promotion Model. Nola Pender's HPM was employed as the theoretical framework for this evidence-based practice project. The HPM was adapted to influence health-promoting behaviors to improve nutritional consumption and increase physical activity through increased knowledge, thus increasing the target population's overall wellbeing.

Individual characteristics and experiences propositional group. The first propositional group is the individual characteristics and experiences. This group includes prior related behavior and personal factors. The purpose of this propositional group is to consider the unique characteristics and experiences of the individual that will affect their subsequent actions. Depending on the targeted health behavior, the individual's characteristics and experiences may allow for the HPM to attain variables that are significant to the health behavior (Pender et al., 2006).

Prior related behavior. Prior related behavior was proposed to directly and indirectly influence the likelihood of engaging in health promoting behaviors. The direct effects of prior related behavior pertain to habit formation and habit strength. In regards to this evidence-based practice project, several participants stated that due to having a labor intensive job or because they worked long hours each day, they seldom exercised outside of work, or they ate fast food regularly due to lack of time to cook. For some individuals, they stated that they have lived with diabetes with these lifestyle habits for over five years; therefore, habit formation and strength was very strong during the time the intervention was implemented.

The prior behavior was also proposed to indirectly effect the health-promoting behavior through perceptions of self-efficacy, benefits, barriers, and activity-related affect (Pender et al., 2006). For a person with diabetes, his perception of barriers to eating healthier meals may hinder his ability to improve glycemic control. For example, if the person perceives that healthier foods have a lesser quality of taste or take longer to prepare, he may be less inclined to consume healthier food. Each time he engages in eating a healthier meal, he will experience positive or negative emotions or affect. The affect is mentally stored and is recovered when he considers eating the healthier meal. Therefore, if he had positive or negative experiences when he previously ate, he will tend to remember this each time it is performed which is known as activity-related affect.

Personal factors. The second concept within this propositional group was personal factors. The personal factors are the biological, psychological, and sociocultural aspects of the individual that are considered prognostic of a given behavior and influence the nature of healthy nutrition and increased physical activity among type 2 diabetic individuals. For this evidence-based practice project, age, strength, aerobic capacity, mobility, current health status, education, and meal preferences were considered through questioning in order to highlight specific physical activities or meal selections pertinent to persons with diabetes. For participants within this evidence-based practice project, most participants identified themselves as being moderately active through work environment only, and many identified themselves as being educated on diabetes. Meal preferences identified by the individuals was variable as some stated that their meal preferences were healthy, while others stated meal preferences were okay to poor.

Behavior-specific cognitions and affect propositional group. The second propositional group was the behavior-specific cognitions and affect. Variables within this group were previously discussed in relationship to prior-related behaviors and include:

perceived benefits to action; perceived barriers to action; perceived self-efficacy; and activity-related affect. Variables within this propositional group were considered a critical core for intervention.

Perceived benefits to action. Perceived benefits to action motivate behaviors by establishing a plan to commit to a particular behavior in order to receive the expected benefits. Benefits of the commitment to maintain healthy nutrition and increase physical activity were identified during the education intervention of the evidence-based practice project. As discussed with participants, established benefits to committing to improved nutritional intake and increased physical activity included: weight loss, potential reduction in current glycemic medication therapy, potential for improved healing, and decreased risk for infection. Additionally established benefits to committing to these behaviors included improved knowledge about diabetes and improved glycemic control.

Perceived barriers to action. Perceived barriers to action influence decision-making behavior directly and indirectly through perceived hurdles or mental blocks with acceptance of the given behavior. During the educational intervention, perceived barriers to healthy nutrition and increased physical activity were addressed through dialogue. Anticipated perceived barriers included: financial concerns, fear of experiencing hypoglycemia, physical limitations, lack of a support system or resources to answer questions, or lack of knowledge. Of the anticipated perceived barriers, physical limitations and lack of knowledge were the only established barriers identified. Most commonly, participants who had additional co-morbidities could not identify safe physical activities which they could perform. Additionally, eleven participants believed that their labor-intensive job was exercise and would be sufficient to meeting physical activity recommendations for persons with type 2 diabetes.

Perceived self-efficacy. Perceived self-efficacy pertains to one’s belief in his capability he possesses to organize and execute a given behavior. Based on dialogue, it

did not appear that perceived self-efficacy was high for this population. Four participants did not believe they had the ability to work and arrange time to increase physical activity levels during the week. Two individuals also noted that they lacked self-control to make healthy food choices when grocery shopping.

Activity-related affect. Activity-related affect is the subjective feeling occurring before, during, or after an activity related to the behavioral event (Pender et al., 2006). During this project, the activity-related affect was challenging to assess. Twelve individuals were not opposed or encouraged to eating healthy or exercising due to a particular feeling. The lack of activity-related affect may have actually prevented participants from making better nutrition and physical activity choices.

Interpersonal Influences and Situational Influences Propositional Group. The third propositional group of the HPM was the interpersonal influences and situational influences. Interpersonal influences pertained to norms, social support, and modeling. There were three interpersonal influence variables that contributed to the health-promoting behavior including: situational influences; commitment to a plan of action; and immediate competing demands and preferences.

Situational influences. Situational influences involved perceptions of options available, demand characteristics, and aesthetic features of the environment. For situational influences, some participants perceived a lack of gym membership or lack of social support as being a reason to prevent change. Options were explored with these participants to discuss increased physical activity without financial distress and how to make lifestyle changes that could include the participant's social support.

Commitment to a plan of action. The commitment to a plan of action initiates the behavioral occurrence. The commitment of a plan of action for this population group was typically limited to improving nutritional intake or increased physical activity. Very few participants were able to commit to improving both while in office. In one particular

instance, a participant stated they had excellent nutritional intake and performed an appropriate amount of physical activity a week as a reason for not committing to a plan of action while in the office.

Immediate competing demands and preferences. The last variables of interpersonal influences were the immediate competing demands and preferences. Competing demands were most often related to work schedules or financial constraints as the participant did not have time to increase physical activity or the finances to join a gym or improve nutritional intake. Competing preferences were related to the participant's preferences with desired food for consumption or types of physical activity performed.

Health-promoting behavior. The final action outcome of the HPM was the health-promoting behavior. The expected outcome was not thoroughly demonstrated due to circumstances within the project. It was anticipated that the diabetes education would promote improved nutrition and increased physical activity, causing improved glycemic control, and increased diabetes knowledge could yield improved glycemic control.

In spite of the circumstances that prevented the health-promoting behavior to be demonstrated, utilization of this model for the EBP project was useful. Advanced practice nurses (APNs) must understand the relationship of the patient's adaptation of health promoting behaviors to varying factors. It is significant for the APN to recognize possible cues for health promoting and preventative actions as well as addressing any barriers to change. As the HPM considers such factors, the HPM allowed for the project manager to anticipate possible barriers to change and address potential hindrances prior to implementation of the project. Without these considerations, the improvement in diabetes knowledge may not have been noted.

The Stetler Model. The Stetler Model provided step-by-step instructions for integrating research into practice.

Preparation. The first step of this model was to prepare by establishing and affirming a priority need. During this step, the PICOT question: What is the effect of nutrition and physical activity education on knowledge and glycemic control among individuals with type 2 diabetes during a three month period?" was established. The project manager was then able to search most relevant and best evidence pertaining to the desired project and proceed to the next stage of the Stetler Model.

Validation. Validation is the second step of the Stetler Model and was established through systematically critiquing each article and synthesizing and summarizing the evidence related to enhanced knowledge and glycemic control in persons with type 2 diabetes. A total of 16 articles were selected and critiqued for their quality, reliability, and credibility.

Comparative Evaluation/Decision Making. This stage was the third stage of the Stetler Model and involved analysis of the risks, resources, and readiness of the target population. For this stage, extensive time and research was made to consider an ideal project location, to select the most appropriate and easy-to-read education tools and method of intervention, and to determine the perception and responsiveness of the project by the clinic staff. During this process, the project manager spent a significant amount of time discussing the most efficient manner to execute the education intervention to clinic staff.

Transition/Application. The fourth stage of the Stetler Model involved translating the findings into a plan and implementing it. During this phase, the nutrition and physical activity education intervention provided to individuals with type 2 diabetes. The diabetes knowledge of these individuals was assessed using a pre-and post-test

intervention. Glycemic control was also evaluated pre-and post education intervention if available in an attempt to establish a potential relationship between the factors.

Evaluation. The final stage was evaluation. The goal of this evidence-based practice project was to increase diabetes knowledge and improve glycemic control for persons with type 2 diabetes enrolled in this project. In spite of being unable to note changes in glycemic control related to the intervention, the Stetler Model was an ideal model for this EBP project. The Stetler Model proved to be appropriate due to modifications that were made during the implementation of the project. Following intervention of the project, participants were mailed post-intervention tests three months later. Initial feedback from participants was poor (n=4), resulting in the project manager reviewing additional methods to increase response rates from participants. It was determined to mail the post-intervention tests one more time, followed by a reminder phone call. This resulted in an additional five responses from participants for a total of nine participants completing the pre-and post-intervention Diabetes Knowledge Tests. Through use of the Stetler Model, nutrition and physical activity education was ultimately provided, and it helped to demonstrate an improvement in diabetes knowledge.

Strengths of EBP

This evidence-based practice project had several strengths to note. The education intervention focused on a need and an area that was not always addressed during visits with the primary care provider. Additionally, the education intervention focused on an area that could easily be applicable to those who do not have diabetes but may be at risk, such as family members who may have also received the education intervention with the participant. During implementation of the project, office staff also inquired about additional places that participants or any persons with type 2 diabetes could be sent in order to receive further diabetes education. Office staff was informed about classes available at local hospitals and how to get patients involved or enrolled

into the classes. The education intervention was an apparent success in improving the diabetes knowledge from the pre-tests to the post-tests. The education intervention did not require extensive resources and is available for free for institutions to provide to their patients; therefore, the office can elect to continue to use these easy-to-read education tools, if desired. Lastly, implementation of this project allowed for office staff to realize the lack of education being provided on frequent office visits to their patients with type 2 diabetes, and the office staff were able to note and begin to address compliance issues with the provider remembering to order diabetes specific laboratory tests in accordance to standard of care and for patients to obtain the laboratory tests as ordered and strongly recommended.

Limitations of EBP

While several strengths were noted, the evidence-based practice project also had several limitations. Initially, the first most notable limitation was related to patients who have type 2 diabetes arriving to their scheduled appointment. Prior to arrival of the patients each day, the office staff would identify patients who had type 2 diabetes and inform the project manager of those patients after they were placed into examination rooms. The project manager was able to identify at least ten patients in four days who were identified as having type 2 diabetes and did not come to their scheduled appointment. Additionally, four patients who have type 2 diabetes declined to receive the education intervention. Arrival or participation may have been related to socioeconomic factors, personal time constraints, or possible lack of a perceived need to receive additional education. Initial participation was overall satisfactory given the volume of patients in the office and assistance from office staff; however, completion of the post-intervention tests by the participants took more extensive effort and involvement by the project manager than originally anticipated. After only receiving four post-intervention test responses by participants, the project manager sought changes through the IRB in

order to obtain more responses. After a second attempt, a total of nine participants responded. The participants were mostly homogenous with eight Caucasians and one Hispanic. This is not representative of all of the participants. Lack of participation in the post-intervention may have been related to time constraints, lack of perceived need or desire to complete the post-intervention, or potential relocation of participants which was identified as a possibility by one participant during the intervention.

Limitations were also identified that were related to office staff and the primary care provider. One limitation was related to the relationship between the office manager and the project manager. Initially, the office manager did not appear to welcome or encourage staff to be compliant with the agreed upon method for obtaining participants for the project. After having personal conversations and identifying cultural similarities between the office manager and the project manager, the office manager was insistent on the staff to promote and encourage patients to speak with the project manager regarding the diabetes education, even if not interested in fully participating. The involvement of the staff appeared to help the project manager enroll more participants into the project; however, this was ended after the office manager abruptly quit her position. Due to the disruption in the office and changes in office flow, it was determined by the project manager to only spend one additional day at the clinical site to obtain participants, resulting in potentially fewer participants. Lastly, review of the available HbA1c levels for the participants showed that often HbA1c levels were not obtained or ordered in accordance to standards of care. Several participants did not have a HbA1c level drawn within the past year. Office staff stated that this may be due to a conversion from paper charting to computer charting and error by the primary care provider. Additionally, the primary care provider may have mistakenly not ordered HbA1c levels on his patients with type 2 diabetes or the patients may not have been compliant with the orders. This limitation impacted the project as the glycemic control outcome could not be

measured; however, this alerted office staff to be more aware of laboratory testing needed and ordered for this population.

Implications for the Future

This evidence-based practice project examined the impact of an educational intervention, despite a small sample size of persons with type 2 diabetes. The educational intervention was determined to have a positive impact on diabetes knowledge. The project has implications based on the findings and lessons learned from the implementation of the project

Theory. Pender has utilized the HPM extensively in research with physical activity and nutrition, which influenced its use for this project. Ultimately, the use of Pender's HPM worked well for this evidence-based practice project. The framework provided direction for implementation of the project. It also allowed for opportunities to answer questions, address perceived benefits and barriers to action, and additional influences that hinder health promotion during the educational intervention with the participants.

As a result of the implementation, increased diabetes knowledge was evidenced from the pre-tests to the post-tests. Of the nine participants who completed the post-intervention test, eight participants demonstrated an increase in diabetes knowledge, while only one participant's score remained unchanged. A statistically significant improvement was noted. While it cannot be determined if increased diabetes knowledge resulted in increased physical activity and improved nutrition, it is possible that increased diabetes knowledge could contribute to a higher level of functioning and a healthier outcome.

Research. Additional areas for further research were noted during the implementation of the study. One question focuses on whether implementation of the educational intervention is most optimal in the primary setting versus another location

such as a classroom or in a group setting? This would add further insight as to whether location can affect how well a patient learns. Secondly, what is an optimal length of time for education interventions on diabetes education? This question is due to the multiple variations of lengths of time of educational interventions within the literature. Lastly, additional research is needed to evaluate and correlate the effectiveness of the educational intervention on glycemic control and diabetes knowledge over a long-term period. Most of the literature evaluates the effects over a 3-month and 6-month period of time, but little evidence exists that evaluates the effects over a year or longer.

Education and practice. After reviewing the literature, there is a need for diabetes education to be provided at each visit to the primary care provider. Healthcare providers are failing to educate and re-educate this population about management and lifestyle changes needed on a consistent basis. Each year, new data is released on diabetes management and lifestyle modifications that persons with type 2 diabetes need to undertake. Based on the implementation and results of this project, the provision of a ten-minute face-to-face intervention can make a difference. Therefore, the hope is that the clinical agency will integrate an educational component for the persons with type 2 diabetes at each office visit. Compliance with standards of care by the healthcare provider and the patient should also be embraced for necessary testing and disease management. This may require support from all staff at the clinical agency; however, collaboration among the staff and patient may produce the most optimal outcome for the patient.

Conclusion

With review of the literature, best practice recommendations were identified and led to the provision of an educational intervention that increased the diabetes knowledge among the participants with type 2 diabetes. While not demonstrated in this evidence-based project, the literature supports that the provision of diabetes education and

increased knowledge can positively impact glycemic control. Increased collaboration among healthcare providers and with the patient can assist in improving and optimizing the health of the patient. Healthcare providers must stay informed about current practice recommendations, continue to educate the patient with each office visit, and negotiate and reinforce patient compliance with the plan of care.

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BIOGRAPHICAL MATERIAL

Inspired by her vocational experience in high school, Alexandra began her journey in healthcare as a certified nurses assistant (CNA) on a cardiology floor and in the emergency department at Porter Hospital in Valparaiso. While working as a CNA, Alexandra completed her Bachelor of Science in Nursing (BSN) from Indiana University in 2011. Alexandra's experience in critical care prompted her to further her education by obtaining her Doctorate of Nursing Practice (DNP) degree with an anticipated graduation in May 2015 from Valparaiso University. While pursing her DNP, Alexandra has served as a nurse in both the emergency department and on a cardiology floor. Alexandra is also a member of Sigma Theta Tau International, the American Association of Nurse Practitioners. Alexandra has based her EBP project on the education of persons with type 2 diabetes to reflect her personal passion for physical activity and proper nutrition. The ultimate goal of her EBP project was to increase diabetes knowledge and improve glycemic control after a face-to-face education intervention. Upon earning her DNP degree and becoming a board certified family nurse practitioner, Alexandra will be working as a nurse practitioner in an emergency department.

ACRONYM LIST

AACE: American Academy of Clinical Endocrinologists

ADA: American Diabetes Association

ANA: American Nurses Association

ANOVA: Analysis of variance

APA: American Psychological Association

APN: Advanced practice nurse

CDC: Centers for Disease Control

CINAHL: Cumulative Index to Nursing and Allied Health

DSME: Diabetes self-management education

ES: Effect Size

ICSI: Institute of Clinical Systems Improvement

IRB: Institutional Review Board

JHNEBP: John Hopkins Nursing Research Evidenced-Base Practice

HbA1c= Hemoglobin A1c

HPM: Health Promotion Model

LPN: Licensed practical nurse

MA: Medical assistant

MDRTC: Michigan Diabetes Research Training Center

MNT: Medical nutrition therapy

MQIC: Michigan Quality Improvement Consortium

RCT: Randomized control trial

RN: Registered nurse

SMBG: Self-management blood glucose

USDHHS: United States Department of Health and Human Services

WHO: Worldwide Health Organization

Appendix A

Review of Literature for Nutrition and Physical Activity Education Among Persons with Type 2 Diabetes

Citation	Purpose	Sample	Design	Measurement	Results/Findings	Level of Evidence
Agurs-Collins, T.D., Kumanyika, S.K., Ten Have, T. R., & Adams-Campbell, L. L. (1997). A randomized control trial of weight reduction and exercise for diabetes management in older African-American subjects. *Diabetes Care, 20,* 1503-1511.	To assess a weight loss and exercise program designed to enhance diabetes management in older African Americans.	64 African Americans ages 55-79 with type 2 diabetes	RCT	Measure weight, physical activity, blood pressure, lipids, dietary components, nutritional knowledge, and mean HgbA1c values at baseline, three, and six months.	Effectiveness of the intervention was demonstrated with an improvement of glycemic control and blood pressure control. Changes were noted at three months in physical activity, nutritional knowledge, and dietary intake of cholesterol. Improvements in physiological outcomes such as HgbA1c do not necessarily correspond to diet, knowledge, or weight.	Level 1/A High

American Association of Clinical Endocrinologists (AACE) (2011). American Association of Clinical Endocrinologists medical guidelines for clinical practice for developing a diabetes mellitus comprehensive care plan. *Endocrine Practice, 17*, 1-53.	To serve as evidence-based and educational resource in clinical practice for the development of comprehensive care plans for clinicians who care for patients with diabetes mellitus.	N/A	Clinical practice recommendation	N/A	Regular physical activity, both aerobic and strength training, are important to improve glycemic control for those with type 2 diabetes mellitus. Exercise plans should be made for each patient in relationship to goals and limitations. Medical nutrition therapy must be addressed and individualized. “Heart Healthy” diet use, weight management, and physical activity are recommended to meet control targets.	Level IV/A High
American Diabetes Association (ADA) (2014). Executive	To provide clinical practice recommendations to	N/A	Clinical Practice Recommend	N/A	Nutritional therapy is recommended or	Level IV/A High

summary: Standards of medical care in diabetes. *Diabetes Care, 37*, S1-S153.	ensure clinicals, health care plans, and policymakers can utilize them for current and authoritative guidelines for diabetes care.		ations		type 2 diabetes as an effective component for improving HbgA1c. Regular exercise has been shown to improve glycemic control. Higher levels of exercise intensity are associated with greater HgbA1c improvement.	
Christensen, N. K., Steiner, J., Whalen, J., & Pfister, R. (2000). Contribution of medical nutrition therapy and diabetes self-management education to diabetes control assessed by hemoglobin A1c. *Diabetes Spectrum, 31,* 72-75.	To determine the influence of diabetes medical nutrition therapy and diabetes self-management education by a dietician to reducing HbA1c values in persons with type 1 or type 2 diabetes.	102 participants with diabetes 15 participants with type 1 diabetes 87 participants with type 2 diabetes	Non-experimental retrospective	HbA1c and patient self-perception of diabetes goal achievement	A significant difference was noted between pre-education HbA1c level and the mean HbA1c levels post-education, regardless of age, sex, level of education, type of diabetes, or body mass index. No significant difference was	Level III/B Good

					noted between the number of men or women who set goals. The perception of understanding of diabetes between pre and post education scores improved following education sessions. No difference in weight was noted.	
Ellis, S. E., Speroff, T., Dittus, R. S., Brown, A., Pichert, J. W., & Elasy, T. A. (2004). Diabetes patient education: A meta-analysis and meta-regression, *Patient Education and Counseling, 52*, 97-105. doi:10.1016/S0738-3991(03)00016-8	To describe and examine the effect of recent patient education interventions on glycemic control based on HbA1c.	21 articles with a total of 28 educational interventions and 21 controls.	Meta-Analysis	Patient education intervention and HbA1c pre- and post-intervention	Patient education improves glycemic control for persons with diabetes. No clinical significance was noted between the amount of the intervention in relationship to the intervention's success. Face-to-face	Level !/A High

					education delivery, cognitive reframing teaching method, and education regarding exercise are most likely to assist in enhancing glycemic control.	
Fan, L., & Sidani, S. (2009). Effectiveness of diabetes self management education intervention elements: A meta-analysis. *Canadian Journal of Diabetes, 33(*1), 18-26.	To investigate the differences in self management behaviors, knowledge, and metabolic control in relation to various self-management education intervention elements.	50 RCTs were evaluated.	Meta-Analysis	Self care knowledge, self-management behaviors, and metabolic control. *Interventions considered included: components of intervention, teaching method, delivery strategies, format, number of diabetes related topics, number of sessions, total	Diabetes self-management education interventions can improve knowledge, self care, behavior, and metabolic control for adults with type 2 diabetes. The greatest effect size was noted with knowledge followed by metabolic control. Face-to-face interventions ere most effective for	Level 1/A High

				contact hours or length of the session, duration, and the delivery of the session. Specific outcomes measured: knowledge, diet, exercise, self managed blood glucose (SMBG), medication, recognition of complications, food care, HbA1c, fasting blood glucose, systolic and diastolic blood pressure, cholesterol, triglycerides, body weight, and body mass index.	knowledge and metabolic control improvement. More sessions and longer duration of interventions were not found to enhance self management behaviors including diet, exercise, SMBG, medication, recognition of complications, or foot care.	
Fitzgerald, J. T., Funnell, M. M., Hess, G. E., Barr, P. A., Anderson, R. M.,	To assess the reliability and the validity of a diabetes knowledge test.	811 participants	Quasi-experimental	Knowledge test scores	Validity and reliability were supported in both the health	Level II/A High

Hiss, R. G., & Davis, W. K. (1998). The reliability and validity of a brief Diabetes Knowledge Test. *Diabetes Care, 21,* 706-710.					department and community samples. Results indicate that the diabetes knowledge test is appropriate in a variety of settings and using with various patient populations.	
Michigan Quality Improvement Consortium (MQIC) (2013). Management of diabetes mellitus. Retrieved from http://www.guideline.gov/content.aspx?id= 46655	To provide clinical practice guidelines based on evidence to manage and improve outcomes for patients with type 2 diabetes.	N/A	Clinical Practice Guideline Recommendations	N/A	Education should include importance of regular physical activity and healthy diet. Self-monitoring of blood glucose is important.	Level IV/B Good
Miller, C., Edwards, L., Kissling, C., & Sanville, L. (2002). Nutrition education improved metabolic outcomes among	To evaluate the influence of a nutrition education program on the metabolic outcomes of people ≥ 65 years of age with	92 people	Randomized control trial	Specific evaluation to assess nutrition effect on blood glucose and lipoprotein	Older adults with diabetes need nutritional education to attain metabolic control.	Level I/A High

older adults with diabetes mellitus: Results from a randomized control trial. *Preventative Medicine, 34*, 252-259. doi:10.1006/pmed.2001.0985	type 2 diabetes.			levels of adults. HbA1C was measured at pre-test and post-test.	Nutrition education can improve metabolic control. Glycemic control can reduce macrovascular and microvasculs risks related to diabetes. Morbidity and mortality risks can be reduced with improved metabolic outcomes.	
Nield, L., Moore, H., Hooper, L., Cruickshank, K., Vyas, A., Whittaker, V., & Summerbell, C. D. (2007). Dietary advice for treatment of type 2 diabetes mellitus in adults. *Cochrane Database of Systematic Reviews,* 1-85. doi:10.1002/	To assess the effects of type and frequency of various types of dietary advice for persons with type 2 diabetes	1467 adults with type 2 diabetes.	Interventional Systematic review	Outcome measurements: weight, development of macro and micro-vascular diabetic complications, quality of life, change in anti-diabetic medication use, overall cardiac assessment,	Addition of exercise with reduced energy diet is the best way to promote better glycemic control in type 2 diabetics. No significant findings were found in relationship to weight.	Level IV/A High

14651858.CD004097.pub4				mortality, HbA1c, serum cholesterol, maximal exercise capacity, blood pressure, and compliance	There was no high quality data on the efficacy of treatments of type 2 diabetes using diet changes.	
Norris, S. L., Engelgau, M. M., & Narayan, K. M. (2001). Effectiveness of self-management training in type 2 diabetes. *Diabetes Care, 24,* 561-587.	To appraise the effectiveness of self-management training in type 2 diabetes through a systematic review	72 studies included	Systematic review	Outcomes measured: knowledge, attitudes and self-care skills, lifestyle behaviors, psychological outcomes, quality of life, glycemic control, cardiovascular disease risk factors, economic measures, and health service utilization	Positive effects of self-management training were found in relation to knowledge, frequency and accuracy of SMBG, glycemic control, and self-reported dietary habits. Interventions that utilized longer follow up and more frequent reinforcement were found to be more effective in improving glycemic control. Education interventions that include	Level 1/A High

					collaboration with the patient may be more effective than didactic interventions to improve glycemic control, lipid profiles, and weight.	
Norris, S. L., Lau, J., Smith, S. J., Schmed, C. H., & Engelgau, M. M. (2002). Self-management education for adults with type 2 diabetes: A meta-analysis of the effect on glycemic control. *Diabetes Care, 25,* 1159-1171.	To assess the efficacy of self-management education on HbA1c levels for adults with type 2 diabetes.	31 studies were included	Meta-analysis	Interventions considered: lifestyle, knowledge, skills (SMBG and foot care), coping skills, and mixed. Outcomes measured: HbA1c	Self-management education enhances glycemic control at the immediate follow up. Increased contact can increase the effect of glycemic control. Benefit of the intervention was found to decrease 1-3 months after the intervention decreases.	Level I/A High
Panja, S., Starr, B., & Colleran, K. M. (2005). Patient knowledge improves glycemic control: Is it	To determine if there is a relationship between a patient's diabetes knowledge and their overall	77 patients with type 2 diabetes	Nonexperie-mental Correlational study	Diabetes Knowledge Test scores and HbA1c levels	An inverse relationship was found between performance scores with the	Level III/B Good

time to go back to the classroom?. *Journal of Investigative Medicine, 53*, 264-266.	glycemic control				diabetes knowledge test and HbA1c levels. Improvement in diabetes knowledge of diabetes along with the importance of treatment may enhance glycemic control and reduce complications related to diabetes.	
Riethof, M., Flavin, P. L., Lindvall, B., Michaels, R., O'Connor, P., Retzer, K., Roberts, J., Smith, S., & Sperl-Hillen, J. (2012). Diagnosis and management of type 2 diabetes mellitus in adults. *Institute for Clinical Systems Improvement*. Retrieved from	To provide a comprehensive approach to the diagnosis and management of prediabetes and type 2 diabetes in people 18 years of age and older.	N/A	Clinical Practice Guideline Recommendations	N/A	Patients with prediabetes or diabetes should receive individualized medical nutrition therapy to achieve treatment goals. The priority for nutrition therapy for type 2 diabetes is to implement	Level IV/ A High

http://www.guideline.gov/content.aspx?id=36905.					lifestyle strategies that will reduce hyperglycemia, hypertension, and dyslipidemia.	
Shaya, F. T., Gbarayor, C. M., Laird, A., Winston, R., & Saunders, E. (2011). Diabetes knowledge in a high risk urban population. *Ethnicity & Disease, 21,* 485-489.	To improve the management of diabetes through increased knowledge of the disease.	823 diabetes patients	Nonexperimental-Prospective Study	Measures: HbA1c and knowledge via Diabetes Knowledge Test at baseline, 6 months, 12 months, 18 months, and 24 months.	The mean scores using the diabetes knowledge test increased over time for insulin and non insulin users. The mean difference in scores utilizing the diabetes knowledge test while comparing insulin and non insulin users was only significant at 6 months follow up. Being Black, being male, and a smoker had a large impact on the diabetes knowledge test score than	Level III/B Good

					combined physician and patient education, insulin use, physician education alone, age, and blood pressure control. The baseline knowledge was higher for insulin dependent individuals, but improvement was found to be better for non-insulin dependent individuals with diabetes. The most predictive and significant factor of score improvement was the patient receiving the education program. Patient who had exposure to the educational	

					program had a higher knowledge score than those who followed usual care. Education alone is effective in improving knowledge regardless of patient characteristics of age, race, sex, or smoking.	
Thomas, D., Elliott, E. J., & Naughton, G.A. (2006). Exercise for type 2 diabetes mellitus. *Cochrane Database of Systematic Reviews,* 1-56. doi:10.1002/14651858.CD002968.pub2	To examine the effects of exercise in type 2 diabetes mellitus	377 participants with type 2 diabetes.	Interventional Systematic Review	Outcome measurements: HbA1c, body mass index, body mass, visceral adipose tissue, muscle mass, hypoglycemic reactions, exercise induced injuries, blood lipids, insulin sensitivity, blood pressure, quality of life, fitness, diabetic	An exercise intervention demonstrated a clinically significant improvement in glycemic control in comparison to controls. Improvement was achieved among a variety of exercise intensities. Some evidence demonstrated	Level IV/A High

				complication rate, and mortality.	that improvement in glycemic control may be sustained over a long period of time. Exercise significantly enhances glycemic control and reduces visceral adipose tissue and plasma triglycerides in people with type 2 diabetes even without weight loss.	

Appendix B

The Effects of Nutrition and Physical Activity Education on Knowledge and Glycemic Control Among Type 2 Diabetics

Informed Consent Form

I understand I am being asked to participate in an evidence-based practice project at _____ in_____ Indiana. This evidence-based practice project will evaluate the effects of nutrition and physical activity education on diabetes knowledge and glycemic control. By signing the informed consent, I agree to take a pre-Diabetes Knowledge Test and may receive up to a ten minute long, individualized education session on nutrition and physical activity for persons with type 2 diabetes today. This will not prolong or interrupt the care that I will receive today during my visit with the physician. I understand that in three months I will be asked to complete the post-Diabetes Knowledge Test. I will receive a copy of the post-Diabetes Knowledge Test in the mail in approximately three months. The post-Diabetes Knowledge Test is to be completed and returned in the pre-stamped and pre-addressed envelope provided as soon as possible. I understand that a copy of my previous hemoglobin A1c (HbA1c) test results may be requested by the project manager from my physician. In three months, a copy of my HbA1c test results will be requested by the project manager from my physician to evaluate the effectiveness of the education I received today. I understand that I will not be asked by the project manager to perform any blood tests for the purpose of this evidence-based practice project. All blood tests and medical treatments are prescribed, managed, and controlled by my physician or other health care providers through routine only and following the standard of care.

I will be asked to complete a demographics questionnaire and provide my name, address, and health care provider who manages my type 2 diabetes on a separate form while in the office. A post-intervention Diabetes Knowledge Test will be addressed and mailed to me. The project manager requests that you complete the post-intervention Diabetes Knowledge Test and mail it back as soon as possible.

Any personal identifying information will remain confidential.

The benefits that can be expected from this evidence-based practice project include: making healthier food choices, increasing physical activity, and improving blood sugar control which can improve healing and decrease risk of complications from wounds and/or poor blood sugar control. Additional benefits may be gained due to an increase in knowledge of the following: eating a balanced diet; selecting healthier foods to eat; recognizing examples of and alternatives to nutritionally poor foods; identifying proper portion control; identifying different types of physical activity; recognizing signs and symptoms of hypoglycemia; and recognizing when to call a health care provider.

There are minimal risks associated with the evidence-based project. Risks associated with changes in nutrition and increased physical activity levels can include low blood sugar and may lead to a change in current diabetes management. I understand that if I should experience low blood sugar, I will contact my primary care physician or seek further treatment immediately. I understand that education I receive on nutrition and physical activity should not replace any current treatments or nutrition or physical activity regiments or restrictions that my established health care providers have prescribed. With

agreeing to participate in this project, my health care provider managing my diabetes will be notified in order to best manage my care.

I realize that I may not participate in the evidence-based practice project if I am 18 years of age or younger, am pregnant, a prisoner, or have any cognitive or mental condition which affects my ability to make decisions for myself.

I understand that the knowledge obtained from this evidence-based practice project may help me or will contribute to helping other individuals with Type 2 diabetes in the future.

I understand that participation in this evidenced-based practice project is completely voluntary, and I may withdraw from this evidenced-based practice project at any time I wish. I understand that I will not be required to explain reasoning for withdrawing from this project, and my participation or lack thereof will not affect or change the care provided to me by my health care providers.

I understand that all information obtained during the evidence-based practice project will be kept confidential. However, my health care provider who I listed as managing my type 2 diabetes on the Participant Address and Health Care Provider form will be notified my participation and provided with a copy of the education pamphlets I received upon request. Additionally, data collected from this evidence-based practice project may be used in nursing publications or presentations, but there will be no personal identifying information used that would reveal who I am or my participation.

I understand that by taking the post-intervention Diabetes Knowledge Test at home, I shall not ask or seek help from other sources including friends, family, the Internet, or books to answer the questions. I understand I will not be penalized if I do not answer all questions correctly, and my health care providers will be unaware of my individualized score for the pre-and post Diabetes Knowledge Tests.

I understand that I will not be compensated for my participation, and I will not incur any additional costs due to participation in this evidence-based practice project.

If I need to, I may contact Alexandra Harris, project manager and Doctoral Nursing Practice (DNP) student, at Valparaiso University School of Nursing any time during the evidence-based practice project via email at _____ or by phone at _____. I may also contact _____ who is the Institutional Review Board Administrator at Valparaiso University at ValpoIrb@valpo.edu or by phone at_____.

The evidence-based practice project has been explained to me. I have read and understand this consent form, all of my questions have been answered, and I agree to participate. I understand that I will be provided a copy of this consent form.

_____

Signature of Participant Date

_____

Signature of Witness Date

_____

Signature of Investigator Date

Appendix C

Introduction

Hello, my name is Alexandra Harris, and I want to thank you for agreeing to participate in this evidence-based practice project. I also want to share some information about myself and why I am doing my evidence-based practice project on nutrition and physical activity education for individuals with type 2 diabetes.

I originally moved to this area about ten years ago and grew to love Northwest Indiana for its close-knit communities and available resources to those living in this area. My passion for being involved and helping individuals in need led me to pursue my undergraduate degree in nursing from IUN in 2011. While I was in nursing school, I realized that I wanted to be more involved for those I provide care to. This led me to apply and be accepted to the Doctorate of Nursing Practice (DNP) program at Valparaiso University to be a nurse practitioner, where I am currently finishing my last year of the program.

While receiving my education, I have worked in local healthcare institutions, serving in multiple healthcare roles. Many of the individuals I have cared for with type 2 diabetes have shared their struggles of maintaining their blood sugar. I learned that many of their struggles were because they needed additional education on how and when to check their blood sugar, what their goal blood sugar should be, healthy food choices, level of physical activity or exercise, or medications they were taking. Due to their struggles, I have spent many hours teaching about diabetes. Ultimately, these individuals assisted me in finding an area of health care that I love to teach, and this led me to selecting diabetes as the topic for my evidence-based practice project.

Thank-you again for agreeing to participate in this evidence-based practice project. I hope that you are able to find this education helpful and useful on a daily basis, and I hope this education assists you in making the best decisions to maintain and improve your diabetes, and maximize your overall health.

Sincerely,

Alexandra Harris, BSN, RN
Graduate Student, Valparaiso University

Appendix D

To Project Participant:

I wanted to take the time to personally thank-you for your involvement in this evidence-based practice project. Without your participation, this project would not have occurred. I truly appreciate the time you took to listen to the education I provided and complete the necessary pre-and post-intervention tests. I hope the education was beneficial to you and how you manage your type 2 diabetes. Please continue to manage your diabetes and talk to your health care provider if you have any additional questions, comments, or concerns regarding your diabetes or overall health.

Please take a few minutes to complete the post-intervention Diabetes Knowledge Test, and mail it in the pre-stamped and pre-addressed envelope enclosed as soon as possible. Remember not to seek help from other sources to complete the post-intervention test. All answers should be yours only.

After I have collected all of the results from other participants, I will review the data, and I will provide my findings in a final report to Valparaiso University. No personal information will be used in the findings of this report. All personal information collected will be destroyed. However, general information may be used in nursing journals or presentations. If you would like to know the results of my evidence-based practice project, you can contact me at _____ or via phone at _____. The results should be available by April 2015. Once this is completed, Dr. _____will also be provided with the results and may share them with you.

Thank you,

Alexandra Harris, BSN, RN
Graduate Student, Valparaiso University

Appendix E

Staff Education Outline

I. Introduction

A. Introduce myself and explain purpose of EBP project in a primary care setting.

B. Explain my project including: who is eligible to recruit; who is eligible to participate; how I will provide the education intervention; and expected risk and benefits for the participant. Provide same in-service to staff (RNs, LPNs, and MAs) as participant would receive.

II. Nutrition

A. Eating a balanced diet. Refer to Diabetes Food Pyramid and name each food group.

B. Discuss some healthier selections for persons with diabetes within all food groups.

C. Discuss limiting of fats and sweets: examples and alternatives

D. Discuss importance of moderation and portion control.

III. Physical Activity

A. Briefly discuss recommended physical activity levels per week per clinical practice guidelines and the four kinds of activity including: stretching; increasing daily activity; aerobic exercise; and strength training.

B. Provide examples that participant can do in accordance to their stated physical activity restrictions.

IV. Hypoglycemia and When to Call Health Care Provider

A. Discuss signs and symptoms of hypoglycemia.

B. When to call health care provider.

V. Conclusion

A. Explain how I can be contacted and who to contact if I am unavailable.

B. Explain when to refer participant to primary care doctor or health care provider managing participant's diabetes.

C. Provide staff with education pamphlets provided to participants. Allow time for individual questions.

Appendix F

Demographics Questionnaire

Instructions: Put a check mark or X in each box that applies or fill in the space as appropriate.

1. How old are you?_____

2. Gender

- ☐ Male
- ☐ Female

3. Race

- ☐ White/Caucasian
- ☐ Black/African American
- ☐ Hispanic
- ☐ American Indian/Native American
- ☐ Asian
- ☐ Pacific Islander
- ☐ Other: (specify)_____

4. How many years have you known you have type 2 diabetes?_____

5. How do you control your blood sugar? Check all that apply or fill space as appropriate.

- ☐ Oral medications (pills)
- ☐ Insulin (including daily and weekly injections/shots)
- ☐ Watching what you eat
- ☐ Exercising
- ☐ I don't try to control my blood sugar.
- ☐ Other: (specify)_____

Appendix G

Participant Address and Health Care Provider Form

Please print below

Participant's name:_____

Address:_____

City/State/Zip Code:_____

Please provide the name of the health care provider who is managing your type 2 diabetes. This individual can be your primary care provider, endocrinologist, etc. This individual will receive a letter stating you are participating in an evidence-based practice project and can receive a copy of the education pamphlets provided to you upon request.

Name of Health Care Provider:_____

Address:_____

City/State/Zip Code:_____

Appendix H

Participant Education Outline

VI. Introduction

A. Discuss type 2 diabetes and the importance of glycemic control and diabetes knowledge.

B. Discuss the purpose of the evidence-based practice project.

VII. Nutrition

A. Eating a balanced diet. Refer to Diabetes Food Pyramid and name each food group.

B. Discuss some healthier selections for persons with diabetes within all food groups.

C. Discuss limiting of fats and sweets: examples and alternatives

D. Discuss importance of moderation and portion control.

VIII. Physical Activity

A. Briefly discuss recommended physical activity levels per week per clinical practice guidelines and the four kinds of activity including: stretching; increasing daily activity; aerobic exercise; and strength training.

B. Provide examples that participant can do in accordance to their stated physical activity restrictions.

IX. Hypoglycemia and When to Call Health Care Provider

A. Discuss signs and symptoms of hypoglycemia.

B. When to call health care provider.

X. Conclusion

Appendix I

Reminder Letter

To Project Participant:

I wanted to take the time to personally thank-you for your involvement in this evidence-based practice project. Without your participation, this project would not have occurred. I truly appreciate the time you took to listen to the education I provided and complete the necessary pre-and post-intervention tests. I hope the education was beneficial to you and how you manage your type 2 diabetes. Please continue to manage your diabetes and talk to your health care provider if you have any additional questions, comments, or concerns regarding your diabetes or overall health.

You may have previously received a similar letter with the post-intervention Diabetes Knowledge Test included. As I have not received the post intervention Diabetes Knowledge Test from you at this time, I was re-mailing you a copy in order to provide you another opportunity to complete it. Please take a few minutes to complete the post-intervention Diabetes Knowledge Test, and mail it in the pre-stamped and pre-addressed envelope enclosed as soon as possible. Remember not to seek help from other sources to complete the post-intervention test. All answers should be yours only.

After I have collected all of the results from other participants, I will review the data, and I will provide my findings in a final report to Valparaiso University. No personal information will be used in the findings of this report. All personal information collected will be destroyed. However, general information may be used in nursing journals or presentations. If you would like to know the results of my evidence-based practice project, you can contact me at _____ via phone at _____. The results should be available by April 2015. Once this is completed, _____ will also be provided with the results and may share them with you.

Thank you,

Alexandra Harris, BSN, RN
Graduate Student, Valparaiso University

Appendix J

To Whom It May Concern:

My name is Alexandra Harris, and I am a graduate student obtaining my Doctorate of Nursing Practice (DNP) at Valparaiso University. As part of my doctoral work, I am implementing an evidence-based practice project that will evaluate the effects of nutrition and physical activity education on diabetes knowledge and glycemic control among persons with type 2 diabetes. The literature heavily supports the provision of this education and has shown an improvement in knowledge and glycemic control in this population upwards to a year after receiving the education. The intent of this evidence-based practice project is to better educate your patient and improve his/her diabetes knowledge and glycemic control over the course of three months.

Your patient, _____, signed an informed consent on _____. Your patient is also a patient of _____ at the _____where he/she received a one-time ten minute face-to-face educational intervention. The education is supported by the Centers for Disease Control and National Institute of Health, and it correlates with clinical practice recommendations made by the American Academy of Clinical Endocrinologists (AACE) and American Diabetes Association (ADA). As discussed with your patient, he/she will not be asked to provide blood tests or perform anything outside of the routine and standard of care he/she would normally receive by _____ or yourself. Your patient was advised to contact you if he/she should experience situations of low blood sugar, if he/she had questions regarding personal dieting or physical activity restrictions, or further questions regarding his/her diabetes management or overall health.

Included with this letter is an outline of the general diabetes information discussed with your patient. If you would like to know more about this evidence-based practice project, findings from the project, or the education pamphlets provided to your patient, do not hesitate to contact me. I can be reached at _____ or via cell phone at _____. Your patient was advised that this is an evidence-based practice project and not a research study. He/she may elect to withdraw from participation at any time. I have also made myself available to your patient using the same contact information for questions or concerns.

Sincerely,

Alexandra Harris, BSN, RN
Graduate Student, Valparaiso University

Appendix K

ID_____

Date_____

Revised Michigan Diabetes Knowledge Scale
- True/False Version.

Here are 20 statements about diabetes, some are true statements and some are false. Please read each statement and then indicate whether you think it is true or false by putting a circle round either TRUE or FALSE. If you do not know the answer please put a circle around DON'T KNOW.

1. The diabetes diet is a healthy diet for most people	TRUE / FALSE / DON'T KNOW
2. Glycosylated haemoglobin (HbA1c) is a test that measures your average blood glucose level in the past week.	TRUE / FALSE / DON'T KNOW
3. A pound of chicken has more carbohydrate in it than a pound of potatoes.	TRUE / FALSE / DON'T KNOW
4. Orange juice has more fat in it than low fat milk.	TRUE / FALSE / DON'TKNOW
5. Urine testing and blood testing are both equally as good for testing the level of blood glucose.	TRUE / FALSE / DON'T KNOW
6. Unsweetened fruit juice raises blood glucose levels.	TRUE / FALSE / DON'T KNOW
7. A can of diet soft drink can be used for treating low blood glucose levels.	TRUE / FALSE / DON'T KNOW
8. Using olive oil in cooking can help lower the cholesterol in your blood.	TRUE / FALSE / DON'T KNOW
9. Exercising regularly can help reduce high blood pressure.	TRUE / FALSE / DON'T KNOW
10. For a person in good control, exercising has no effect on blood sugar levels.	TRUE / FALSE / DON'T KNOW

Revised Michigan Knowledge Questionnaire – True/False Version, C.E.Lloyd, 12.12.08

P.T.O.

Revised Michigan Knowledge Questionnaire – True/False Version, C.E.Lloyd, 12.12.08

11. Infection is likely to cause an increase in blood sugar levels. TRUE / FALSE / DON'T KNOW

12. Wearing shoes a size bigger than usual helps prevent foot ulcers. TRUE / FALSE / DON'T KNOW

13. Eating foods lower in fat decreases your risk for heart disease. TRUE / FALSE / DON'T KNOW

14. Numbness and tingling may be symptoms of nerve disease. TRUE / FALSE / DON'T KNOW

15. Lung problems are usually associated with having diabetes. TRUE / FALSE / DON'T KNOW

16. When you are sick with the flu you should test for glucose more often. TRUE / FALSE / DON'T KNOW

SKIP TO QUESTION 19 IF YOU DON'T TAKE INSULIN

17. High blood glucose levels may be caused by too much insulin. TRUE / FALSE / DON'T KNOW

18. If you take your morning insulin but skip breakfast your blood glucose level will usually decrease. TRUE / FALSE / DON'T KNOW

19. Having regular check-ups with your doctor can help spot the early signs of diabetes complications. TRUE / FALSE / DON'T KNOW

20. Attending your diabetes appointments will stop you getting diabetes complications. TRUE / FALSE / DON'T KNOW

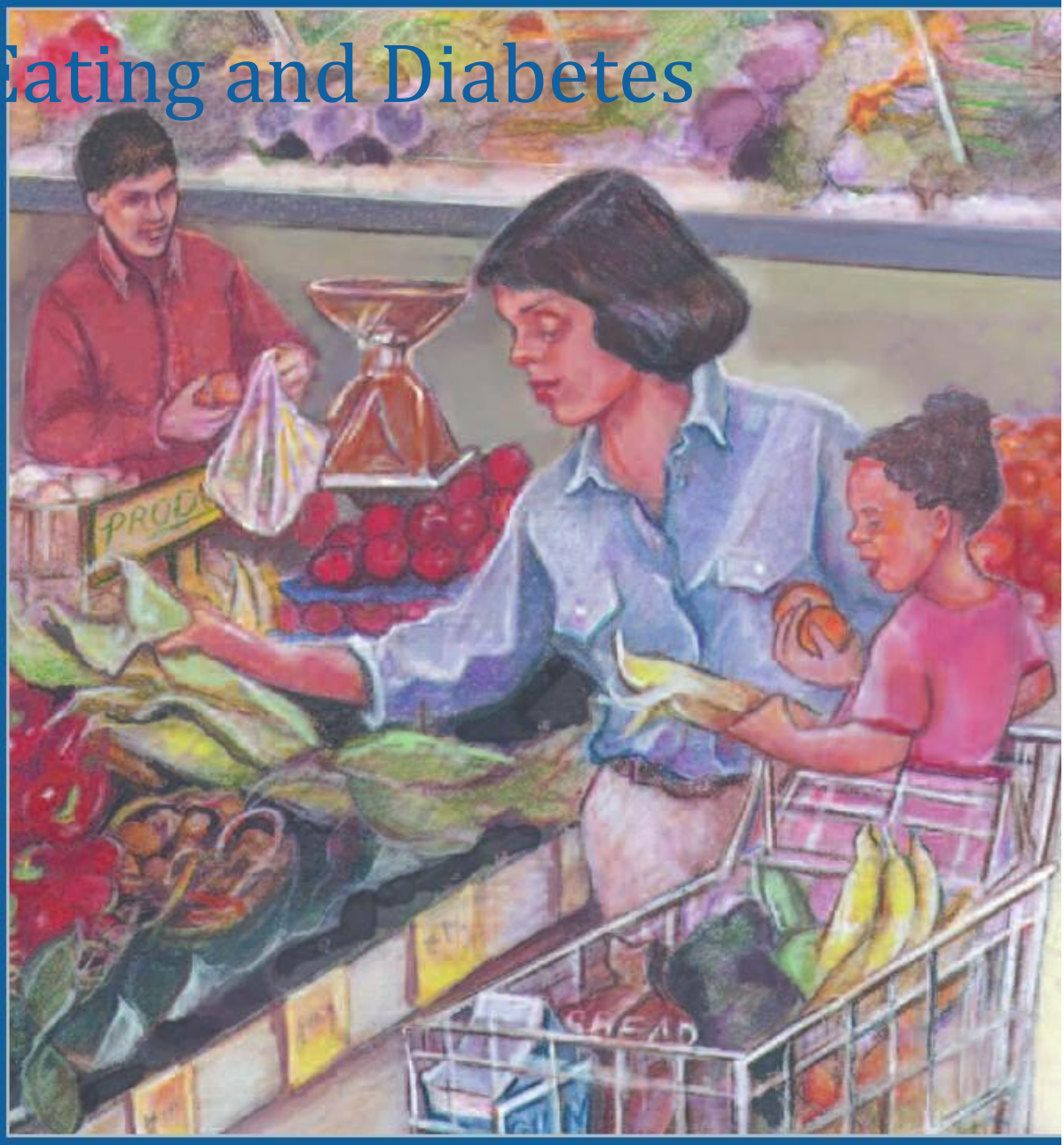
THANK YOU FOR YOUR HELP!

Appendix L

Participant Education Tools

What I need to know about

Eating and Diabetes



NIDDK | NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES

What I need to know about Eating and Diabetes

U.S. Department of Health and Human Services

NATIONAL INSTITUTES OF HEALTH

NIDDK | NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES

National Diabetes Information Clearinghouse

Contents

Eating and Diabetes

You can take good care of yourself and your diabetes by learning

- what to eat
- how much to eat
- when to eat

Making wise food choices can help you

- feel good every day
- lose weight if you need to
- lower your risk for heart disease, stroke, and other problems caused by diabetes

Healthful eating helps keep your blood glucose, also called blood sugar, in your target range. Physical activity and, if needed, diabetes medicines also help. The diabetes target range is the blood glucose level suggested by diabetes experts for good health. You can help prevent health problems by keeping your blood glucose levels on target.

Blood Glucose Levels

What should my blood glucose levels be?

Target Blood Glucose Levels for People with Diabetes	
Before meals	70 to 130
1 to 2 hours after the start of a meal	less than 180

Talk with your health care provider about your blood glucose target levels and write them here:

My Target Blood Glucose Levels	
Before meals	_____ to _____
1 to 2 hours after the start of a meal	less than _____

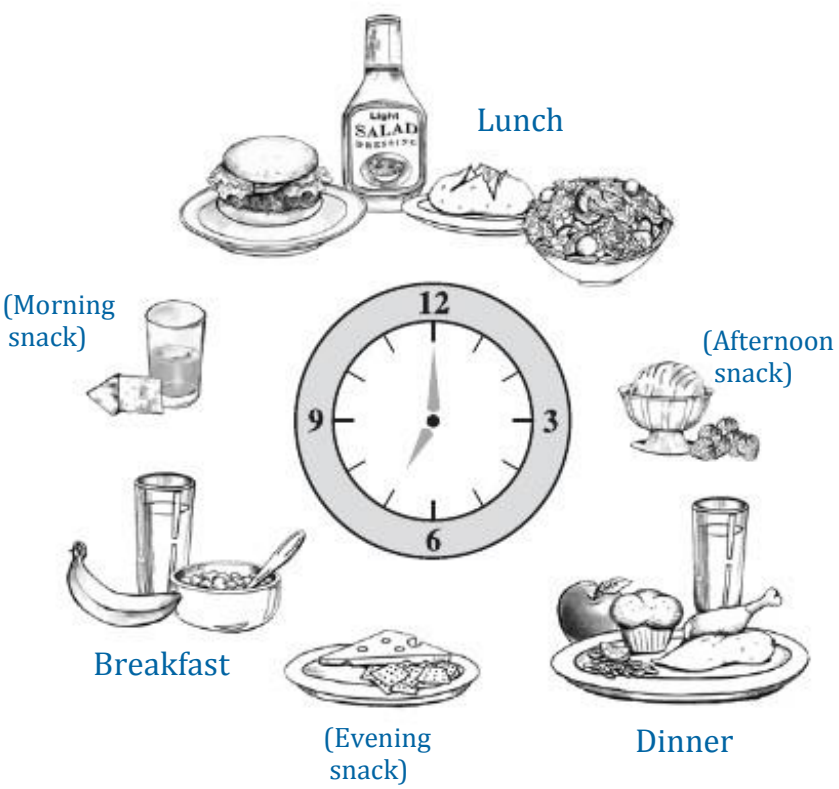
Ask your doctor how often you should check your blood glucose on your own. Also ask your doctor for an A1C test at least twice a year. Your A1C number gives your average blood glucose for the past 3 months. The results from your blood glucose checks and your A1C test will tell you whether your diabetes care plan is working.

How can I keep my blood glucose levels on target?

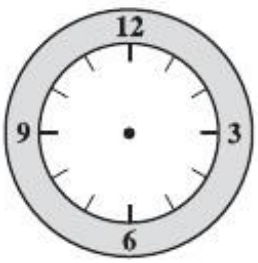
You can keep your blood glucose levels on target by

- making wise food choices
- being physically active
- taking medicines if needed

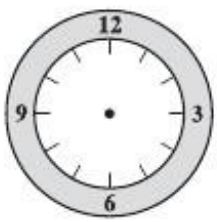
For people taking certain diabetes medicines, following a schedule for meals, snacks, and physical activity is best. However, some diabetes medicines allow for more flexibility. You'll work with your health care team to create a diabetes plan that's best for you.



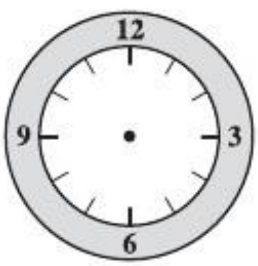
Talk with your doctor or diabetes teacher about how many meals and snacks to eat each day. Fill in the times for your meals and snacks on these clocks.



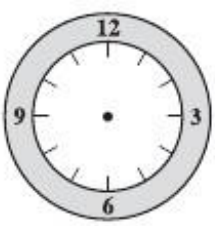
Breakfast



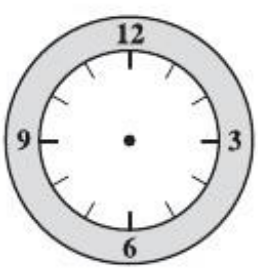
Morning snack



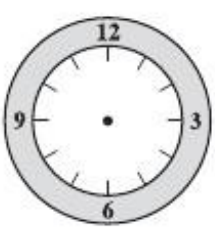
Lunch



Afternoon snack



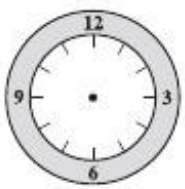
Dinner



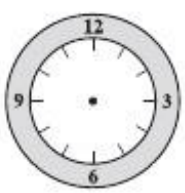
Evening snack

Your Diabetes Medicines

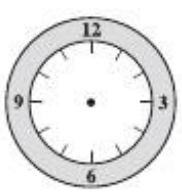
What you eat and when you eat affect how your diabetes medicines work. Talk with your doctor or diabetes teacher about when to take your diabetes medicines. Fill in the names of your diabetes medicines, when to take them, and how much to take. Draw hands on the clocks to show when to take your medicines.



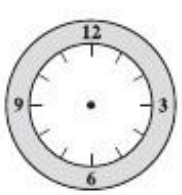
Name of medicine: _____
Time:_____ Meal: _____
How much: _____



Name of medicine: _____
Time:_____ Meal: _____
How much: _____



Name of medicine: _____
Time:_____ Meal: _____
How much: _____



Name of medicine: _____
Time:_____ Meal: _____
How much: _____

Your Physical Activity Plan

What you eat and when also depend on how much you exercise. Physical activity is an important part of staying healthy and controlling your blood glucose. Keep these points in mind:

- Talk with your doctor about what types of exercise are safe for you.
- Make sure your shoes fit well and your socks stay clean and dry. Check your feet for redness or sores after exercising. Call your doctor if you have sores that do not heal.
- Warm up and stretch for 5 to 10 minutes before you exercise. Then cool down for several minutes after you exercise. For example, walk slowly at first, stretch, and then walk faster. Finish up by walking slowly again.
- Ask your doctor whether you should exercise if your blood glucose level is high.
- Ask your doctor whether you should have a snack before you exercise.
- Know the signs of low blood glucose, also called hypoglycemia. Always carry food or glucose tablets to treat low blood glucose.
- Always wear your medical identification or other ID.
- Find an exercise buddy. Many people find they are more likely to do something active if a friend joins them.

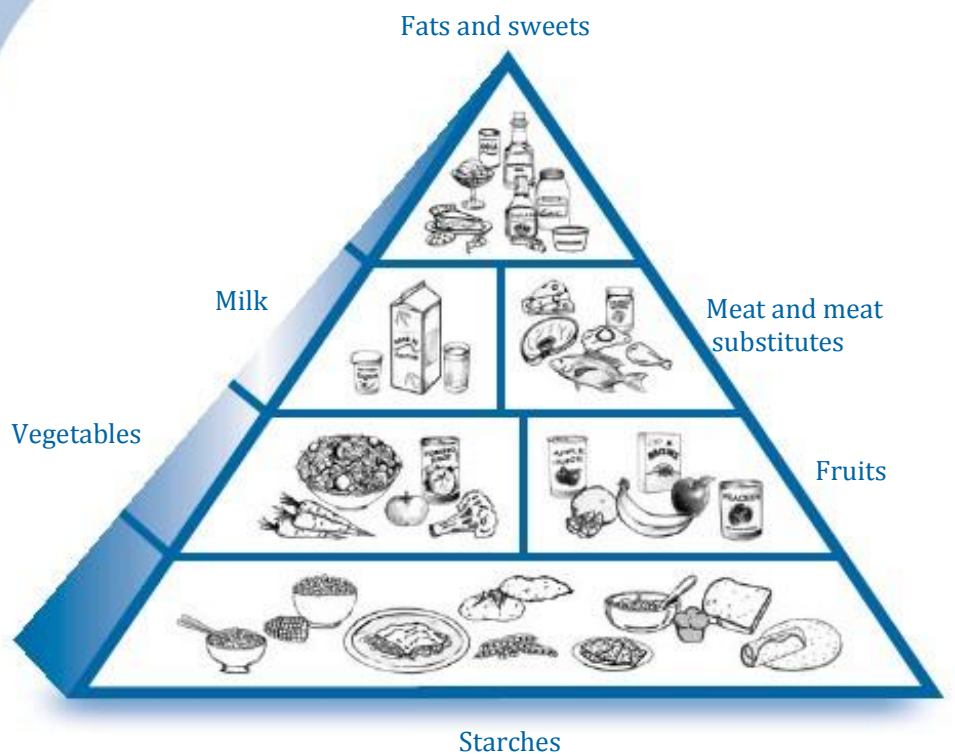
Low Blood Glucose (Hypoglycemia)

Low blood glucose can make you feel shaky, weak, confused, irritable, hungry, or tired. You may sweat a lot or get a headache. If you have these symptoms, check your blood glucose. If it is below 70, have one of the following right away:

- 3 or 4 glucose tablets
- 1 serving of glucose gel—the amount equal to 15 grams of carbohydrate
- 1/2 cup (4 ounces) of any fruit juice
- 1/2 cup (4 ounces) of a regular (not diet) soft drink
- 1 cup (8 ounces) of milk
- 5 or 6 pieces of hard candy
- 1 tablespoon of sugar or honey

After 15 minutes, check your blood glucose again. If it's still too low, have another serving. Repeat these steps until your blood glucose level is 70 or higher. If it will be an hour or more before your next meal, have a snack as well.

The Diabetes Food Pyramid



The diabetes food pyramid can help you make wise food choices. It divides foods into groups, based on what they contain. Eat more from the groups at the bottom of the pyramid, and less from the groups at the top. Foods from the starches, fruits, vegetables, and milk groups are highest in carbohydrate. They affect your blood glucose levels the most. See pages 9, 10, and 11 to find out how much to eat from each food group.

How much should I eat each day?

Have about 1,200 to 1,600 calories a day if you are a

- small woman who exercises
- small or medium-sized woman who wants to lose weight
- medium-sized woman who does not exercise much

Choose this many servings from these food groups to have 1,200 to 1,600 calories a day:

6 starches	2 milks
3 vegetables	4 to 6 ounces meat and meat substitutes
2 fruits	up to 3 fats

Talk with your diabetes teacher about how to make a meal plan that fits the way you usually eat, your daily routine, and your diabetes medicines. Then make your own plan.

Have about 1,600 to 2,000 calories a day if you are a

- large woman who wants to lose weight
- small man at a healthy weight
- medium-sized man who does not exercise much
- medium-sized or large man who wants to lose weight

Choose this many servings from these food groups to have 1,600 to 2,000 calories a day:

8 starches	2 milks
4 vegetables	4 to 6 ounces meat and meat substitutes
3 fruits	up to 4 fats

Talk with your diabetes teacher about how to make a meal plan that fits the way you usually eat, your daily routine, and your diabetes medicines. Then make your own plan.

Have about 2,000 to 2,400 calories a day if you are a

- medium-sized or large man who exercises a lot or has a physically active job
- large man at a healthy weight
- medium-sized or large woman who exercises a lot or has a physically active job

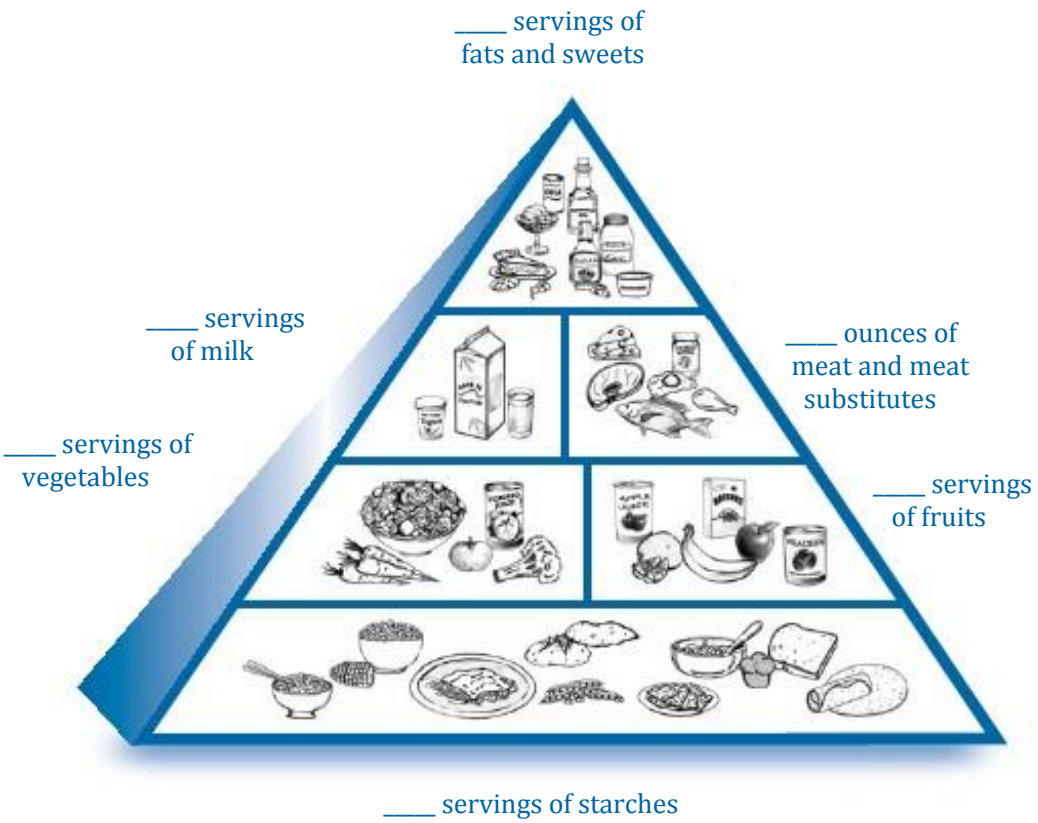
Choose this many servings from these food groups to have 2,000 to 2,400 calories a day:

10 starches	2 milks
4 vegetables	5 to 7 ounces meat and meat substitutes
4 fruits	up to 5 fats

Talk with your diabetes teacher about how to make a meal plan that fits the way you usually eat, your daily routine, and your diabetes medicines. Then make your own plan.

Make Your Own Diabetes Food Pyramid

Each day, I need

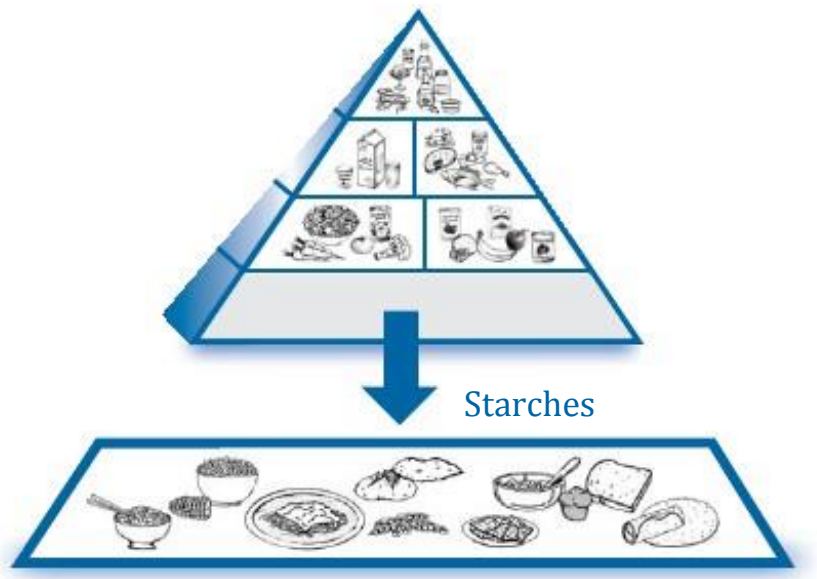


On pages 38 and 39, you can make your own meal plan. Write down how many servings to have at your meals and snacks.

Starches

Starches are bread, grains, cereal, pasta, and starchy vegetables like corn and potatoes. They provide carbohydrate, vitamins, minerals, and fiber. Whole grain starches are healthier because they have more vitamins, minerals, and fiber.

Eat some starches at each meal. Eating starches is healthy for everyone, including people with diabetes.



Examples of starches are

- bread
- potatoes
- pasta
- rice
- corn
- crackers
- pretzels
- cereal
- tortillas
- beans
- yams
- lentils

How much is a serving of starch?

Examples of 1 serving:


1 slice of bread

OR


1 small potato

OR


1/2 cup cooked cereal or 3/4 cup dry cereal flakes

OR


1 6-inch tortilla

Examples of 2 servings:


1 small potato

+


1 small ear of corn

OR


2 slices of bread

Examples of 3 servings:


1 small roll

+


1/2 cup of peas

+


1 small potato

OR


1 cup of rice

If your plan includes more than one serving at a meal, you can choose different starches or have several servings of one starch.

1. How many servings of grains, cereals, pasta, and starchy vegetables (starches) do you now eat each day?

   I eat _____ starch servings each day.

2. Go back to page 9, 10, or 11 to check how many servings of starches to have each day.

   I will eat _____ starch servings each day.

3. I will eat this many servings of starches at

   Breakfast _____ Snack _____

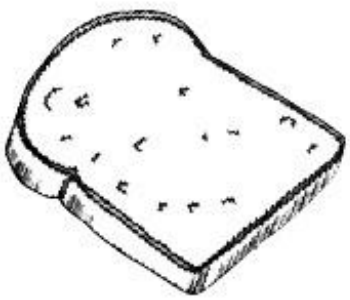
   Lunch _____ Snack _____

   Dinner _____ Snack _____

   A diabetes teacher can help you with your meal plan.

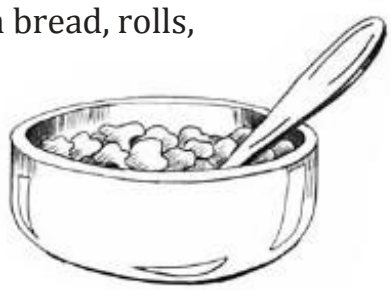
What are healthy ways to eat starches?

- Buy whole grain breads and cereals.
- Eat fewer fried and high-fat starches such as regular tortilla chips and potato chips, french fries, pastries, or biscuits. Try pretzels, fat-free popcorn, baked tortilla chips or potato chips, baked potatoes, or low-fat muffins.



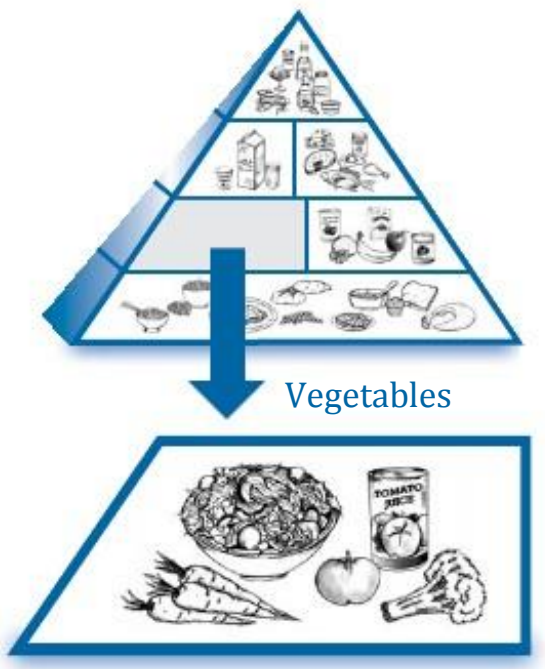
- Use low-fat or fat-free plain yogurt or fat-free sour cream instead of regular sour cream on a baked potato.

- Use mustard instead of mayonnaise on a sandwich.
- Use low-fat or fat-free substitutes such as low-fat mayonnaise or light margarine on bread, rolls, or toast.
- Eat cereal with fat-free (skim) or low-fat (1%) milk.



Vegetables

Vegetables provide vitamins, minerals, and fiber. They are low in carbohydrate.



Examples of vegetables are

- lettuce•
- broccoli•
- vegetable juice•
- spinach•

peppers
carrots
green beans
tomatoes

- celery
- chilies
- greens
- cabbage

How much is a serving of vegetables?

Examples of 1 serving:

1/2 cup
cooked carrots

OR

1/2 cup
cooked
green beans

OR

1 cup salad

Examples of 2 servings:

1/2 cup
cooked
carrots

\+

1 cup
salad

OR

1/2 cup
vegetable
juice

\+

1/2 cup
cooked
green beans

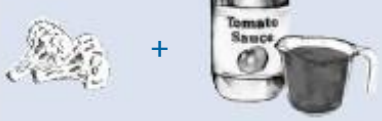
Examples of 3 servings:

1/2 cup
cooked
greens

\+

1/2 cup cooked
green beans
and 1 small
tomato

OR



1/2 cup
broccoli

\+

1 cup
tomato
sauce

If your plan includes more than one serving at a meal, you can choose several types of vegetables or have two or three servings of one vegetable.

1. How many servings of vegetables do you now eat each day?

   I eat _____ vegetable servings each day.

2. Go back to page 9, 10, or 11 to check how many servings of vegetables to have each day.

   I will eat_____vegetable servings each day.

3. I will eat this many servings of vegetables at

   Breakfast _____ Snack _____

   Lunch _____ Snack _____

   Dinner _____ Snack _____

   A diabetes teacher can help you with your meal plan.

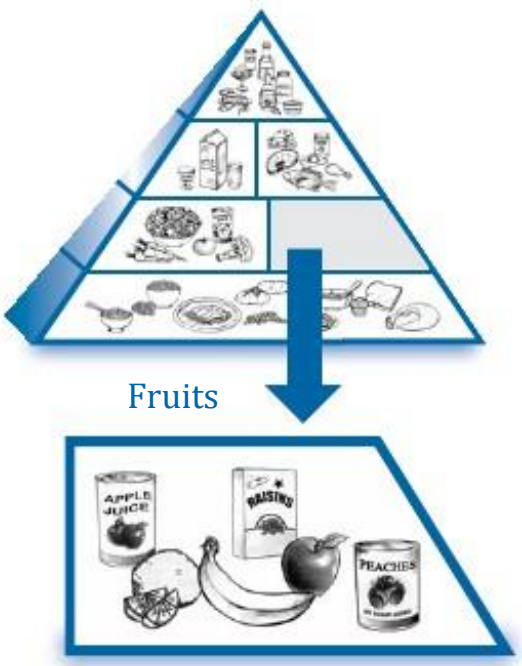
What are healthy ways to eat vegetables?

- Eat raw and cooked vegetables with little or no fat, sauces, or dressings.
- Try low-fat or fat-free salad dressing on raw vegetables or salads.
- Steam vegetables using water or low-fat broth.

- Mix in some chopped onion or garlic.
- Use a little vinegar or some lemon or lime juice.
- Add a small piece of lean ham or smoked turkey instead of fat to vegetables when cooking.
- Sprinkle with herbs and spices.
- If you do use a small amount of fat, use canola oil, olive oil, or soft margarines (liquid or tub types) instead of fat from meat, butter, or shortening.

Fruits

Fruits provide carbohydrate, vitamins, minerals, and fiber.



Examples of fruits include

- apples
- bananas
- fruit juice
- raisins
- strawberries
- oranges
- dried fruit
- watermelon
- grapefruit
- peaches
- mango
- guava
- papaya
- berries
- canned fruit

How much is a serving of fruit?

Examples of 1 serving:

1 small apple

OR

1/2 cup juice

OR

1/2 grapefruit

Examples of 2 servings:

1 banana

OR

1/2 cup orange juice

+

1 1/4 cups whole strawberries

If your plan includes more than one serving at a meal, you can choose different types of fruit or have several servings of one fruit.

1. How many servings of fruit do you now eat each day?

I eat _____ fruit servings each day.

2. Go back to page 9, 10, or 11 to check how many servings of fruit to have each day.

I will eat _____ fruit servings each day.

3. I will eat this many servings of fruit at

Breakfast _____ Snack _____

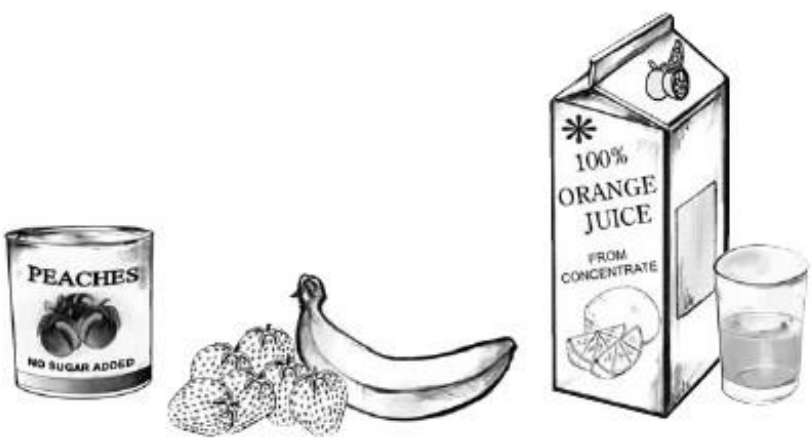
Lunch _____ Snack _____

Dinner _____ Snack _____

A diabetes teacher can help you with your meal plan.

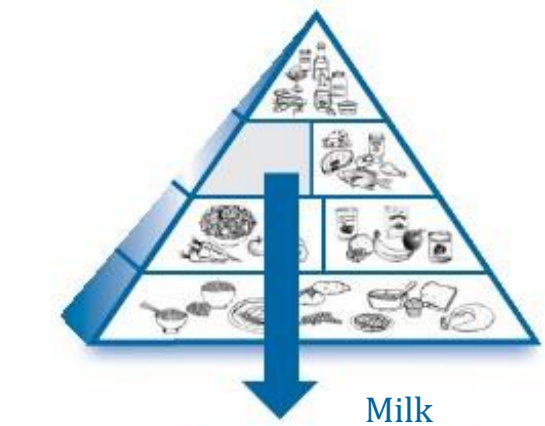
What are healthy ways to eat fruits?

- Eat fruits raw or cooked, as juice with no sugar added, canned in their own juice, or dried.
- Buy smaller pieces of fruit.
- Choose pieces of fruit more often than fruit juice. Whole fruit is more filling and has more fiber.
- Save high-sugar and high-fat fruit desserts such as peach cobbler or cherry pie for special occasions.



Milk

Milk provides carbohydrate, protein, calcium, vitamins, and minerals.



Milk

How much is a serving of milk?

Examples of 1 serving:

1 cup fat-free or
low-fat yogurt

OR

1 cup fat-free (skim) or
low-fat (1%) milk

Note: If you are pregnant or breastfeeding, have four to five servings of milk each day.

1. How many servings of milk do you now have each day?

   I have _____ milk servings each day.

2. Go back to page 9, 10, or 11 to check how many servings of milk to have each day.

   I will have _____ milk servings each day.

3. I will have this many servings of milk at

   Breakfast _____ Snack _____

   Lunch _____ Snack _____

   Dinner _____ Snack _____

   A diabetes teacher can help you with your meal plan.

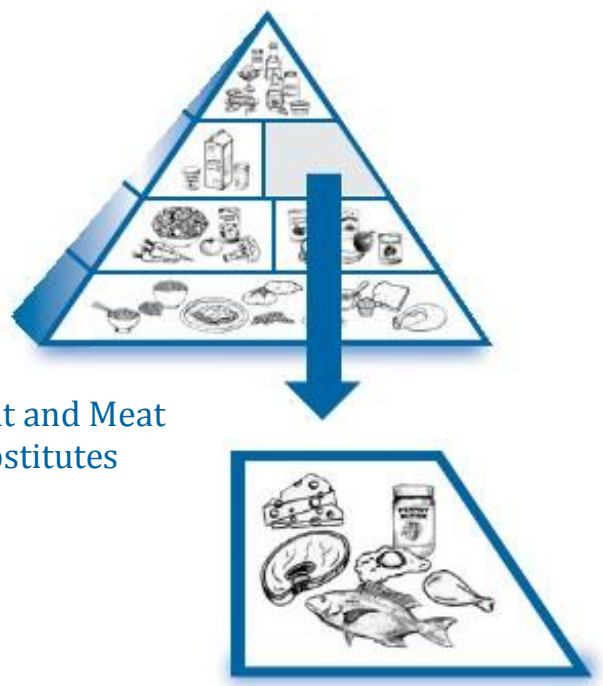
What are healthy ways to have milk?

- Drink fat-free (skim) or low-fat (1%) milk.
- Eat low-fat or fat-free fruit yogurt sweetened with a low-calorie sweetener.
- Use low-fat plain yogurt as a substitute for sour cream.

Meat and Meat Substitutes

The meat and meat substitutes group includes meat, poultry, eggs, cheese, fish, and tofu. Eat small amounts of some of these foods each day.

Meat and meat substitutes provide protein, vitamins, and minerals.



Meat and Meat Substitutes

Examples of meat and meat substitutes include

- chicken• eggs• cheese
- beef• peanut butter• pork
- fish• tofu• lamb
- canned tuna or• cottage cheese• turkey other fish

How much is a serving of meat and meat substitutes?

Meat and meat substitutes are measured in ounces. Here are examples.

Examples of a 1-ounce serving:

1 egg

OR

2 tablespoons of peanut butter

Example of a 2-ounce serving:

1 slice (1 ounce) of turkey
+
1 slice (1 ounce) of low-fat cheese

Example of a 3-ounce serving:

3 ounces of cooked lean meat, chicken, or fish*

*Three ounces of meat (after cooking) is about the size of a deck of cards.

1. How many ounces of meat and meat substitutes do you now eat each day?

   I eat _____ ounces of meat and meat substitutes each day.

2. Go back to page 9, 10, or 11 to check how many ounces of meat and meat substitutes to have each day.

   I will eat _____ ounces of meat and meat substitutes each day.

3. I will eat this many ounces of meat and meat substitutes at

   Breakfast _____ Snack _____

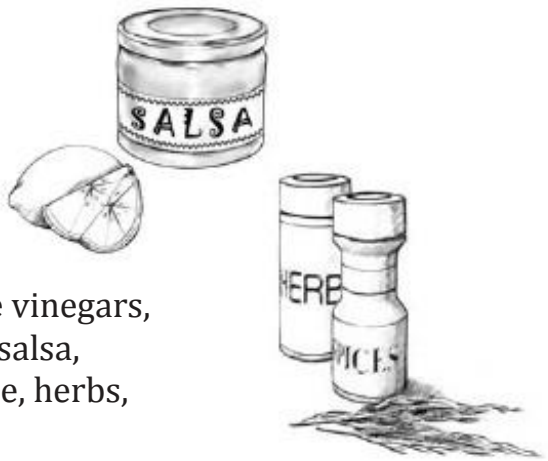
   Lunch _____ Snack _____

   Dinner _____ Snack _____

   A diabetes teacher can help you with your meal plan.

What are healthy ways to eat meat and meat substitutes?

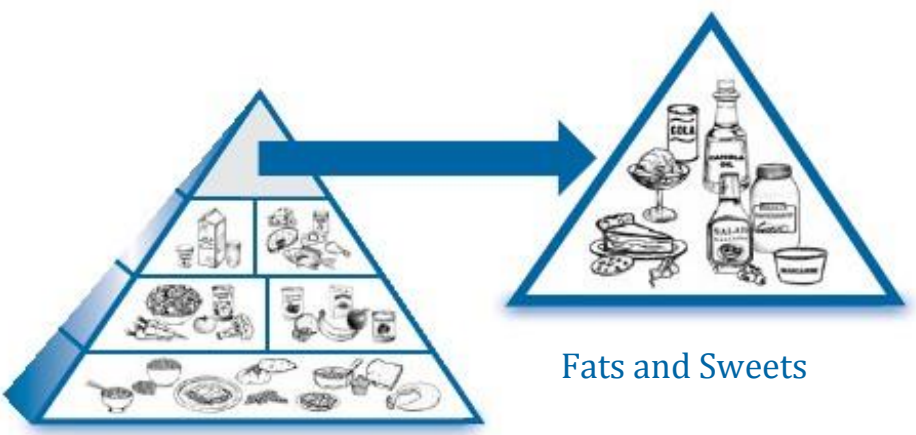
- Buy cuts of beef, pork, ham, and lamb that have only a little fat on them. Trim off the extra fat.
- Eat chicken or turkey without the skin.
- Cook meat and meat substitutes in low-fat ways:
  - broil
  - grill
  - stir-fry
  - roast
  - steam
  - microwave



- To add more flavor, use vinegars, lemon juice, soy sauce, salsa, ketchup, barbecue sauce, herbs, and spices.
- Cook eggs using cooking spray or a non-stick pan.
- Limit the amount of nuts, peanut butter, and fried foods you eat. They are high in fat.
- Check food labels. Choose low-fat or fat-free cheese.

Fats and Sweets

Limit the amount of fats and sweets you eat. Fats and sweets are not as nutritious as other foods. Fats have a lot of calories. Sweets can be high in carbohydrate and fat. Some contain saturated fats, trans fats, and cholesterol that increase your risk of heart disease. Limiting these foods will help you lose weight and keep your blood glucose and blood fats under control.



Fats and Sweets

Examples of fats include

- salad dressing
- butter
- oil
- margarine
- cream cheese
- mayonnaise
- avocado
- olives
- bacon

Examples of sweets include

- cake
- pie
- ice cream
- syrup
- cookies
- doughnuts

How much is a serving of sweets?

Examples of 1 serving:

1 3-inch cookie

OR

1 plain cake doughnut

OR

1 tablespoon maple syrup

How much is a serving of fat?

Examples of 1 serving:

1 strip of bacon

OR

1 teaspoon oil

Examples of 2 servings:

1 tablespoon regular salad dressing

OR

+

2 tablespoons reduced-fat salad dressing

1 tablespoon reduced-fat mayonnaise

How can I satisfy my sweet tooth?

Try having sugar-free popsicles, diet soda, fat-free ice cream or frozen yogurt, or sugar-free hot cocoa mix.

Other tips:

- Share desserts in restaurants.
- Order small or child-size servings of ice cream or frozen yogurt.
- Divide homemade desserts into small servings and wrap each individually. Freeze extra servings.

Remember, fat-free and low-sugar foods still have calories. Talk with your diabetes teacher about how to fit sweets into your meal plan.

Alcoholic Drinks

Alcoholic drinks have calories but no nutrients. If you have alcoholic drinks on an empty stomach, they can make your blood glucose level go too low. Alcoholic drinks also can raise your blood fats. If you want to have alcoholic drinks, talk with your doctor or diabetes teacher about how much to have.

Your Meal Plan

Plan your meals and snacks for one day. Work with your diabetes teacher if you need help.

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Measuring Your Food

To make sure your food servings are the right size, you can use

- measuring cups
- measuring spoons
- a food scale

Or you can use the guide below. Also, the Nutrition Facts label on food packages tells you how much of that food is in one serving.

Guide to Sensible Serving Sizes

This much	is the same as
	3 ounces 1 serving of meat, chicken, turkey, or fish
	1 cup 1 serving of • cooked vegetables • salads • casseroles or stews, such as chili with beans • milk

This much	is the same as
	1 /2 cup 1 serving of • fruit or fruit juice • starchy vegetables, such as potatoes or corn • pinto beans and other dried beans • rice or noodles • cereal
	1 ounce 1 serving of • snack food • cheese (1 slice)
	1 tablespoon 1 serving of • salad dressing • cream cheese
	1 teaspoon 1 serving of • margarine or butter • oil • mayonnaise

When You're Sick

Take care of yourself when you're sick. Being sick can make your blood glucose go too high. Tips on what to do include the following:

- Check your blood glucose level every 4 hours. Write down the results.
- Keep taking your diabetes medicines. You need them even if you can't keep food down.
- Drink at least one cup (8 ounces) of water or other calorie-free, caffeine-free liquid every hour while you're awake.
- If you can't eat your usual food, try drinking juice or eating crackers, popsicles, or soup.
- If you can't eat at all, drink clear liquids such as ginger ale. Eat or drink something with sugar in it if you have trouble keeping food down, because you still need calories. If you can't eat enough, you increase your risk of low blood glucose, also called hypoglycemia.

- In people with type 1 diabetes, when blood glucose is high, the body produces ketones. Ketones can make you sick. Test your urine or blood for ketones if
  - your blood glucose is above 240
  - you can't keep food or liquids down
- Call your health care provider right away if
  - your blood glucose has been above 240 for longer than a day
  - you have ketones
  - you feel sleepier than usual
  - you have trouble breathing
  - you can't think clearly
  - you throw up more than once
  - you've had diarrhea for more than 6 hours

Where can I get more information?

Diabetes Teachers (nurses, dietitians, pharmacists, and other health professionals)

To find a diabetes teacher near you, call the American Association of Diabetes Educators toll-free at 1–800–TEAMUP4 (832–6874) or see www.diabeteseducator.org and click on "Find an Educator."

Recognized Diabetes Education Programs (teaching programs approved by the American Diabetes Association)

To find a program near you, call the American Diabetes Association toll-free at 1–800–DIABETES (342–2383) or see www.diabetes.org/education/edustate2.asp on the Internet.

Dietitians

To find a dietitian near you, call the American Dietetic Association's National Center for Nutrition and Dietetics toll-free at 1–800–877–1600 or see www.eatright.org and click on "Find a Nutrition Professional."

National Diabetes Information Clearinghouse

1 Information Way
Bethesda, MD 20892–3560
Phone: 1–800–860–8747
Fax: 703–738–4929
Email: ndic@info.niddk.nih.gov
Internet: www.diabetes.niddk.nih.gov

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Publications produced by the Clearinghouse are carefully reviewed by both NIDDK scientists and outside experts. This booklet was originally reviewed by Marion J. Franz, M.S., R.D., L.D., C.D.E., Minneapolis, and Carolyn Leontos, M.S., R.D., C.D.E., University of Nevada.

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