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Adult Learning And The Effect Of Education And Gender Interaction On Type 2 Diabetics

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ADULT LEARNING AND THE EFFECT OF EDUCATION AND GENDER
INTERACTION ON TYPE 2 DIABETICS

A Dissertation

Presented to

The College of Graduate and Professional Studies

Department of Teaching and Learning

Indiana State University

Terre Haute, Indiana

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

By

Abdi H. Nur

December, 2017

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Keywords: education, adult learning, diabetes education, medication, healthy exercise, gender

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ABSTRACT

The purpose of this mixed methods research study was to investigate whether the relationships between education and medication and healthy exercise adherence were the same among female and male Type 2 diabetic adult learners. The purpose included also exploring whether registered nurses would alter their approach to diabetic adult learners' education on medication and healthy exercise adherence considering patients' gender and education levels. The study also investigated the correlation between diabetes duration and medication and healthy exercise adherence. The research investigation employed mixed methods sequential explanatory design using qualitative data to help explain the quantitative findings. The quantitative study was based on preexisting data of 102 Type 2 diabetic adult learners collected by the researcher. The qualitative study was a phenomenological investigation based on semi-structured interviews of 10 registered nurses from Terre Haute Regional Hospital.

The research investigation suggested no significant interaction between gender and education levels regarding medication and healthy exercise adherence (respectively $p = .746$; $p = .664$). In contrast, the findings in the qualitative analyses suggested that the registered nurses would change their approach to patients' education on medication adherence based on education levels, not gender. The nurses expressed also that healthy exercise adherence among Type 2 diabetic adults was individual based, i.e., education attainment and gender had no impact on patients' healthy exercise adherence. The quantitative analyses also suggested an inverse correlation between how long Type two diabetic adult learners have been diagnosed with the

disease and their healthy exercise adherence. The longer patients were diabetic the less they were adherent to healthy exercise routines.

The study recommended that more investigation on Type 2 diabetic adult learners would be useful to understand the impact of the interaction between gender and education attainment on medication and healthy exercise routines. The study suggested as well that future investigations should include larger sample sizes of study subjects and more representation of male Type 2 diabetic adult learners. They should as well include more representation of minority and young Type 2 diabetic populations. Moreover, this study suggested future investigations which include other groups of diabetes educators such as specialists from dietary and pharmacy professions.

PREFACE

I was raised in a rural Central Somalia town of Abudwaq, which was frequently inhabited by a pastoral community. At the time of my childhood, the town had few thousands of residents. Today, it is one of the major towns in the country's heartland. It had, at the time of my juvenile, only a primary school education, so I had to move to the capital city of Mogadishu to pursue my next levels of education. Thanks to my older brother's support, I completed my intermediate and high school education levels in Mogadishu. I subsequently pursued my higher education in the U.S., mainly in the medical profession.

As a medical professional, I regularly meet with individuals that suffer from diabetes complications such as kidney failure and lower limb amputations. These disease complications could have been avoided by properly following the diabetes educators' instructions regarding the medication and healthy exercise adherence. As adult learners, Type two diabetic persons require well trained diabetes educators who can effectively instruct them about the disease medication and other vital treatment elements including physical activity routines. However, as Knowles (1990) suggested, the most important assets for instruction exist in the adult learners themselves. The role of the educators is to assist adult learners to decide on effective ways to use these assets. Therefore, I conducted this study to advance patient—educator collaboration, which would greatly improve patients' adherence to their diabetes instructions.

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Achieving treasured goals, like this work, requires individuals who generously offer you their support in succeeding these goals. I owe to the following individuals the utmost gratitude and appreciation. First, after my Lord, I would like to thank and acknowledge my wife, Kadija Anod, for her grit, support, and inspiration in achieving my goal of successful completion of my Ph.D. degree, including this dissertation work. It would have been difficult for me to achieve this goal without her support and encouragement. Second, I would like to thank my brother, Ali A. Farah, whose support for me had started long before I began my Ph.D. work. After I finished my primary school in a small town in Central Somalia, I dearly needed to relocate to a more urban city where higher levels of education were available. My brother's support and guidance for me to successfully complete my elementary and high school education in Mogadishu, Somalia, were the foundation of my success throughout my subsequent educational journey. This dissertation would not have been possible without his sponsorship. Third, I would like to extend my thanks to the study subjects (patients and registered nurses) who accepted to participate in the research study. Finally, I would like to express my utmost gratitude and appreciation to my dissertation chair, Dr. Susan Powers, and to my other dissertation committee members, Dr. Bassou El Mansour and Dr. Cassandra Caruso-Woolard. Their guidance was important and instrumental in this work.

DEDICATION

I dedicate this work to my late parents, especially to my mother who always was my inspiration to succeed in my endeavors. Thank you Mother and Father. My Lord blesses your souls.

To my wife, Khadija Anod, You always supported me to achieve my educational goals. Without your support, this work wouldn't have been accomplished. Thank you for your support.

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CHAPTER 1

INTRODUCTION

Adult learning is an enormous and unstructured field of practice. With its many content areas, delivery systems, objectives, and clienteles, it resists simple classification (Merriam & Caffarella, 1999). Learning in adulthood is a broad impression of what we know about the practice including the perspective in which it comes about, who the participants are, what they absorb and why, the nature of the instruction progression, the advance of concept in adult learning, and other subjects important for the adult learning progression (Merriam & Caffarella, 1991). The process of learning in adulthood appears in relations between individuals, and between them and experiences (Jarvis, 2004). It is the process which directs to relatively permanent changes in our potential for performance as the result of our previous contact with the environment (Lovell, 1980). What people need to learn and the methods in which they learn what they are offered are determined largely by the nature of the people at any point in time (Merriam & Caffarella, 1999). People are diverse in their learning techniques and there is no a single approach that can produce high quality learning condition (Williams, Brown, & Etherington, 2012). As Knowles (1990) argued, learners' experience has effects on their learning, and any group of adults will be diverse with regard to education, learning style, needs, interests, and objectives. Besides, as Knowles illustrated, adult learners question the reason they want to

learn specific things before they learn. Therefore, the main task of educators is to help adult learners comprehend why they need to learn what they are offered to learn.

Diabetes learning activities delivered through adult learning programs is no exception. The process of diabetes education comprises assessment of the patients' specific learning needs, evaluation of patients' achievement of recognized self-management objectives, and appropriate records of all diabetes learning encounters (American Association of Diabetes Educators, n.d.). Many diabetics, however, choose not to join diabetes learning sessions for diabetes management. As a result, they experience serious diabetes education gaps (Elliott, Abdulhadi, Al-Maniri, Al-Shafae, & Wahlström, 2013). Diabetes educators believe that even though efforts were made to help patients alter their harmful activities, there are still people who make unsafe decisions and continue to engage in detrimental actions (Fomby-White, 2010).

Diabetes Overview

Diabetes is a growing community health burden and among the major sources of death and disability in the United States. The disease is the seventh prominent cause of mortality in the United States. (Qaseem, Humphrey, Sweet, Starkey, & Shekelle, 2012). Together, cancer, diabetes, heart disease, and stroke account for nearly two-thirds of all U.S. deaths. Considered earlier a minor disease, diabetes is now shaping itself as a widespread and daring chronic illness (Magee & Narayan, 2013; Mattei et al., 2015). The disease decreases people's life expectancy and quality of life as it is the risk factor for different serious health conditions including cardiovascular diseases (CVD), stroke, kidney failure, nerve damage, leg amputations, and eye damage among other health complications (Centers for Disease Control and Prevention [CDC], 2012a). It is a chronic condition, wherein individuals' self-care is essential to avoid injury and death (Kav et al., 2010).

Approximately 29.1 million people in the U.S. (i.e., 9.3% of U.S. residents) were estimated to have the disease in 2012, of which 8.1 million were undiagnosed (American Diabetes Association [ADA], 2016a). According to the ADA (2016a), another 86 million U.S. residents aged 20 and older were diagnosed with prediabetes condition in the same year. According to the CDC (2016), 76,488 deaths in the U.S. were directly associated with diabetes in 2014. While the disease's prevalence rate in the U.S. is similar to that of a global prevalence level, the financial burden of the disease in the U.S. is a real concern. The economic burden of pre-diabetes and diabetes in the US were projected to \$218 billion in 2007 (Dall et al., 2010). Roughly after nine years since that estimation, it was projected in 2016 that diabetes and prediabetes would cost the U.S. \$322 billion in 2016 (ADA, 2016b). Worldwide, the prevalence of the disease soared from 108 million in 1980 to 422 million people in 2014; approximately 1.5 million deaths worldwide were directly related to the disease in 2012 (World Health Organization [WHO], 2015). Globally, diabetes expenditures were estimated to reach \$376 billion in 2010, i.e., 12% of health care expenses in that year alone. This figure is projected to reach \$490 billion in 2030 (Hu, 2011).

Diabetes has two main types of conditions. With Type 1, in the most cases, people need to inherit risk factors from both parents (ADA, 2014c). Type 2 diabetics, whom account for the overwhelming majority of the diabetes population, either people's bodies do not produce the necessary amount of insulin or their body cells ignore the use of insulin (ADA, 2013a). Because of these two reasons, glucose surges in the bloodstream rather than moving into cells. The major risk factors of developing Type 2 diabetes are obesity and overweight conditions (Beane, 2011; Okwechime, Roberson, & Odoi, 2015); however, other lifestyle elements add to developing the disease. A failure to be physically active, alcohol consumption, genetics, age, high blood

pressure, abnormal cholesterol, and unhealthy eating habits can all play a major role in developing diabetes (ADA, 2016c; Van Dam, 2003). While obesity, alcohol consumption, smoking, and unhealthy eating can be managed, some of the risk factors, like family history and age, are impossible to change (ADA, 2014a). Researchers are in search of ways individuals can lessen the risk for developing the disease (ADA, 2014b). Risk factors including family history, body mass index, and metabolic rate condition are used by physicians to counsel patients about the top predictors in developing Type 2 diabetes (Wessel, Gupta, & Groot, 2016).

Over time, a glucose increase in the blood, if not controlled, may cause acute and chronic health problems such as CVD, blindness, renal failure, and lower-extremities amputations, among other health conditions (ADA, 2013a; CDC, 2012a). Investigators are in pursuit of means diabetics can use to decrease their risk of the different types of cancer which may be associated with the disease, including liver, pancreas, uterus, colon, breast, and bladder cancer (ADA, 2014b). It is still under investigation whether the relationship between the condition and risk of specific type of cancers is mostly due to common risk factors such as obesity, unhealthy eating, lack of exercise, and age, or if the disease itself increases the danger for certain types of cancer (Giovannucci et al., 2010). Yeh et al. (2012) reported that individuals with cured diabetes were expected to have more cancer than people with no history of diabetes, particularly pancreatic cancer. Another study suggested that women who have undergone menopause with a history of treated diabetes, mainly with insulin, have a considerably higher risk of developing lung cancer (Luo et al., 2012). In addition, there was an association between colon cancer and diabetes, especially proximal colon cancer (Jarvandi, Davidson, & Schootman, 2013). The primary step to prevent and to minimize the damage of diabetes and its problems is to identify those having and at risk for the disease. Initial fighting of the diabetes, limiting calories, and

increasing physical activity routines may be sufficient as well to confront and to control Type 2 diabetes. However, severe loss of pancreas capacity to produce necessary insulin requires the need for medication treatment (Fradkin, 2012).

Diabetes can affect any part of human body including small vessels. For example, injury to the small vessels damages the retina, kidneys, and nerves making the condition the driving reason of renal loss, impaired vision, and lower leg amputations (Fradkin, 2012). Good care of diabetes is essential to preventing complications that can lead to premature injury and deaths. According to the WHO (2016), a small amount of generic medicines, a change to healthy lifestyles, self-care awareness, and “regular screening for early detection and treatment of complications through a multidisciplinary team” (p. 47) are all significant to manage the disease and to avoid the aforementioned diabetes complications. Thus, while physicians’ and other medical and healthcare professionals’ influence on diabetics is crucial to act in accordance with instruction guidelines, in the end patients’ self-care is an effective tool to achieve optimum glycemic outcomes (Borgsteede et al., 2011). Adherence, which is a key element in the treatment of diabetes condition, is a conduct wherein patients’ actions such as taking medications on a regular basis or altering exercise and diet routines agree with physicians’ plans and counsels (Vimalavathini, Agarwal, & Gitanjali, 2008). Therefore, managing diabetes in a successful way obliges alterations in dietary behavior, physical activity routines, and interminable adherence to medication schedules (Hertz, Unger, & Lustik, 2005). However, diabetics may have difficulties in adapting to the new behaviors of diet, exercise, and medication (Hertz et al., 2005). Following physicians’, medical professionals’, and health educators’ plans about regularly taking medicine and altering to healthy diet and healthy exercise routines may assist diabetics to achieve optimum glycemic control outcomes and avoid serious health problems such as CVDs and kidney failures.

On the other hand, adherence rates among Type 2 diabetics are fairly low. The adherence rate is between 36% and 94% (Borgsteede et al., 2011). Researchers revealed that younger employed patients and females were more likely to be reluctant to comply with the treatment procedures (Hertz et al., 2005). Moreover, patients' self-assessment can help diabetics adhere to healthy eating plans, make appropriate food choices, and give ways to offer feedback on improvements made in reaching dietary plans (Sevick et al., 2010). Besides, changing the undesired behaviors regarding to adhering treatment routines among Type 2 diabetics is a crucial element in meeting optimal glycemic goals (Shi, Ostwald, & Wang, 2010). Therefore, it has been advised that Type 2 diabetics should be active players in setting for themselves ideal and effective glycemic goals (Ismail-Beigi et al., 2011).

Achieving optimum blood glucose levels is crucial to control diabetes and to prevent complications that could cause serious injury and death (Kav et al., 2010; Nuckols et al., 2011). Accordingly, important factors to maintain ideal blood glucose levels include complying with healthy diet, healthy exercise, medication, and regular checking of blood sugar levels (Sousa & Zauszniewski, 2005). Exploring how patients' educational attainment impacts their diabetes control efforts is an important factor to study as the disease's worldwide incidence dramatically worsens. However, as medication adherence, healthy eating, and healthy exercise are essential to properly manage and control diabetes, assessing the effects of patients' educational attainment on the factors important to properly manage the disease is imperative as well. These factors include medication and healthy exercise adherence.

Statement of Purpose

It is important to explain the goal of the investigation in order to enable the reader to evaluate the success of the study (Huck, 2012). After careful review of related and important

literature on the subject of Type 2 diabetes at large, especially the relationship between gender, education and diabetes, the current study examined important areas the prior studies on this topic either discounted or studied with limited investigations. It has been investigated and found that overall Type 2 diabetes is inversely linked to patients' educational attainment (Maier et al., 2014). It was reported that the prevalence of the disease is lower among people with higher educational attainment compared to those with lower education achievements (Brown, Nevitte, Szeto, & Nandi, 2015). However, it had not been studied, to my knowledge, the impact of the interaction of patients' gender and education levels on their medication and healthy exercise adherence. Therefore, the main purpose of this investigation was to explore whether the relationship between education and medication and healthy exercise adherence among Type 2 diabetics were the same for men and women. The aim of the research included exploring whether registered nurses altered their approach to patients' education on medication and healthy exercise adherence considering patients' gender and their education levels. The study also examined the link between diabetes duration and medication and healthy exercise adherence.

Statement of the Problem

The statement of the problem, as a simple declarative statement, offers guidance in the research plan (Neutens & Robinson, 2010). The present statement of the problem directed the investigation and offered emphasis and focus in the research proposal and strategy. Therefore, the problem the current research may help alleviate through this study is to understand the influence of the interaction of Type 2 diabetics' educational attainment and gender on their medication and healthy exercise adherence, and whether that influence is the same for men and women. The current study may as well help explain by what method registered nurses would

alter their approach to patients' education on medication and healthy exercise adherence considering patients' gender and their education levels.

Significance of the Study

The present investigation provides important information of how Type 2 diabetics' educational achievement can impact their medication and healthy exercise adherence. It also provides information of whether the relationships between education levels and medication and healthy exercise adherence among patients are the same for men and women. Studying the impact of the interplay of patients' education achievement and their gender on medication and healthy exercise adherence may have two significant advantages for clinicians and diabetes educators. The findings of the investigation helped diabetes educators alter their approach to patients' education about medication and healthy exercise adherence. They helped as well the educators to better understanding of patients' adherence with regards to medication and healthy exercise based on the interaction of gender and education levels. Those two advantages could enable clinicians and diabetes educators to successfully educate patients about medication and healthy exercise routines. Therefore, studying whether the link between aforesaid variables is the same for male and female diabetics was significant to explore. Similarly, it was important to explore how diabetes educators would change their tactic to patients' education on medication and healthy exercise adherence considering the interaction of patients' gender and education levels.

Research Questions

Primary Questions

1. Is the relationship between education attainment and medication adherence the same for men and women?

2. Is the relationship between education attainment and healthy exercise adherence the same for men and women?
3. How would registered nurses alter their approach to patients' education on medication and healthy exercise adherence considering patients' gender and education levels?

Secondary Question

Is there a relationship between how long patients have been diagnosed with diabetes and their medication and healthy exercise adherence?

Null Hypotheses

1. The relationship between education attainment and medication adherence is the same for men and women
2. The relationship between education attainment and healthy exercise adherence is the same for men and women
3. There is no relationship between how long patients have been diagnosed with diabetes and medication and healthy exercise adherence

Definition of Terms

Education attainment: for the purpose of the study, education attainment is the highest degree of education achieved by the study participants. It includes less than high school, high school, some college education, college education, and graduate level.

Diabetes education: for the purpose of the study, diabetes education is the interactive, joint, continuing process involving diabetic patients or pre-diabetic individuals and the health educators (American Association of Diabetes Educators, n.d.).

Limitations of the Study

As limitations include the margins of the problem created by factors or people other than the researcher (Neutens & Robinson, 2010), the current study had the following limitations:

1. Most of the study data were based on patients' and registered nurses' self-reports; therefore, the researcher had no control over how carefully or honestly patients and registered nurses responded to the investigation's questionnaire and the interview.
2. Similar reliable data, reflecting general population, were not found to study the relations between the current study's variables. Thus, data for the present quantitative study was limited to the information obtained from an existing data set.
3. Given the small sample size and the narrow regional draw, the limitations include a lack of generalizability of the study findings.
4. Only registered nurses from Terre Haute Regional Hospital were invited to participate in the qualitative phase of the study.

Delimitations of the Study

Since delimitations manage the boundaries of the problem and are established by the researcher (Neutens & Robinson, 2010), the current study had the following delimitations, which represent elements that were not be included in the present study.

1. Patients' identifications (names, documents, and credentials) and their addresses were not part of the study assuring patients' confidentiality.
2. Only data of Type 2 diabetics aged 18 years and older were part of the investigation.
3. Only data of Type 2 diabetics from Vigo County, Indiana, and the surrounding Indiana and Illinois counties were included in the study.

4. Data from patients' medication and healthy exercise routines were included; data from patients' diet history were not part of the current investigation.

Assumptions

I assumed that the participants of the preexisting data responded honestly and to the best of their knowledge to the questions from the prior study's questionnaire. I assumed also that the subjects followed the instructions of the study and in doing so submitted valid information. Additionally, I assumed that the materials from the preexisting data answered the research questions of the current study. I assumed as well that the subjects of the qualitative study responded honestly and to the best of their information to the interview questions.

Summary of Chapter 1

Adhering to health educators' instructions with regards to medication and healthy exercise routines is essential to maintain optimum blood glucose levels and to prevent developing serious health complications (Kav et al., 2010; Nuckols et al., 2011). These health conditions include cardiovascular diseases, kidney failure, blindness, stroke, and lower-extremity amputations (ADA, 2016a). The present investigation could provide significant information of how the relationship between patients' educational achievements and their gender can influence their medication and healthy exercise adherence. It could also provide necessary information of whether the relationship between these variables is the same for men and women. The study could provide important information of how registered nurses would approach patient education on medication and healthy exercise adherence considering patients' education levels and their gender.

CHAPTER 2

LITERATURE REVIEW

A number of scholarly databases were searched with the aim of retrieving the maximum numbers of related literature which investigated subjects related to the topic of the current study. Therefore, most of the data of this literature review were derived from ProQuest or EBSCOhost databases. However, some of the revised works were derived from other relevant educational and research databases including the WHO and International Diabetes Federation (IDF). Some of the literature were also retrieved from websites of reliable governmental and none-governmental foundations, such as the CDC and the ADA. Only the literature written in English and related to the research topic was identified and carefully studied.

Medication, Healthy Exercise Adherence

According to the CDC (2013a), medication adherence is “the patient’s conformance with the provider’s recommendation with respect to timing, dosage, and frequency of medication-taking during the prescribed length of time” (p. 5). Although dietary and exercise behaviors change are essential to control blood glucose levels, adherence to physicians’ guidelines about medication is equally important (Fediaevsky, Chwalow, & Tibiana-Rufi, 2005). While it is common that diabetics are advised about lifestyle changes and adherence to medications (as prescribed by physicians), medication non-compliance is prevalent among diabetics (Hauber, Mohamed, Johnson, & Falvey, 2009). It was reported that medication non-adherence levels of

different medication treatments (insulin shots, pills, and insulin and pills) were 40%, 34%, and 45% respectively (Nur, 2015). Another study found that adherence rate with oral glucose-reducing medications was between 61% and 85% (Wabe, Angoma, & Hussein, 2011). However, Tiv et al. (2012) reported that the medication adherence risk factors include age, ethnicity, financial difficulties, social support, psychological factors, and the quality of the relationship between patients and physicians.

On the other hand, healthy exercise is crucial for diabetics in conjunction with proper meal planning and taking medications as recommended by physicians (ADA, 2013b). However, Diabetics are believed to be less prepared to improve their healthy exercise than non-diabetics (Vähäsarja et al., 2012). Being active almost doubles the danger of developing diabetes than being very active (Okwechime, et al., 2015). According to the CDC (2012a), diabetics need, at best, 30 minutes of moderate-intensity workout on five or more days each week. According to the WHO (2014), moderate-intensity physical activity involves a reasonable amount of energy which remarkably increases the heart rate. Moderate-intensity includes walking, dancing, gardening, housekeeping and domestic chores, traditional hunting and gathering, general building tasks, and lifting or moving moderate loads < 20kg (WHO, 2014). Additionally, WHO (2014) described vigorous-intensity physical activity any exercise that entails an enormous energy and makes quick breathing and a significant rise in heart rate. According to WHO (2014), vigorous-intensity physical activity includes running, fast cycling, aerobics, fast swimming, competitive sports (e.g., football and basketball), heavy shoveling or digging ditches, and carrying or moving heavy loads (> 20kg). The ADA recommends the following types of physical activity for diabetics to manage their diabetes: aerobic exercise and strength training. The aerobic exercise (e.g., swimming, cycling, walking, and rowing) helps the body use insulin

better, improves blood circulation, and lowers heart disease risks (ADA, 2013b). The ADA endorses that Type 2 diabetics need to perform at least 30 minutes of moderate to vigorous aerobic physical activity five days a week, without over two successive days between working out (ADA, 2013b). Additionally, strength training (e.g., lifting light weights, resistance bands, heavy gardening, and free weight) lowers blood glucose in the body, helps to maintain strong muscles, and minimizes the risks for developing osteoporosis and bone fractures (ADA, 2013b), and the ADA recommends these activities twice a week. Therefore, increasing physical activity routines may benefit to manage the disease and its complications (Fradkin, 2012), which may cause serious injury and deaths (Kav et al., 2010). However, whether intentional weight loss could be related to reducing mortality among Type 2 diabetics is still a matter of investigation. Harrington, Gibson, and Cottrell (2009), reported in a meta-analysis study of weight loss, which mainly centered studies of individuals with Type 2 diabetes, that intentional weight loss was related to reducing mortality. However, Køster-Rasmussen et al. (2016) argued that intentional weight loss among Type 2 diabetics did not decrease mortality or cardiovascular morbidity.

State of Health Education

As the mission of healthcare in the United States has developed and grown, educational institutions that provide healthcare curricula including health education programs have grown in number. By 2011, the number of accredited public health schools expanded to 46 universities that educate and train healthcare professionals of every level, conduct research to prevent diseases, and deliver healthcare services to local communities (Rosenstock, Helsing, & Rimer, 2011). The use of health education programs continues to increase as a result of calls for a learning revolution across the professions by learning and labor force leaders, in consort with governmental and professional organizations (Calhoun, Wrobel, & Finnegan, 2011). The level

of change for the health education programs improved as well as a result of the electronic and digital arrival to the healthcare profession. In addition, it improved as a result of the domestic and global reaction to the disease deterrence and the health instruction programs (“Report of the 2011 Joint Committee on Health Education and Promotion Terminology [JCHEPT],” 2011). According to the JCHEPT report, the practice of health education field will carry on to quickly advance in the next decade. Such rapid progress will include the use of digital and new media technology in order to provide online health education programs and target different groups in the society. The suggested media tactics include tailoring health education messages through social media, including Facebook, Twitter, YouTube, Pinterest, and Instagram (Armstrong & Burcin, 2016).

Along with the expansion of schools that provide healthcare programs at all levels and the use of digital and social media technologies, the quality of monitoring and improving courses taught in schools were urged to be assessed as well (Thibault, 2013). This proposition is to ensure the competence of the new graduates and whether these graduates have the skills necessary to meet the challenges of the healthcare policies and practices. Even with the sheer number of health experts required for future health related services, all health experts must be educated in a different way to face the challenges of a vastly growing patient population and to steer and succeed in a fast changing healthcare system (Thibault, 2013).

In addition, education in the healthcare profession should be assessed for all stages of the skill mix group. Lindley, Sayer, and Thurtle (2011) argued that, for instance, newly registered nurses need to be trained to work in an increasingly diverse mix of professionals at a healthcare facility. Therefore, it is important to review the content of the health education curriculum to effectively educate highly skilled healthcare professionals and health educators who can

communicate with patients. The objectives of training-capable health educators include integrating the role of the supervisory expertise into the health care education curriculum. Incorporating the role of the supervisory skills in the health education curriculum is an essential part of competence training instruction in both classroom and in the clinical education settings to ensure the next generation's capacity to have the basic skills to supervise lower level healthcare assistants (Schmidt & Grad, 2013).

Effective communication between patients and healthcare professionals is an integral part of a successful health care profession and patient-centered care. Therefore, nursing teaching institutions that teach undergraduate and graduate curricula, for instance, can play a vital role in organizing and preparing nursing staff members who can effectively communicate and offer needed patient-centered care. Patient-centered care is important knowledge for nurses throughout learning stages to meet patients' satisfaction and advance the value and the wellbeing of the health care profession (Boykins, 2014). The basic role of the healthcare professionals and health educators is to design operational health instructions that can successfully educate new graduates who can effectively influence the health actions of patients along with the surrounding environment which effects their health and safety. However, while patients' education may be the key to a better healthcare access, many health educators believe that in spite of many efforts to educate patients to change their unhealthy behaviors, still there are individuals who make unsafe choices and continue to engage harmful activities (Fomby-White, 2010).

Diabetes Health Education

Diabetes education is the interactive, joint, continuing process involving diabetic patients or pre-diabetic persons and the health educators (American Association of Diabetes Educators, n.d.). It is an essential part of patient care and is vital to advance health outcomes (Funnell et al.,

2010). Diabetes education is also a significant element of cohesive diabetes treatment as it is an organized instruction where patients understand the disease and the best ways to minimize its complication (Li et al., 2014). The process of diabetes education includes evaluation of the patients' specific educational needs, assessment of patients' achievement of identified self-management goals, and proper records of all diabetes learning encounters (American Association of Diabetes Educators, n.d.). The diabetes education process is anticipated to respond to the development of diabetes knowledge, treatment plans, educational policies, and the changing healthcare profession (Funnell et al., 2010).

Diabetes education was largely ignored among individuals with recently diagnosed diabetes (Li et al., 2014). As a consequence, many individuals experienced serious diabetes self-management education gaps, where a considerable number of diabetic individuals could not even reference the signs of abnormal blood sugar levels or take treatment steps if noticed (Elliott et al., 2013). Patients with minimal levels of health literacy can achieve effectively normal levels of blood glucose if they are able to comprehend diabetes health instruction materials (Chen, Huang, Yang, & Lew-Ting, 2014). Thus, sufficient health knowledge and better consideration of health education are certainly associated. Most of the newly-diagnosed individuals either receive no appropriate self-management instructions about the disease, or they receive insufficient information through other health care encounters, such as physician visits (Cauch-Dudek, Victor, Sigmond, & Shah, 2013). According to these researchers, only 1 in 5 of the recently-diagnosed diabetics were involved in a diabetes self-care learning sessions six months after they are diagnosed with diabetes condition. Most people who joined in diabetes self-management trainings programs received individual learning rather than group instruction (Hwee, Cauch-Dudek, Victor, Ng, & Shah, 2014).

Individual counseling was more frequent and common for persons living in rural areas, where gathering enough patients for a group class education was challenging. However, patients joining in group classes had less severe diabetes problems (Hwee et al., 2014). Research by Azar et al. (2015) illustrated while efforts to advance both instant and lasting efficiency of behavioral routine interventions continues, it is vital for physicians to keep using the current available assets since small measures of diabetes instructions can even make significant differences in better diabetes management. Patients recently diagnosed with Type 2 diabetes can be, for the most part, friendly to learning about how to self-manage the disease and even possibly in part reverse the condition through behavioral lifestyle change according to these researchers. Therefore, it is imperative for physicians to refer these newly diagnosed diabetics for formal counseling with diabetes education programs to gain additional information of how their present activities may influence the disease condition (Azar et al., 2015). Schäfer et al. (2014) reported that physicians' guidance of patients' involvement in diabetes education programs increases the participation level among the individuals who have the disease. Therefore, physicians who would like to motivate diabetics for the disease education need to openly inspire these persons to join in diabetes health education sessions. According to Schäfer et al. (2014), physicians need to explain that patients can benefit from education programs albeit the results of the disease's medication treatment are encouraging.

Diabetes education has usually been delivered by registered nurses whom are employed regularly as instructors in offering formal diabetes self-management education (Funnell et al., 2010). However, because of the necessity of the medical nutrition treatment, registered dietitians became a crucial part of the diabetes education team as well. Diabetes educators can be found in

different settings including hospitals, physician offices, clinics, and nursing homes (American Association of Diabetes Educators, n.d.).

Concept of Adult Learning

Learning reflects a transformation in what people do, and what they feel. It can happen in all these spheres all at once. It occurs holistically and happens through experience and practice and believed to be relatively permanent (Wilson, 2013). In general, learning comes about where people have no adequate information of the world in which they reside (Liu, Hodgson, & Lord, 2010). It is an experiential phenomenon that takes place in most individuals throughout most of their lives (Jarvis, 2004). Learning can take place in a formal context where there are special sites, such as a class-room, a workshop, or a laboratory; or it can be casual, which happens as a result of people's daily life experience (Lovell, 1980). What people desire to absorb, what is taught, and the methods in which they learn are decided to a great extent by the nature of the people and the social order they dwell in any given time (Merriam & Caffarella, 1999). Thus, to be good learners and to be better facilitators of other persons' learning, educators need to grasp how learning occurs, and how adults learn differently than children do (Merriam & Caffarella, 1999).

While people are different in their learning styles and no one tactic can generate high quality learning situation for all of them (Williams et al., 2012), adult learners are to some extent different than younger learners. Understanding how adult learners approach educational materials are like piecing together a puzzle where the learner and the context in which the learning comes about are key pieces of this puzzle (Merriam & Caffarella, 1999). Adults, unlike youth or children, are more self-directed in their learning activities (Wilson, 2013). They are oriented to social and mental reasoning and not to professional and learning drives when it

comes to learning prospects (Lorek, Ewart, & Dattilo, 2012). They bring life experiences relevant to their learning activities (Wilson, 2013). If they feel that the information offered to them is not what they desired, they likely avoid absorbing it (Wilson, 2013). Adults also absorb information when it is necessary to be more productive for their daily lives (Knowles, 1984). However, while adult learners have established skills and the ability to improve certain experiences, they at times come across barriers to their learning they are unable to overcome. These barriers include serious health issues, financial constraints, and personal challenges (Connell, 2011). Overlooking people's different learning needs may generate difficulties between educators and learners (Williams et al., 2012). Therefore, the finest teachers are facilitators who apply their teaching style to the learner's needs (Wilson, 2013).

Theoretical Framework

Andragogy theory. The andragogy model was first developed by Knowles in the 1970s. It is important because it guides instructors to identify how adults learn information (Shannon, 2013). Unlike pedagogical models, which are child-focused teaching approaches that aim to transmit knowledge and information, the andragogical model is a process which helps adult learners acquire knowledge and information through having access to relevant processes and resources (Knowles, 1990). It presents basic values of adult learning, which sequentially assist planning and steering adult learning to construct more active learning procedure for adult learners (Knowles, Holton, & Swanson, 1998).

Knowles (1990) illustrated in his andragogy theory how adults learn in a different way than children do. He developed an andragogical concept which was founded on numerous assumptions different from the pedagogical model. He argued that adult learners have a special need to decide why they should learn specific things before learning them. As a result, Knowles

suggested that the primary mission of educators is “to help the learners become aware of the need to know” (p. 58). He also maintained that adult learners have perceptions of being responsible for their own choices, expecting others to treat them and see them as being independent (Knowles, 1990). As a result, adult learners resist conditions where they feel other people are imposing their wills on the learner. Knowles also believed that adult learners’ expertise has implications for their learning. He believed it guarantees that in every group of adult learners there will be a broader range of personal distinctions as opposed to a group of young individuals. Therefore, adult learners, Knowles stressed, will be more diverse with regards to “background, learning style, motivation, needs, interests, and goals than is true of a group of youths” (p. 59). Knowles (1990) suggested that the best assets for instruction exist in the adult learners themselves. For that reason, the greater stress in adult learning on realistic methods that get into the competence of the learner, including group dialogue, problem-solving actions, and case methods is essential (Knowles, 1990).

Another andragogical assumption Knowles developed was how adults’ readiness to learn influences their decision to absorb information they want to learn. Adult’s readiness to learn new information requires assessing their developmental situation. Knowles (1990) suggested that a key foundation of willingness to acquire information is the developmental tasks related to moving from one developing phase of an individual to the next phase. Therefore, educators need to encourage readiness “through exposure to models of superior performance, career counseling, simulation exercises, and other techniques” (p. 61). Another andragogical assumption Knowles initiated was adult learners’ orientation to learn. In contradiction to youth’s and children’s subject-centered learning, adults are problem-centered in their direction to learn (Knowles, 1990). Adults are willing to initiate efforts to learn information as long as they think that it will

assist them achieve tasks or cope with challenges they face in their daily life settings. Hence, adults' method of learning, according to Knowles, is from a problem-solving viewpoint. Their orientation to learning is self-directed and they are driven to absorb information as they recognize the needs and the interests that knowledge will satisfy. The last andragogical assumption Knowles introduced was motivation. Knowles (1990) argued that although adults are open to outside motivators, the most effective motivators are inside pressures. Therefore, adult educators may need to assess adult learners' individual needs, interests, skills, and educational levels.

Andragogy use in health education. This theory is widely used in medical and health education (Abela, 2009). It has become the foundation of many instructional approaches. It helps instructors understand more about adult learners (Shannon, 2003). The theory has been used to address the individual needs of adult learners by promoting communication between instructors and adult learner (Leigh, Whitled, & Hamilton, 2015).

In adult learning health settings, education can concentrate more on training, and the role of the educator changes from being the source of information to an advisor and a tutor requiring different approaches to educate learners (Pavlova & Sanger, 2016). As a result, applying adult learning theory in health education procedures requires changing the roles of teachers and adult learners, i.e., altering adult learning from an educator-centered process to a student-centered process (Leigh et al., 2015). That means the learner's role is not just receiving information passively from instructors, but also exploring and pursuing skills, knowledge and information actively by changing perceptions toward learning (Taylor & Hamdy, 2013). As health instructors and patients, as adult learners, interact with each other in healthcare settings and in community circles, independent and practical learning are key approaches, but responses and

comments from learners are fundamental to assist them to make the best use of their contact time. By applying andragogy theory regularly and cautiously, instructors can be certain to assist learners become successful in their learning activities (Taylor & Hamdy, 2013).

The following is a summary of Knowles' six assumptions as stated by Knowles et al. (1998):

1. The need to know: Adults need to know why they need to learn something before undertaking it
2. The learners' self-concept: Adults have a self-concept of being responsible for their own decisions
3. The role of the learners' experiences: Adults come into an educational activity with both a greater volume and a different quality of experience from youths.
4. Readiness to learn: Adults become ready to learn those things they need to know and be able to do in order to cope effectively with their real-life situations.
5. Orientation to learning: In contrast to children's and youths' subject-centered orientation to learning, adults are life-centered in their orientation to learning.
6. Motivation: While adults are responsive to some external motivators, the most potent motivators are internal pressure.

Effect of the Educational Attainment on Type 2 Diabetics

Overall the incidence of Type 2 diabetes is inversely related to educational attainment (Maier et al., 2014). The incidence of the condition is higher among individuals with lower educational achievement compared to those with higher educational attainments (Borrell, Dallo, & White, 2006; Brown et al. 2015; Bullen, 2016). Bullen (2016) suggested that lower educational achievement can lead to lower paying jobs and to lower income status which her

study found has a significant relationship with diabetes incidence. Congruently, researchers from another study had a parallel finding where lower educated individuals have a higher incidence of diabetes compared to higher educated individuals (Borrell et al., 2006). In a cohort study of female health professionals, Lee et al. (2011) reported that diabetes prevalence has an inverse relationship with advanced education and good income levels. That means that the more people are educated the less chance they develop diabetes compared to individuals with less education.

However, Dinwiddie, Zambrana, and Garza (2014) reported in a study specially focused on U.S.-born Mexican females that as education achievement increases, the chances of the disease incidence increases. Furthermore, Agardh et al. (2001) reported in a meta-analysis study which measured the correlation between type 2 diabetes and education achievement, that there was a substantial burden of Type 2 diabetes attributed to lower educational levels. They recommended more investigations to be done to examine the link between the disease and patients' educational achievement. The opposite direction of the relationship is possible too where diabetes, in its turn, may lead to lower educational levels (Fletcher & Richards, 2012). That means that people with diabetes may have less educational achievement compared to people without the disease.

In addition, some of the Type 2 diabetes' risk factors may be related to poor educational attainment. Mezuk, Eaton, Golden, and Ding (2008) reported in a 23-year old population-based cohort research study in Baltimore, Maryland, that depression, which is a significant risk factor for Type 2 diabetes, was associated with poor educational achievement, especially among individuals with lower educational attainment. Also, education level among diabetics is an important mediator of the association between depression and Type 2 diabetes. The association

is strongest among individuals with high school degree or less (Mezuk et al., 2008). In a cohort study aimed exclusively at ten European countries, Hermann et al. (2011) investigated an association between participants' educational attainment and their body mass index (BMI) and waist circumference (WC), another risk factor for the disease. They found that individuals with higher educational achievement had overall lower BMI and smaller WC, an indication of link between educational attainment and obesity, which is another risk factor of Type 2 diabetes.

The diagnosis of diabetes condition and its treatment require significant efforts from both healthcare professionals who diagnose and treat the condition and patients who receive different types of treatments including self-care techniques. Despite the fact that healthcare specialists and patients play key roles in preventing and managing the disease through medication and through healthy diet and healthy exercise, there are different influences which can play significant roles as well. Education attainment and knowledge about the disease among diabetics and non-diabetics are certainly not exception.

Elliott et al. (2013) reported a link between diabetes' self-care and education and diabetes information gaps among diabetics. This gap can happen when patients decline to join diabetes education sessions. Cauch et al. (2013) reported that one in every five diabetics newly diagnosed with diabetes attend diabetes self-control education programs within six months of diagnosis. The investigators added that the remaining patients either receive insufficient diabetes self-management education plans from physicians' offices or they do not obtain diabetes self-care education at all. Chen et al. (2014) reported that sufficient health literacy among diabetics alone may not be linked to good glycemic control. The later researchers concluded that individuals with minimal health knowledge can also achieve optimum blood sugar control if they are able to comprehend health directives. The investigators added that "patients with a higher

socioeconomic status (higher educational attainment and higher household income) were significantly associated with having adequate health literacy” (p. 7). Hwee et al. (2014) reported that patients who attend group education classes do better for glycemic control compared to those who join individual diabetes counseling.

Educational achievement among Type 2 diabetics may facilitate and play a decisive auxiliary role for patients to achieve better and effective self-care objectives. Glycemic control and treatment loyalty among Type 2 diabetics improves due to educational accomplishment among patients and because of diabetes education follow-ups with patients by trained diabetes healthcare professionals (Jaleh et al. 2013; Su et al., 2016). Huang et al. (2016) reported that nurses would have lesser risk in developing diabetes than non-nurse persons. This phenomena could be credited to the nurses’ health awareness and their understanding about the disease compared to non-nurse individuals. Both Type 2 diabetes and low socioeconomic status among people, including education levels, relate to overall mortality (Dalsgaard, Skriver, Sandbaek, & Vestergaard, 2015).

While most (72%) of the patients receive information about diabetes self-management education, only 52% of the patients understand what they receive (Compean Ortiz et al., 2016). Casagrande et al. (2012) argued that 82% of diabetics knew about the A1C measurement. Among respondents “familiar with A1C and tested in the past year, 48% stated their A1C level” (p. 1557). The later researchers reported that the A1C knowledge was highest among people with higher education levels and among individuals with higher income. Additionally, they added that awareness of A1C was highest among non-Hispanic whites, and lowest in Mexican Americans. Yang at el. (2016) also found similar findings, where diabetics’ good understanding of the A1C correlates with their level of education; the higher education levels the better

understanding of the A1C. Similar findings reported that higher educational levels were related to better diabetes knowledge; thus, higher A1C levels were independently linked with worse diabetes knowledge (Fenwick, Xie, Rees, Finger, & Lamoureux, 2013). Additionally, the later study reported that individuals who understood well about their A1C were better in terms of diabetes self-care behaviors and had lower A1C numbers compared to patients who had no understanding about their A1C levels. In conjunction with the education levels, patients' age, gender, diabetes duration, region, and diabetes education were associated with their knowledge of the A1C. For instance, older patients and persons who had the disease for longer period of time were more expected heed to their diabetes management (Yang et al., 2016).

Schäfer et al. (2014) suggested that physicians may need to encourage diabetics to participate in diabetes education. They argued that not every person with the disease should be counseled to take part in diabetes education programs. They reasoned that some of the diabetics who have only slightly increased blood sugar levels with no harmful result may not necessarily need diabetes education programs. However, while education through printed resources that are readily available for patients at doctors' offices result in good progress in glycemic control among type 2 diabetics (Selea et al., 2011), patients' educational attainment may principally associate with a lower risk of diabetes including preventing future development of serious health complications. O'Brien, Whitakar, Yu, and Ackermann (2015) reported that intensive lifestyle mediation and taking metformin diabetes medicine as prescribed by physicians have greater efficiency among highly educated individuals. That means that diabetics' educational attainment may assist them to design and to implement successful lifestyle plans such as taking medications on a regular basis. O'Brien and his colleagues (2015) reported as well in their study that college graduates had more resources to employ to effectively succeed in their lifestyle objectives. The

researchers concluded that since education was positively linked to income in their study group, college graduates' advantages may have delivered to them greater access to healthy exercise and healthy food than less educated individuals in the study. Another study from Xu, Pan, and Liu (2010) suggested that those with higher educational achievement among type two diabetics were better to self-manage their diabetes than those with lower education levels regarding to healthy behaviors including healthy exercise and medication adherence. Thus, the impact of individuals' educational attainment on diabetes self-management is important to examine and should not be overlooked when studying the different phases of diabetes including diagnosis, treatment, and prognosis. In another research study, the level of education attainment among Type 2 diabetics was the main predictor of the level of understanding and practice on the subject of diabetes self-care behaviors (Mesmar, Eljack, & Al-Kuwari, 2011). The study also found that age and occupation were significantly related to patient's awareness about the condition. In line with the later study, other researchers reported that type two diabetics who were under age of 65 and with high school or greater educational achievement were related to better diabetes information (Hu, Gruber, Liu, Zhao, & Garcia, 2013). Therefore, significant burden of the disease can be associated with poor educational achievement (Agardh et al., 2011). Quite the opposite, another study revealed that education attainment, along with other factors such as income, was not predictive of poor blood sugar control (Harris, Eastman, Cowie, Flegal, & Eberhardt, 1999).

Gender and Income Mediation

While the association between education levels and diabetes are widely reported by different relevant research, the connection between the two may be even greater among women than men (Kautzky-Willer, Dorner, Jensby, & Rieder, 2012). A study found an inverse relationship between diabetes prevalence and high income and higher educational levels,

particularly among women (Lee et al., 2011). Among females, the link between educational achievement and diabetes prevalence may have different levels than among men. While the frequency of the disease amongst both genders was inversely related to educational achievement in unadjusted analysis, in a study involved in multiple variables the relationship was constant only among females with high school diploma as opposed to postsecondary graduation (Ross, Gilmour, & Dasgupta, 2010). In a prospective cohort of women health experts, Lee et al. (2011) observed an advanced decline in diabetes condition with increasing education attainment and income. The result indicated that lower socioeconomic status is related to increased diabetes incidence for women even if they are well educated. In a separate study, Krishnan, Cozier, Rosenberg, and Palmer (2010) concluded that lower levels of education and income among specifically Black women who were living in poor neighborhood areas were linked to risk of developing Type 2 diabetes.

In addition, research by Brown et al. (2015) suggested that social disparities in diabetes, particularly for women should be wary. The study indicated that the diabetes prevalence rate among females expanded from 2.5% to 4.5% compared to 1.4% to 2.3% for males between 2004 and 2012. Studies have shown that gender can influence diabetics' adherence to better manage diabetes through medication and exercise. Men and women have different opinions as regards to the readiness to take effective health measures (Ramesh, 2000). Researchers found that women, along with working-aged diabetics, are more likely to be noncompliant about diabetes treatments (Hertz et al., 2005).

On the other hand, the prevalence of diabetes among lower socioeconomic groups will likely rise compared to wealthy societies (Maty, James, & Kaplan, 2010; Okwechime et al., 2015). Bullen (2016) reported a significant correlation between socioeconomic status and

diabetes incidence. The author found that the prevalence of the disease was higher among individuals with a lower household income. Similar outcome that household income has a strong association with Type 2 diabetes was reported by Bird, Lemstra, Rogers, and Moraros (2015). Quite the opposite, middle household income, instead of low income and education levels, was related to high incidence of diabetes mellitus (Hayashino, Yamazaki, Nakayama, Sokejima, & Fukuhara, 2010). That means that income increase, not education levels, is associated with the diabetes incidences.

In additions, increasing diabetes costs significantly impact an individuals' diabetes expenses (Gupta, Kishore, Ray, Kohli, & Kumar, 2016). For instance, persons with low income usually have “less access to both healthy food choices and opportunities for physical activity” (CDC, 2013b). Peeters et al. (2010) reported that socioeconomic status may stop diabetics from access to basic medications and other supplies needed for blood glucose control. That is to say, diabetics from low income and low education backgrounds may have difficulties to establish exercise routines and to order necessary diabetes medications on a regular basis. Thus, diabetes care among people of low socioeconomic status is worse compared to individuals with higher socioeconomic status (Grintsova, Maier, & Mielck, 2014).

However, Harris et al. (1999) argued that “education, income, health insurance coverage, number of physician visits per year, and other variables were not predictive of poor glycemic control” (p. 5). They referred to a Michigan public investigation of 18 Caucasians and a South Carolina research of nine African Americans and Caucasians, wherein both studies reported no correlation between poor glycemic outcomes and patients' educational attainments (as cited in Harris et al., 1999, p. 5). The research limitations were not included in the Harris et al. (1999) research, nevertheless, the number of the research participants from the Michigan community

and the South Carolina study were considerably small. Quite the reverse, the impact of diabetes condition on individuals' income and educational achievement can be detected. Diabetes can cut financial earnings on educational resources or make education challenging for diabetics (Fletcher & Richards, 2012). Whatever the case may be, the later researchers concluded that high school and college graduate persons still earn more income (1.5% and 2.7% respectively) compared to high school dropouts. This finding may indicate that individuals' educational attainment, not diabetes condition, impacts their financial returns.

Another research included ethnicity alongside income factors that affect diabetes control. Nicklett (2011) reported that social detriment with regards to wealth and ethnicity increases the danger of poorer lasting health consequences among older diabetic patients (65 years and older). The researcher, who studied data from the Health and Retirement Study (HRS), which was comprised of 12,654 adults with the disease, recommended that wealth and race disparities should be addressed through programs and policies to improve the health outcomes among the older diabetic population.

Summary of Chapter 2

This chapter delineated a number of research studies related to the research questions. It included the state of health education, which will continue to advance in the next decade. The number of health education programs has expanded over the years along with the quality of assessing and improving different courses and health education programs taught in schools. The chapter additionally gave details about the concept of adult learning, which is important to identify the way adults approach to instructional materials. Adult learners are more self-directed in their learning actions (Wilson, 2013). They like social and rational learning rather than professional ambitions in regard to learning prospects (Lorek et al., 2012). The literature

indicated that adults learn when they understand and accept the reason they need to know information, and with the express purpose of improving their lives (Knowles, 1984). Type 2 diabetic adult learners are no exception whether their learning takes place as a group or as individual. Their orientation to learning, as adult learners, is self-directed as they identify how the information they learn will satisfy their needs and interests.

The chapter also included the effect of the educational achievement on Type 2 diabetics, along with gender and income mediation. The prevalence of the disease was inversely linked to patients' lower education attainments (Brown et al., 2015). It was also higher among people with a lower household income (Bullen, 2016). With diabetics' education levels, diabetes education and how long patients have been diagnosed with the disease were related to the level of patients' knowledge about the condition (Fenwick et al., 2013). Individuals who understood about the disease had better diabetes self-management performances compared to people who did not know about the disease. While the high incidence of the disease among people with lower socioeconomic status was delineated in the literature, the effect of gender and education interaction on medication and healthy exercise routines was not explored.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter includes information about the research questions, study design, description of the research sample, study variables rationale, study procedure, and data analyses. It includes as well the limitations of the study and the summary of this chapter. The purpose of the study was to explore whether the link between diabetic patients' education levels and their adherence to medication and healthy exercise were the same for men and women. The aim of the research included as well exploring whether registered nurses would alter their approach to patients' education on medication and healthy exercise adherence considering patients' gender and education levels. The study also investigated the correlation between patients' diabetes duration and their medication and healthy exercise adherence.

Research Questions

The following research questions guided the current investigation. During the selection of the research questions, respect for the study subjects, confidentiality of the data, and subjects' privacy were greatly considered.

Primary Questions

1. Is the relationship between education and medication adherence the same for men and women?

2. Is the relationship between education and healthy exercise adherence the same for men and women?
3. How would registered nurses alter their approach to patients' education on medication and healthy exercise adherence considering patients' gender and education levels?

Secondary Question

Is there a relationship between how long patients have been diagnosed with diabetes and medication and healthy exercise adherence?

Study Design

The study employed mixed methods sequential explanatory design using qualitative data to help illuminate the quantitative findings (Zhang & Watanabe-Galloway, 2014). The focus of mixed methods design is to collect and investigate quantitative and qualitative data in one study or series of research investigations (Creswell & Plano Clark, 2007). Creswell and Plano Clark (2007) underscored that employing quantitative and qualitative methods in unison provides “a better understanding of research problems than either approach alone” (p. 5). In the serial explanatory approach, the quantitative data is collected in an initial stage of a study followed by the studying of qualitative findings (Creswell & Plano Clark, 2007). The quantitative study explored whether the relationship between education levels and medication and healthy exercise adherence scores were the same for men and women type two diabetics. It also examined the correlation between how long patients have been diagnosed with type 2 diabetes and patients' medication and healthy exercise adherence. The qualitative study investigated the registered nurses' perspective on how they would alter their teaching method to patients' education on medication and healthy exercise adherence considering patients' gender and their education levels.

Quantitative Study Design

The quantitative study was based on preexisting data I collected from May 2014 to December 2014. The purpose of the data, which were collected through a survey questionnaire, was to examine the glycemic control among Type 2 diabetics (Nur, 2015). The investigator employed descriptive analyses, two-way analyses of variance (ANOVA), and correlation analysis. According to Krathwohl (2009), the fundamental role of descriptive data is to facilitate exploring and summarizing data. There were numerous measures that were used in this research investigation including mean, standard deviation, and range. These measures were descriptively analyzed in the current study. The research also used two-way ANOVA. The aim of the two-way ANOVA analysis is to compare group means when two independent variables are in the ANOVA investigation (Neutens & Robinson, 2010). In addition, the researcher used correlation analysis to examine the direction of the association between duration as independent variable and medication and healthy exercise adherence scores as dependent variables. Correlation investigation is expressed by the correlation coefficient r along with α value (Neutens & Robinson, 2010).

Description of the quantitative sample. The subjects, who were recruited from two healthcare facilities (Terre Haute Regional Hospital and the Diabetes Endocrinology Clinic), were 102 patients with type two diabetes. All of them were from Vigo County, Indiana and the surrounding Illinois and Indiana counties. Their ages ranged from 35-85 ($M = 62.19$, $SD = 11.74$). A majority of the subjects, 65 (64%), were female and 37 (36%) were male (see Table 1). Table 2 describes subjects' different education levels as less than high school, high school, and post-secondary level.

Table 1

Gender Descriptive Statistics (N = 102)

Gender	N	%
Female	65	63.7
Male	37	36.3
Total	102	100

Note. Adapted from “Glycemic Control among Type 2 Diabetics,” by A. H. Nur, 2015, *ProQuest Dissertations & Theses A&I*, 28. Copyright 2015 by ProQuest Database

Table 2

Education Levels of Participants (N = 102)

Education level	N	%
Less than High School	11	10.8
Completed High School	42	41.6
Post-Secondary School	48	47.6
Missing	1	1.0

Note. Adapted from “Glycemic Control among Type 2 Diabetics,” by A. H. Nur, 2015, *ProQuest Dissertations & Theses A&I*, 28. Copyright 2015 by ProQuest Database

Quantitative study variables rationale. In general, Type 2 diabetes is inversely linked to lower educational achievement (Maier et al., 2014). However, it was not explored, to my knowledge, whether the relationships between education attainment and medication and healthy exercise adherence scores were the same between genders. Therefore, studying the effect of gender-education interaction on patients’ medication and healthy exercise adherence could provide important information to successfully manage the disease. It could also provide valuable information to diabetes educators to effectively educate patients. Therefore, the reason this study chose gender and education independent variables in Tables 1 and 2 was to investigate whether

the interaction of these variables could cause changes to patients' medication and healthy exercise adherence levels. Besides, it was important to assess, as a secondary study, the relationship between how long patients have been diagnosed with diabetes and medication and healthy exercise adherence scores. The data measurement scales included nominal, ordinal, and interval. There were three independent variables including education, gender, and duration (see Table 3). The education variable was measured as ordinal while gender variable was measured as nominal. The duration variable was measured on an interval scale. Table 3 also includes medication and healthy exercise routines, which are the dependent variables. Healthy exercise and medication variables were measured as interval scales.

Table 3

Dependent and Independent Variables

Dependent variables	Independent variables
Medication, healthy exercise	Gender, education, duration

Quantitative study procedure. The study followed the next five steps to analyze the data in order to answer the research questions:

1. I received consent from Terre Haute Regional Hospital and Diabetes Endocrinology Clinic to use the preexisting data for the current investigation
2. After the approval of the proposal by the study chair and the committee members, I submitted to the Institutional Review Board (IRB) of Indiana State University (ISU) all required documents for review
3. After obtaining the exempt letter from the IRB, data in the SPSS program were checked for errors to assure the data were accurately entered into the SPSS
4. I analyzed data in order to answer the research questions

5. After the study analyses were completed, the findings of the investigation were summarized in relation to the research questions.

Quantitative study instrumentation. The questionnaire used to collect the preexisting data was adopted from two separate survey questionnaires from Stanford University School of Medicine and University of Louisville's Psychology Lab (Nur, 2015).

The survey questionnaire instrument from the University of Louisville, Personal Diabetes Questionnaire (PDQ), measured medication and healthy exercise adherences scores. It was reviewed by a multidisciplinary research and medical staff of a United States university-based Diabetes Research and Training Center (Stetson et al., 2011). The PDQ was a valuable measure of diabetes self-management conduct and associated insights and problems that are consistent, valid and practical to administer in a healthcare setting (Stetson et al., 2011). This measure, as stated by Stetson et al. (2011), can be employed to collect data to explore diabetes self-management and obstacles to monitor patient care.

The Stanford University School of Medicine's questionnaire, CDSMP Sample Questionnaire (Stanford Patient Education Research Center, n. d.), measured, together with patients' background information, general health status, highest year of school completed, healthy exercise scores, and self-efficacy scores (Lorig, Ritter, Villa, & Armas, 2009). The psychometric properties including validity and reliability were provided in the *Outcome Measures for Health Education and Other Health Care Interventions* book authored by Lorig, a professor at the Stanford University School of Medicine (Townsend, 1998). I could not find further information of the psychometric properties including validity and reliability for both questionnaires.

In order to ensure the consistency of the data obtained through this survey questionnaire instrument, some questions that were relevant and were not found in the two adopted instruments were added, such as patients' income, physician visit after being diagnosed with the disease, self-efficacy, and the level of workout intensity (Nur, 2015). The questionnaire was organized in blocks and contained restricted and unrestricted, nonintrusive questions. The close-ended questions comprised dichotomous, multiple choice, rating, and ranking types of research questions (Nur, 2015).

Quantitative study scoring method. The results from the four healthy exercise variables (questions 1, 3, 4 and 6) were measured on an interval scale and were recoded as dichotomous (1s for those who were adherent and 0s for those were not adherent). This formed two groups (see Table 4), those individuals who exercised at best 30 minutes, five days per week, and those who did not (Nur, 2015). If patients performed at least 30 minutes of moderate to vigorous aerobic physical activity five days during the past week (e.g., swimming, cycling, walking, and rowing), they were considered adherent; if they did not perform, they were not considered adherent (Nur, 2015). If patients reported that they achieved, during the past week, 30 minutes or more of physical activity on five days each week, they were viewed as adherent; if they did not, they were not considered adherent (Nur, 2015). The scores assigned (1s and 0s) for questions 1, 3, 4, and 6 were combined for each patient with a range of 0 - 4. In addition, subjects' prescribed medication was revised and evaluated whether or not patients followed medication treatment as prescribed by physicians to assess medication adherence levels (see Table 5). This process created two groups (1s for adherents and 0s to those who were not adherent), respondents who followed medication treatment as prescribed by physicians and those who did not (Nur, 2015). The education variable was measured as ordinal and included three

levels, less than high school, high school, and post-secondary. The duration variable (years of being diagnosed as diabetic) was measured as interval; the intervals between values were equally spaced (5 years). Duration was measured in years (1 – 5 years; 6 – 10 years; 11 – 15 years; 16 – 20 years; and 21 years and more). The gender variable was characterized by a dichotomous variable, where female was coded as 1 and male as 2 (Nur, 2015).

Table 4

Healthy Exercise Adherence Scores

Healthy Exercise During Past Week (1, 3, 4, 6)	Adherent = 1	Nonadherent = 0
30 min of moderate to vigorous aerobic exercise 5 days a week	1	0
Spent at least 30 minutes of working out five days a week	1	0
Performed moderate or vigorous exercise five days a week	1	0
Performed strength training activities five days a week	1	0
Total Scores	4	0

Note. Score Range = 0 - 4

Table 5

Medication Adherence Scores

Medication Adherence During Past Week	Adherent = 1	Nonadherent = 0
How often do you take pills for your diabetes?		
I never miss a dosage.	1	
I miss a dose a couple times a month or less		0
I miss a dose once or twice a week		0
I miss a dose three to five times a week		0
I miss a dose almost every day		0
I never take my prescribed pills		0
How often do you take your insulin?		
I never miss a shot	1	
I miss a couple times a month		0
I miss once or twice a week		0
I miss three to five times a week		0
I miss almost every day		0
I never take my prescribed insulin		0

Qualitative Study Design

The study also conducted a qualitative phenomenological investigation based on semi-structured interviews (see Appendix). It included a core of structured questions from which the researcher could approach related directions for in-depth investigation (Neutens & Robinson, 2010). Interviews are a major qualitative data-collecting means that assist the objectives of qualitative method (Krathwohl, 2009). Purposeful sampling of the study respondents was carried out. Purposeful sampling means that the investigator intentionally selects study subjects who

have expertise with the key concept being explored (Creswell & Plano Clark, 2007). The researcher recruited 10 registered nurses to collect valid qualitative data as suggested by Creswell and Plano Clark (2007). Subjects were checked for eligibility criteria. They were all registered nurses who participated in the treatment and the education processes of diabetics and were willing to provide reliable information. Diabetes education has regularly been offered by nurses (Funnell et al., 2010). I described to the respondents the purpose of the research investigation and the duration of the interview. Informed consent was obtained from the respondents before the interviews were conducted. I interviewed the participants face-to-face at Terre Haute Regional Hospital and at a time of their convenience. The interview duration was 60 minutes for each subject.

The interview included opening questions about the respondents' background such as profession and education level ("please tell me your profession and education level"). Several study questions related to the investigation were followed. These research questions included how subjects would alter their approach to patient education on medication when considering gender and education levels and how they would alter their approach to patient education on healthy exercise when considering gender and education levels. I took handwritten notes to collect data from the subjects to protect their confidentiality and to recruit the maximum number of the study participants. All data were numbered in a chronological order of their occurrence (Neutens & Robinson, 2010).

Reliability and validity of the qualitative data. Validity denotes the extent to which a procedure assesses what is supposed to measure, while reliability refers to the dependability of the instrument (Neutens & Robinson, 2010). The qualitative research questions were refined through a pilot test process. Pilot testing is the act of testing research instruments to detect errors

and develop measurement (Valente, 2002). It was administered to a registered nurse in the same way as proposed for the actual investigation (interview). The pilot testing sample was critically investigated by two registered nurses who worked in the field of health education at Terre Haute Regional Hospital with regard to “sensitivity of issues, question wording and order, response categories, reliability checks, physical layout, length of time for answering, and instructions” (Neutens & Robinson, 2010, p. 123). The pilot test process ensured that the instrument produced a reasonable model of all possible answers from the respondents and that the same results would be constantly repeated in subsequent administrations of these questions.

Qualitative data collection procedures. The study followed the next steps to collect the qualitative data to answer the study questions:

Sampling procedure. According to Creswell (2003), in order to address a research question, the investigator chooses individuals and research locations that are able to provide necessary information, puts a sampling process ready, and “determines the number of individuals that will be needed to provide data” (p, 112). Therefore, after approval and exemption of the proposal by the research committee and the IRB, I purposefully selected 10 registered nurses from Terre Haute Regional Hospital. The purposeful sampling strategy that was used was maximum variation sampling, in which individuals that were chosen were all registered nurses who had different perspectives on how to educate diabetic patients about medication and healthy exercise routines. The criteria for maximizing differences might include gender, level of schooling, or any other factors that may differentiate subjects (Creswell & Plano Clark, 2007). Therefore, subjects’ years of experience as registered nurses were included to maximize their differences. I obtained consent to conduct the study from the hospital officials. I excluded the

registered nurses who critically investigated the pilot testing sample and helped validate the interview.

Information to be collected. The source of the current investigation was an open-ended interview. I assumed that this type of data source was possible to explore and would best answer the research questions. The open-ended questions asked during the interview allowed the subjects to provide responses in their own words (Creswell & Plano Clark, 2007). I conducted direct interviews (face-to-face) with the subjects at Terre Haute Regional Hospital and at the time of their convenience. The interviews were conducted from April 20 to July 10, 2017.

Data recording process. According to Creswell and Plano Clark (2007), before entering the site for qualitative investigation data collection, the investigator develops forms for recording the information. That means that the interview protocol has, in addition to the research questions, a place for necessary data about the time, day, and the location where the interview takes place (Creswell & Plano Clark, 2007). Hence, I developed a form for recording data, which listed these essential data as well as the heading and the instructions to the interview. The form also included space in which I recorded subjects' comments. The scheduling of the interview occurred by issuing a verbal invitation to the subjects. Recruiting scripts were as well provided to the subjects. I explained to the subjects the purpose of the study and the duration (60 minutes) of the interview. During the interview, I stayed to the research questions and completed the investigation interview within the assigned 60 minutes. I took handwritten notes to collect data from the subjects to protect their confidentiality. After the completion of the interview, the study subjects were thanked. I entered as well the sites in which the interview took place "in a way that is respectful and does not disrupt the flow of activity" (Creswell & Plano Clark, 2007, p. 116).

Research Settings

In this study, the preexisting data for the quantitative investigation were collected from subjects at Diabetes Endocrinology Clinic and Terre Haute Regional Hospital. The qualitative data were collected from a group of 10 registered nurses from Terre Haute Regional Hospital. The clinic and the hospital are two unrelated healthcare facilities in Terre Haute, Indiana.

Diabetes endocrinology clinic. When individuals are diagnosed with Type 2 diabetes at the Diabetes Endocrinology Clinic, the providers, including the registered nurses, teach these patients on a regular basis the timing, dosage, and the frequency of medication-taking for the disease control. They also encourage and instruct these patients for lifestyle change including proper dietary planning and improving their physical activity based on the American Diabetes Association's recommendations. The clinic refers the newly diagnosed Type 2 diabetics to Union Hospital Diabetes Education Center, which employs certified diabetes educators who are also trained registered nurses and registered dietitians. Along with the providers at the Endocrinology Clinic, the center's diabetes educators assist these individuals in the management of the disease regarding dietary planning, medication, and physical activity routines (Union Hospital Diabetes Education Center, 2017). The patients also regularly visit the clinic for the disease management follow-ups, where the clinic providers including the registered nurses ensure whether patients properly followed the disease control instruction.

Terre Haute Regional Hospital. The majority of the subjects in the preexisting data were recruited from the hospital to participate in the previous study. According to the records from the preexisting data, all of these patients stated that they had visited a diabetes physician after they have been diagnosed with the condition. Therefore, I assumed that these patients experienced regular diabetes management procedures with regards to medication and physical

activity routines. During their stay at the hospital as in-patients, these patients received diabetes control instructions from the hospital clinicians and registered nurses who acquired their diabetes education training from the hospital's education department.

Mixed Methods Data Analyses

There were two phases of data analysis in this mixed methods research investigation, quantitative and qualitative analyses.

Quantitative Analysis

In the quantitative investigation, a two-way ANOVA was used to investigate whether there were statistical significant variances among groups, and the impact of the two independent factors (gender and education levels) on the dependent variables (medication and healthy exercise adherence). In this phase, the influence of the interaction between gender and education attainment on the dependent variables was as well assessed. There were two steps in the quantitative phase to investigate the relationship between these variables. The first step examined whether the association between education and medication adherence was the same for men and women. In this step, the study looked into the significance of the variance in the mean values of medication adherence across the three levels of education as well as the gender independent factor. The study also assessed the impact of the interaction between education levels and gender on medication adherence. The second step explored whether the relationship between education and healthy exercise adherence was the same for men and women. In the second step, the study investigated the significance of the variance in the mean values of healthy exercise adherence across the three levels of education as well as the gender factor. It also explored the effect of the interaction between education and gender on healthy exercise.

In both steps, I examined first whether the interaction between factors was significant. If not, I descriptively interpreted the main effects and examined whether there was a statistically significant main effect for each factor, i.e., whether the main effect means for education levels and gender factors were further apart from each other than was expected. If the interaction between factors were significant, the researcher interpreted the simple main effects, i.e., investigating the cell means to examine whether there was a statistically significant interaction between education levels and gender. Cell means include sample size, a mean, and a standard deviation (Huck, 2012). All tests of significance were conducted at an $\alpha = .05$, two tailed. Additionally, the study examined the correlation between duration and medication and healthy exercise adherence as a secondary analysis. In this examination, the level of relationship was expressed by the correlation coefficient r alongside α value. The correlations were considered significant at an $\alpha < 0.05$, two tailed.

Table 6

Levels of the Independent Variables

Gender	Education
Male	Less than high school
Female	High school
	Post-Secondary

Note. Adapted from “Glycemic Control among Type 2 Diabetics,” by A. H. Nur, 2015, *ProQuest Dissertations & Theses A&I*, 28. Copyright 2015 by ProQuest Database

Qualitative Analysis

In the qualitative study, analysis begins with coding collected information, dividing the data into small units (phrases, sentences, and paragraphs), and giving a label to each component (Creswell & Plano Clark, 2007). Thus, I reviewed the data carefully and developed descriptive coding for the important subjects that keep recurring. These codes were saved on a separate document for easy reference. The coding method served to organize and gather data that have

been collected (Neutens & Robinson, 2010). I then determined the common themes and patterns that might support answering the research questions.

Summary of Chapter 3

This mixed methods study examined the impact of the interaction between patients' education achievement and gender on their medication and healthy exercise adherence, and whether the influence from such interaction was the same for men and women. The study also investigated how registered nurses, as diabetes educators, would change their approach to patient education on medication and healthy exercise adherence considering patients' education levels and gender. The study as well explored the correlation between patients' diabetes duration and their medication and healthy exercise adherence. The study employed mixed methods sequential explanatory design to help illuminate the quantitative findings through qualitative data.

The quantitative phase of the investigation was based on preexisting data. The preexisting data included relevant information about medication and healthy exercise adherence among Type 2 diabetics. The data were methodically studied using two-way ANOVA and correlation analyses to measure the links between the above-mentioned variables. The two-way ANOVA examined whether there were statistical significant variances among groups. It also measured the influence of gender and education variables on medication and healthy exercise adherence. The correlation analysis explored, as a secondary investigation, the relationship between how long patients were diabetic and their medication and healthy exercise adherence.

The qualitative phenomenological investigation was based on data collected through semi-structured interviews. I purposefully selected 10 registered nurses from Terre Haute Regional Hospital based on their experience and qualification to treat and educate Type 2 diabetics on medication and healthy exercise routines. The qualitative data from these subjects

were coded under separate categories, and I developed common themes from these codes to answer the research questions. The confidentiality of both data was assuredly protected since the patients' and the registered nurses' identifiers, such as their names and addresses, were not part of the investigation.

CHAPTER 4

RESULTS

The purpose of this mixed-methods investigation was to explore whether the relationship between diabetic patients' education attainment and their adherence to medication and healthy exercise are the same for men and women. The purpose of the research also included examining whether registered nurses would alter their approach to Type 2 diabetes education on medication and healthy exercise adherence considering patients' gender and education attainment. The study additionally explored the correlation between how long patients have been diagnosed with type 2 diabetes and their medication and healthy exercise adherence.

Mixed Methods Data Analysis

This sequential explanatory investigation presented first the quantitative data analysis followed by the qualitative data analysis.

Quantitative Data Analysis

The quantitative data analyses were completed in IBM SPSS Statistics software program (version 24).

Preparing data for analysis. The raw data was transformed into a form suitable for data analysis (Creswell & Plano Clark 2007). The raw data, which were collected from preexisting data, were converted into numeric values that represent each response. The data were cleaned from any entry errors in the database. Special variables that were necessary for computer

analysis were also created. In the quantitative analysis, exploring data involves visually reviewing data and conducting a descriptive analysis such as mean, standard deviation, and variance of responses to each entry to determine the general trends in the data (Creswell & Plano Clark 2007). The data were visually inspected and a descriptive analysis was generated for relevant independent and dependent variables.

Results of the Mixed Methods Analysis

The following findings show an overview of the database of this investigation.

Quantitative Findings

The study investigated the two primary research questions and one secondary question.

Primary question. The following primary research questions guided the quantitative part of the investigation.

1. *Is the relationship between education and medication adherence the same for men and women?* In response to primary question 1, Table 7 displays subjects' gender and education demographics. Tables 8 and 9 indicate gender and education main effect on medication adherence. Table 10 displays descriptive statistics on medication adherence. Table 11 shows that the simple main effect was not significant ($p = .746$). In Figure 1, an interaction effect is not seen in the graph as the lines are parallel. Therefore, the main effects in Table 8 are interpreted.

Table 7

Medication Adherence Analysis

Variable	Value	Value Label	N
Are you female or male?	1	Female	65
	2	Male	36
Education Attainment	1	Less than High School	11
	2	High School	42
	3	Post-Secondary	48

Note. A total of 101 subjects were surveyed including 65 female (64%) and 36 male (36%). Additionally, 48 subjects had post-secondary education, followed by 42 subjects who had high school level of education. Only 11 subjects had less than high school education.

Table 8

Gender Main Effect on Medication

Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Female	.734	.071	.593	.875
Male	.527	.108	.313	.742

Note. The gender main effect on medication adherence, female respondents' medication adherence average score ($M = .73$) was higher than male respondents' ($M = .53$).

Table 9

Education Main Effect on Medication

Education Attainment	<i>M</i>	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Less than High School	.771	.163	.447	1.094
High School	.496	.076	.346	.647
Post-Secondary	.625	.074	.479	.771

Note. The education level main effect on medication adherence, subjects with less than high school scored highest ($M = .77$) followed by subjects with post-secondary level ($M = .63$). Subjects with high school level scored the lowest ($M = .50$).

Table 10

Descriptive Statistics on Medication

Gender	Education attainment	<i>M</i>	<i>SD</i>	<i>N</i>
Female	Less than High School	.88	.35	8
	High School	.64	.49	25
	Post-Secondary	.69	.47	32
	Total	.69	.47	65
Male	Less than High School	.67	.58	3
	High School	.35	.49	17
	Post-Secondary	.56	.51	16
	Total	.47	.51	36
Total	Less than High School	.82	.41	11
	High School	.52	.51	42
	Post-Secondary	.65	.48	48
	Total	.61	.49	101

Note. Females performed better with education levels ($M = .69$) than males ($M = .47$), $F(2, 95) = 1.48$, $p = .23$, two tailed. Subjects with less than high school scored highest ($M = .82$, $SD = .41$) followed by those with post-secondary ($M = .65$, $SD = .48$). Subjects with high school degree scored lowest ($M = .52$, $SD = .51$).

Table 11

Test Between Subjects Effects on Medication Adherence

Source	df	SS	MS	F	p	η^2
Corrected Model	5	1.944 ^a	.389	1.679	.147	.081
Intercept	1	22.005	22.005	95.037	.000	.500
Gender	1	.591	.591	2.554	.113	.026
Edulevel	2	.686	.343	1.482	.232	.030
Gender * Edulevel	2	.136	.068	.295	.746	.006
Error	95	21.997	.232			
Total	101	62.000				
Corrected Total	100	23.941				

a. R Squared .081 (Adjusted R Squared = .033)

Note. The *F*-ratio of gender and education level are not significant respectively ($p = .113$; $p = .232$). No significant interaction between gender and education level as well ($p = .746$), therefore, the main effects are interpreted.

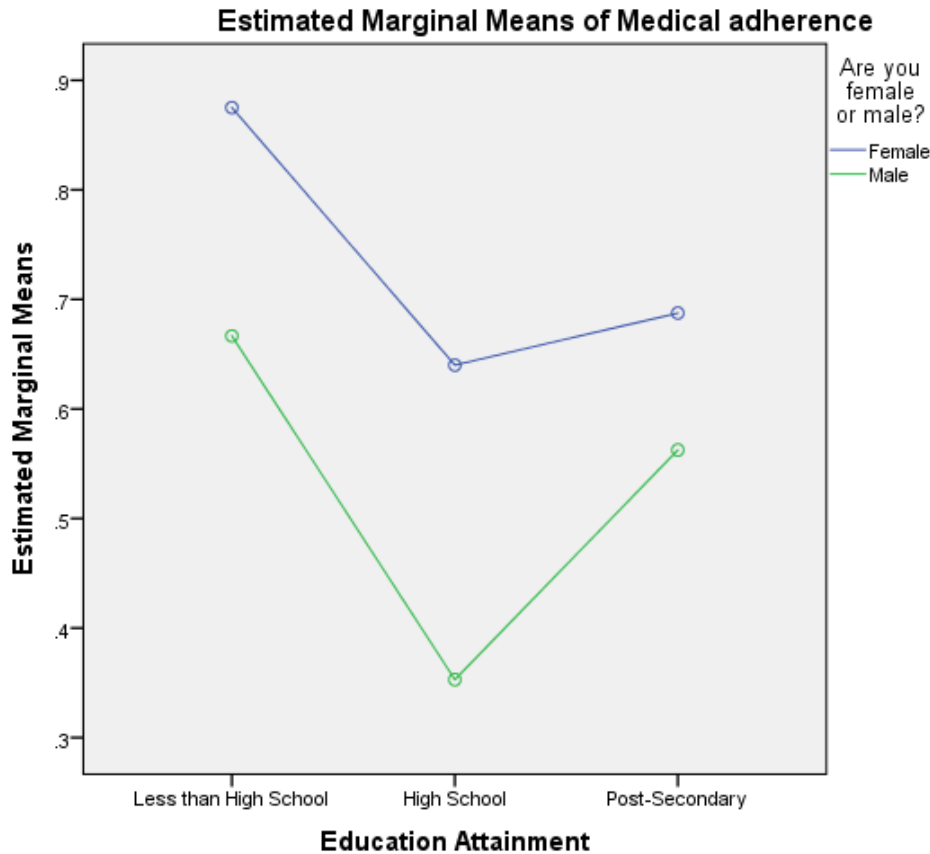


Figure 1. Profile plots for medication adherence.

Note. Interaction effect is not seen in the graph as the lines are parallel; however, females performed better with education levels than males. Females and Males scored highest with less than high school, scored lowest with high school. No apparent difference with post-secondary.

2. *Is the relationship between education and healthy exercise (physical activity) adherence the same for men and women?* In response to primary question 2, Table 12 shows gender and education demographics of those subjects who responded to this question. Table 13 and 14 display gender and education main effect on healthy exercise (physical activity) adherence. Table 15 shows descriptive statistics on healthy exercise adherence. Table 16 indicates the simple main effect was not significant ($p = .664$). In Figure 2, interaction

effect is not seen in the graph as the lines are parallel. Therefore, the main effects are interpreted in Table 14.

Table 12

Between-Subjects Factors

Variable	Value	Value Label	N
Are you female or male?	1	Female	50
	2	Male	27
Education Attainment	1	Less than High School	4
	2	High School	34
	3	Post-Secondary	39

Note. A total of 77 subjects were surveyed including 50 female (65%) and 27 male (35%).

Table 13

Gender Main Effect on Healthy Exercise

Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Female	1.650	.169	1.314	1.986
Male	1.808 ^a	.168	1.474	2.142

Note. The gender main effect on healthy exercise adherence, male respondents' healthy exercise adherence average score ($M = 1.81$) was higher than female respondents' ($M = 1.65$).

a = Based on modified population marginal mean.

Table 14

Education Level Main Effect on Healthy Exercise

Education Attainment	<i>M</i>	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Less than High School	1.750 ^a	.435	.883	2.617
High School	1.850	.152	1.548	2.152
Post-Secondary	1.558	.148	1.263	1.852

Note. The education level main effect on healthy exercise adherence, subjects with high school degree scored highest ($M = 1.85$) followed by subjects with less than high school ($M = 1.75$). Subjects with post-secondary level scored the lowest ($M = 1.56$).

a = Based on modified population marginal mean.

Table 15

Descriptive Statistics on Healthy Exercise Adherence

Gender	Education attainment	<i>M</i>	<i>SD</i>	<i>N</i>
Female	Less than High School	1.75	.96	8
	High School	1.70	.92	25
	Post-Secondary	1.50	.65	32
	Total	1.60	.78	65
Male	High School	2.00	1.11	3
	Post-Secondary	1.62	.87	16
	Total	1.81	1.00	36
Total	Less than High School	1.75	.96	11
	High School	1.82	1.00	42
	Post-Secondary	1.54	.72	48
	Total	1.68	.87	101

Note. Males performed better with education levels ($M = 1.81$) than females ($M = 1.60$), $F(2, 95) = 1.02$, $p = .37$, two tailed. Subjects with high school scored highest ($M = 1.82$, $SD = 1.0$) followed by those with less than high school ($M = 1.75$, $SD = .96$). Subjects with post-secondary level scored lowest ($M = 1.54$, $SD = .72$).

Table 16

Test Between Subjects Effects on Healthy Exercise Adherence

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	η^2
Corrected Model	5	2.356 ^a	.589	.778	.543	.041
Intercept	1	115.196	115.196	152.111	.000	.679
Gender	1	.729	.729	.962	.330	.013
Education level	2	1.542	.771	1.018	.366	.028
Gender * Edulevel	1	.144	.144	.190	.664	.003
Error	72	54.527	.757			
Total	77	273.000				
Corrected Total	76	56.883				

Note. The *F*-ratio of gender and education level are not significant respectively ($p = .330$; $p = .366$). There was no significant interaction between gender and education level ($p = .664$), therefore, the main effects are interpreted.

a. R Squared .041 (Adjusted R Squared = -.012)

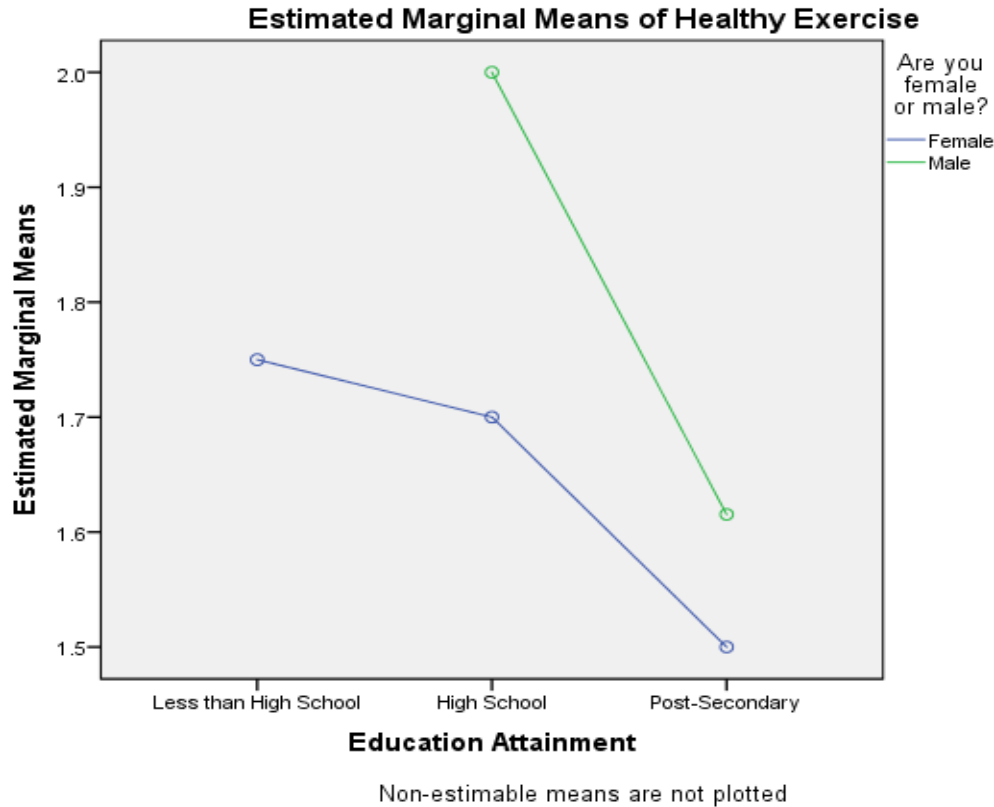


Figure 2. Profile plots for healthy exercise adherence.

Note. An interaction effect is not seen in the graph as the lines are parallel. Overall, male respondents performed better with healthy exercise than females. Males and females scored lowest with post-secondary school. Males scored highest with high school, while females scored highest with less than high school.

Secondary question. The following secondary question guided the research to answer the relationship between diabetes duration and medication and healthy exercise (physical activity) adherence.

Is there a relationship between how long patients have been diagnosed with diabetes and medication and healthy exercise adherence? In response to the secondary question, Table 17 displays the average years patients have been diagnosed with diabetes. The table also shows the descriptive statistics of medication and healthy exercise adherence. The average score of subjects who responded to their medication adherence was .62 ($SD = .49$). The mean score of

healthy exercise adherence was 1.68 ($SD = .87$). The mean score of subjects who responded to the years of being diabetic was 2.66 ($SD = 1.39$). Table 18 displays an inverse relationship between how long patients have been diagnosed with diabetes and their healthy exercise (physical activity) adherence ($p < .05$), two tailed. The scatterplot line displays as well that diabetes duration has inverse relationship with healthy exercise

Table 17

Descriptive Statistics of Duration, Medication and Healthy Exercise

Variables	<i>M</i>	<i>SD</i>	<i>N</i>
Medical Adherence	.62	.49	102
Healthy Exercise	1.68	.87	77
Duration	2.66	1.39	99

Note. Subjects who reported their medication adherence scores were 102 with an average score of .62 ($SD = .49$). Those subjects who reported their healthy exercise adherence scores were 77 with an average score of 1.68 ($SD = .87$). Subjects who responded to the years of being diabetic were 99 with an average score of 2.66 ($SD = 1.39$). The average diabetes duration score 2.66 is closer to 3 (11 – 15 years).

Table 18

Correlations between Duration, Medication and Healthy Exercise

Variable	Medical Adherence	Healthy Exercise	Duration
Medical Adherence	--		
Healthy Exercise	-.043	--	
Duration	.089	-.229*	--

Note. * $p < .05$. All tests were two-tailed.

As years of being diabetic (Duration) increases, healthy exercise adherence decreases as well, $r(73) = -.23$, $p < .05$, two tailed.

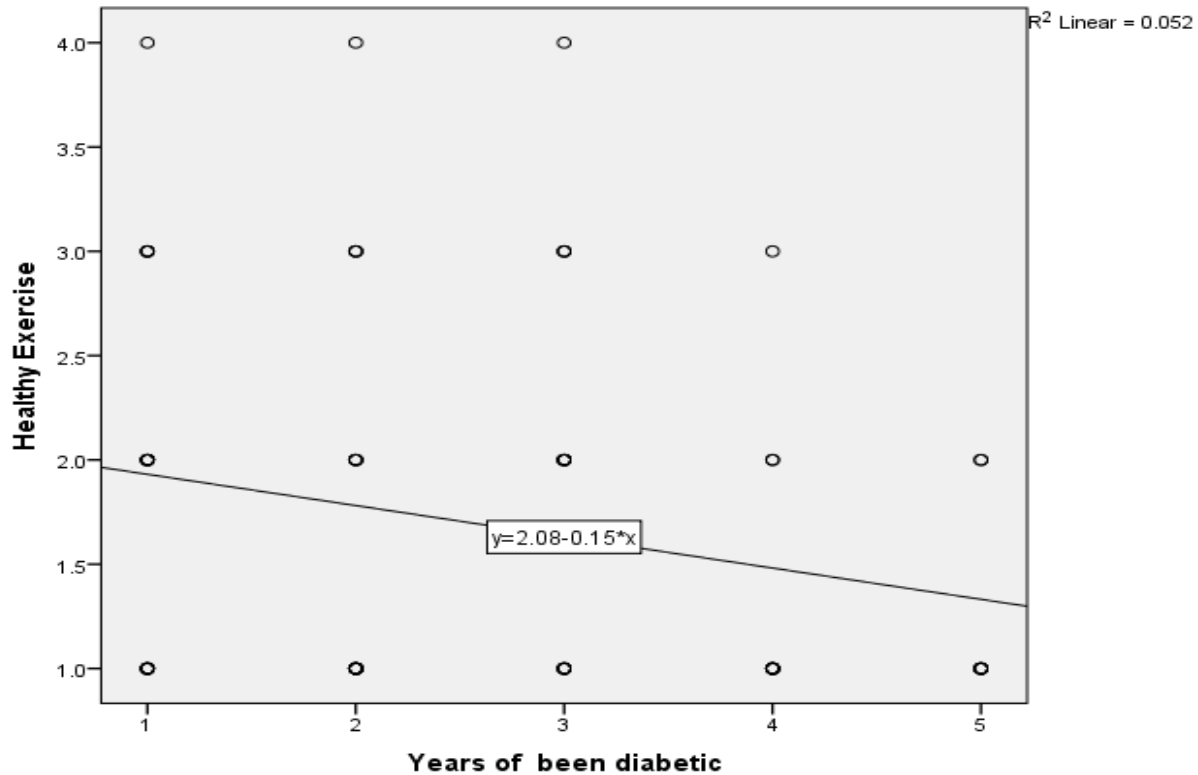


Figure 3. Correlation between duration, medication, and healthy exercise.

Note. Healthy Exercise. The scatterplot line indicates that diabetes duration has inverse relationship with healthy exercise. As years of being diabetic (duration) increases, healthy exercise adherence decreases.

Qualitative Findings

The following primary research question guided the qualitative part of the current investigation: How would registered nurses alter their approach to patients' education on medication and healthy exercise adherence considering patients' gender and education levels?

There were four main themes that emerged from the qualitative data analysis (see Table 19): (a) medication education based on education level, (b) physical activity is individual based, (c) involvement in type 2 diabetes education, and (d) nurses need to learn new information. The first theme indicated that the participants would alter their approach to patients' education on medication adherence based on diabetics' education levels. The second theme that emerged

indicated the participants believed that physical activity is individual based and they would not alter their approach to patients' education on healthy exercise adherence. The third theme indicated that the nurses were regularly involved in educating patients on medication and healthy exercise routines. The fourth emerged theme indicated that the nurses would like to learn any new information about type 2 diabetes.

Theme 1: Medication education based on education level. The findings of the qualitative data indicated that nine (90%) of the registered nurses interviewed in this qualitative study would alter their approach to patients' education on medication adherence based on patients' education levels. The categories associated with medication education based on education level are (a) education levels, (b) using simpler terms, and (c) no gender effect.

Education levels. Nine of the 10 registered nurses (90% of the respondents) stated how they would alter their approach to patients' education on medication adherence based on patients' education levels. Those registered nurses believed that they would not alter their approach to patient education on medication based on gender. Registered Nurse 1 stated,

I would focus on patients' education levels then gender. Education level tells me how much information diabetic patients absorb and how much they process. A patient with more college education would listen to what I am saying as a professional talking to him/her than non-college educated person. Gender would not be my focus as much as education level.

Registered Nurse 4 stated,

Education levels of the patients influence greatly on medication adherence. The higher the patients are educated the more they are financially stable and the more they do

research on the disease and the medication. Higher educated patients can be more adherent to medication. I would focus on lower educated diabetics more.

Registered Nurse 10 stated,

The most important thing is making diabetics understand why they need to take the medication. Lower educated diabetics would need more explanations about the medicine. I would educate lower educated diabetics more about medication.

Six (60%) of the registered nurses (N1, N2, N4, N5, N6, and N10) indicated that they would focus on lower educated diabetics when educating patients on medication adherence. Four (40%) registered nurses (N1, N4, N5, N7, and N8) believed that higher educated diabetics would be more adherent to medication than lower educated diabetics. Registered Nurse 4 stated,

Education levels of the patients influence greatly on medication adherence. The higher the patients are educated the more they are financially stable and the more they do research in the disease and the medication. The higher educated patients can be more adherent to medication. I would focus more on lower educated diabetic patients.

Registered Nurse 5 stated,

Education level in general has an effect on patients' adherence on medication. Higher educated diabetics would listen and would be more adherent to medication than lower educated diabetics.

Using simpler terms. Five (50%) registered nurses (N2, N6, N7, N8, and N9) reported that they would use simpler terms to educate diabetic patients on medication adherence.

Registered Nurse 9 stated,

Education levels of the patients matter. To know their reading levels are important as well. You can't assume that patients who are highly educated know medical terminology. I would talk to them in layman's term.

Registered Nurse 6 stated,

I would assess my patients on person of how they understand the instruction rather than basing it on gender type. If patients have low education levels, I would talk to them with more basic terms, so they can understand the instruction in a simple way.

Registered Nurse 7 stated,

I would focus on lower educated diabetics by educating them on medication in a simple manner. The lower educated diabetics may not understand the medical terminology I use. Those higher educated diabetics may understand the terminology I use more readily.

No gender influence. Nine (90%) of the 10 registered nurses who participated in the study stated that they would not alter their approach to patients' education on medication adherence based on patients' gender. Those registered nurses described that gender has no influence on diabetics' medication adherence. Registered Nurse 7 stated,

Female and male diabetic patients would be the same when educating them about medication adherence. Gender shouldn't determine how we teach patients about medication regimen.

Registered Nurse 10 stated,

I don't think the gender of the patients matters. The most important thing is to enable them understand why they need to take their diabetes medication.

Registered Nurse 4 stated,

Both genders can be equally noncompliant, so the education should focus on the importance of medication. Gender is not relevant for medication adherence. Female diabetics can be non-compliant like male diabetics.

Registered Nurse 3 and 6 stated that medication adherence is individual based and gender has no effect on medication education whatsoever. Only Registered Nurse 5 stated that she would alter her approach to patient education on medication adherence based on gender. This nurse believed that female diabetics were more adherent to medication than male diabetics. The nurse stated that female diabetics would ask questions about medication and would give feedback.

Theme 2: Physical activity is individual based. Results from the qualitative data indicated that eight (80%) out of the ten registered nurses reported that they would not alter their approach to patients' education on healthy exercise (physical activity) adherence based on gender or education levels. Those registered nurses believed that physical activity adherence was individual based. Two categories emerged from their explanation of physical activity is individual based: (a) individual based and (b) education levels.

Individual based. Eight registered nurses (80% of the respondents) stated that physical activity adherence is individual based. Those registered nurses (N3, N4, N5, N6, N7, N8, N9, and N10) reported that they would not change their approach to patients' education on healthy exercise adherence based on patients' gender or their education levels. Registered Nurse 4 stated,

Gender has no role on physical activity adherence. I give to diabetics [the] same type of education information about physical activity. It is about the individual ability to learn.

Registered Nurse 6 stated,

I still feel that you have to look into the person. It [physical activity] is individual based. You have to assess their education level and their physical activity level. People with high level of education tend to have more resources (i.e., more income) or eat healthier food.

Registered Nurse 7 stated,

No difference in terms of patients' gender. It depends on their individual needs. I think that both female and male diabetics are less active. I wouldn't focus on one specific gender on physical activity adherence.

Education levels. Registered Nurses 3, 5, 6, and 7 (40% of the registered nurses) reported that they would consider diabetics' educational levels for physical activity education. However, those registered nurses believed that physical activity adherence was individual based. Registered Nurse 3 stated,

I would change my approach to educating diabetics on physical activity adherence base on patients' education levels. College level educated diabetics tend to join gym and eat healthier food. Individual diabetics with lower education would need more assistance with resources.

Registered Nurse 5 stated,

I would ask feedback of how patients understand the benefits of being physically active. Education levels as well matter. Higher educated patients would be more adherent than lower educated patients. It depends as well on what type of education patients have: Formal versus informal education.

Registered Nurse 6 stated,

I think diabetics with higher level of education tend to have more resources such as income, gym at workplaces, or eat healthier food. You have to help individuals with lower education, offer them some resources, where to go for gym, and explain to them the benefits of being physically active.

Theme 3: Regularly educate type 2 diabetics. The findings of the qualitative data indicated that all of the ten registered nurses (100%) were involved in educating type 2 diabetics about medication and healthy exercise adherence. Registered Nurse 6 stated that she had been moderately involved in patients' education about diabetes medication and physical activity routines. Registered Nurse 4 state,

My involvement with diabetics starts with admission assessment and then I continue to see them for additional assessments. It is an ongoing process throughout the nurse-patient relationships. I have to develop trust and relationships with patients throughout the whole time I am caring about them. I routinely educate Type 2 diabetics on medication and physical activity throughout my nurse profession.

Registered Nurse 7 stated,

It is very routine and a common place to have Type 2 diabetics. I routinely educate them about medications with meals or before meal. Very much so. I involved in educating diabetics about medication and physical activity adherence.

Registered Nurse 10 stated,

When I am at the hospital floor, I explain to the diabetics how they take their medication and do their physical activity. So, there are enough interaction between

nurses and diabetics to understand what the medication does in terms of taking their blood sugar down.

Theme 4: Nurses need to learn new information. The results from the qualitative data indicated that nine (90%) registered nurses would like to have more training to learn new information about the disease. One category emerged from the nurses' description of wanting additional training to educate Type 2 diabetics about medication and healthy exercise: new information.

New information. Nine (90%) out of ten of the registered nurses stated how they would need for additional training about new diabetes information to effectively educate patients about medication and healthy exercise (physical activity) routines. Those registered nurses indicated that there was always new information about medication and physical activity that they would like to know. Registered Nurse 7 stated,

There is always opportunity to learning and grow. There are always new medications being released. There are always new guidelines released. So, I feel personally teaching Type 2 diabetics, but there is always opportunity to learn.

Registered Nurse 8 stated,

Everybody can always learn more. I would like to know if there are new information to educate myself about diabetes, medications, and physical activity routines.

Registered Nurse 9 stated,

It would be nice to have education materials about diabetes to give it to patients – more readily available. I would like to have enough time to educate patients properly about medication and physical activity. Therefore, you can never know enough. I would like to know the new information and the new medications about the disease.

Table 19

Categories and Themes

Questions	Categories	Themes
Question 1	Category 1 Education level N (1,2,4,5,6, 7,8,9,10)	Would use simpler terms and alter my approach to education based on education level, not gender
	Category 2 Using simpler terms (N 2, 6, 7, 8, 9)	
	Category 3 No gender effect N (1,2,3,4,6,7,8,9,10)	
Question 2	Category 1 Gender effect 50/50 N (3, 4, 8, 9,10)	Considered altering my approach based on education levels, not gender
	Category 2 Education levels N (2, 4, 5, 6, 8, 9, 10)	
Question 3	Category 1 Individual based N (3, 4, 5, 6, 7, 8, 9, 10)	Would not alter my approach; physical activity is individual based
	Category 2 Education levels (N 3, 5, 6, 7)	

Table 19 continued

Questions	Categories	Themes
Question 4	Category 1	Altered my approach based on education levels, not gender
	Education levels	
	N (1, 2, 3, 4, 6, 7, 9,)	
	Category 2	
	Not altered for gender	
	N (3, 4, 5, 6, 7, 8, 9, 10)	
Question 5	Category 1	It would change my approach based on patients' understanding level
	It would change my approach	
	N(1, 2, 3, 4, 5, 6, 7, 8, 9)	
	Category 2	
	Lower educated	
	N (3, 6,7)	
Question 6	Category 3	Regularly educate type 2diabetics
	Knowing patients' history	
	N (3, 4, 5, 7, 8, 9,)	
Question 7	Category 1	Medication and physical activity adherence are individual based
	Involved in patient education	
	N (1, 2, 3, 4, 5, 6, 7, 8, 9, 10)	
Question 7	Category 1	Medication and physical activity adherence are individual based
	Individual based	
	N (3, 4, 6,7, 8, 9, 10)	
Question 7	Category 2	Medication and physical activity adherence are individual based
	Female compliance	
	N (1, 2, 5)	

Table 19 continued

Questions	Categories	Themes
Question 8	Category 1 Higher education influence N (1, 2, 3, 4, 5, 6, 7, 9)	Higher level education has positive influence on medication and healthy exercise adherence
	Category 2 Lower education influence N (7, 10)	
	Category 3 Individual based N (8, 9)	
Question 9	Category 1 New information N (1, 2, 4, 5, 6, 7, 8, 9, 10)	Yes, would need more training to learn the new information
	Category 2 No need for more training N (3)	

Summary of Chapter 4

The results from this mixed methods investigation are delineated in this chapter. The quantitative findings indicated there was no significant interaction between education level and gender on medication adherence with regards to female and male Type 2 diabetics. However, in the descriptive statistics, female Type 2 diabetics were more adherent to medication in every education level than male Type 2 diabetics. Similarly, the findings of the quantitative analysis indicated that there was no significant interaction between education level and gender on healthy exercise adherence regarding to female and male Type 2 diabetics. In the descriptive statistics,

male Type 2 diabetics were more adherent to healthy exercise routines than female Type 2 diabetics. The quantitative results indicate as well an inverse relationship between how long patients have been diagnosed with Type 2 diabetes and their healthy exercise adherence. The results indicated that there was no significant relationship between how long patients were diagnosed with Type 2 diabetes and their medication adherence.

The findings of the qualitative part of the investigation indicated that the registered nurses would alter their approach to patients' education on medication adherence based on their education levels. The findings indicated as well that the registered nurses would not alter their approach to patients' education on healthy exercise adherence. The data results suggested that physical activity adherence was individual based. There were four themes emerged from the analysis of the qualitative data: a) medication education based on education level, b) physical activity is individual based, c) involvement in type 2 diabetes education, and (d) nurses need to learn new information. The emergence of the first theme suggested that the registered nurses would alter their approach to patients' education on medication adherence based on diabetics' education levels. The second theme that emerged indicated the nurses believed that physical activity was individual based and they would not change their approach to patients' education on healthy exercise adherence. The emergence of the third theme indicated that the registered nurses were regularly involved in educating Type 2 diabetics on medication and healthy exercise adherence. The fourth emerged theme indicated that the registered nurses would like to know any new information pertaining to Type 2 diabetes' medication and physical activity routines.

CHAPTER 5

DISCUSSION AND CONCLUSION

The main goal of diabetes educators, including registered nurses, is to improve the quality of life of diabetic patients. Successful improvement depends on the degree to which diabetics adhere to medication and healthy exercise routines. The purpose of this sequential explanatory study was to explore whether the relationship between Type 2 diabetics' education levels and their medication and healthy exercise adherence are the same for men and women. The purpose of the study included whether registered nurses would alter their approach to patients' education on medication and healthy exercise adherence considering patients' gender and education levels. The research investigation explored also the relationship between how long patients have been diagnosed with diabetes and their medication and healthy exercise adherence.

Summary and Discussion of Findings

This segment presents discussion about the findings of the data from this mixed methods study analyzed during the course of this investigation. Due to my review of related literature, no other study explored the interaction between gender and education attainment with respect to Type 2 diabetics' medication and healthy exercise adherence. However, various studies explored separately the influence of gender and education achievement among Type 2 diabetic patients on their medication and physical activity routines. To my knowledge, no other investigation

explored how registered nurses would alter their approach to patients' education on medication and healthy exercise adherence considering patients' gender and education levels.

Quantitative Findings

The quantitative phase of this sequential explanatory investigation sought to answer the following research questions:

Primary research question 1. The findings from this research investigation suggested no significant interaction between gender and education levels regarding medication adherence ($p = .746$). However, the descriptive analysis from this investigation suggested that gender, not education levels, has greater effect on medication adherence among Type 2 diabetics, although statistically it is no better than chance. Previous studies suggested no significant association between gender and medication adherence (Nur, 2015; Tiv et al., 2012). Research by Geiselmarbaise and Stummer (2010) found similar results, where there were no significant gender variances for oral medication adherence among Type 2 diabetics. The present investigation is in agreement with these findings regarding the effect of gender variable on medication adherence ($p = .113$). However, in the main effects, the data suggested greater female medication adherence when education levels were mediated in sum ($M = .69$; $M = .47$) and in different levels: less than high school ($M = .88$; $M = .67$); high school ($M = .64$; $M = .35$); and post-secondary ($M = .69$; $M = .65$). In the descriptive analysis section of the current study, female Type 2 diabetics scored higher compared to male diabetics on medication adherence with no education mediation ($M = .73$; $M = .53$). These results, based on this small sample, led to the conclusion that female Type 2 diabetics adhere to medication regimens greater than male Type 2 diabetics with or without education mediation.

With regard to education effect, Jaleh et al. (2013) found that treatment loyalty, such as medication adherence, improves due to educational achievement among Type 2 diabetics. In line with that assessment, O'Brien et al. (2015) reported that taking medication as prescribed by physicians has greater efficiency among well-educated diabetic persons. The present study is inconsistent with these findings. There is no significant association found between education achievement among Type 2 diabetics and their medication adherence ($p = .232$). In the main effects, data suggested that education achievement among Type 2 diabetic patients is not predictive of greater medication adherence. Drawing upon the qualitative data results, this finding could be the result of the nurses' focus on education levels in their work with patients on medication adherence.

Primary research question 2. The findings from the data of this research investigation suggested no significant interaction between gender and education attainment regarding healthy exercise adherence ($p = .664$). However, the descriptive analysis from this study suggested that gender, not education levels, has greater influence on healthy exercise adherence among Type 2 diabetics, although statistically it is no better than chance. Data in the main effects suggested Type 2 diabetic males scored higher than female Type 2 diabetics in adhering to healthy exercise routines when education levels were involved in sum ($M = 1.81$; $M = 1.60$) and in high school and in post-secondary education levels: ($M = 2.00$; $M = 1.70$) and ($M = 1.62$; $M = 1.50$). The corresponding population marginal mean of the male respondents with less than high school education level was not estimable. Nonetheless, the mean score of female respondents with less than high school was 1.75, which represented the highest score among the female respondents' scores on healthy exercise adherence. In the descriptive analysis, male subjects scored higher compared to female subjects on healthy exercise adherence with no education attainment

mediation. Previous studies reported similar findings. Research by Hays and Clark (1999) illustrated that female Type 2 diabetics had less physical activity per week compared to male Type 2 diabetics. Cohn, Cirillo, Wingard, Austin and Roffers (1997) reported as well that physical activity was lower among female Type 2 diabetics.

Regarding the impact of education attainment on patients' healthy exercise adherence, data from this study indicated no significant relationship between education levels and healthy exercise adherence among Type 2 diabetics ($p = .366$). Similar results were reported by Samardzija (2009) who found no association between education levels and patients healthy exercise adherence. In the main effects, data suggested that education levels among Type 2 diabetic patients were not predictive of greater healthy exercise adherence. Hence, gender, not education levels, had greater influence on healthy exercise adherence among Type 2 diabetics.

Secondary research question. In contrast with the findings of Yang et al. (2016), where people with longer diabetes duration were more likely to adhere their diabetes management schedules, the data from this investigation suggested varied findings with regards to diabetes self-care. While there is no correlation between medication adherence and how long patients have been diagnosed with diabetes, the data suggested an inverse relationship between healthy exercise adherence and how long patients were diagnosed with the disease. That means that as years of being diabetic (duration) increases, healthy exercise adherence among Type 2 diabetics decreases as well.

Qualitative Findings

The qualitative phase of this mixed methods investigation was chosen to answer the following research question:

How would registered nurses alter their approach to patients' education on medication and healthy exercise adherence considering patients' gender and education levels?

The findings of the qualitative investigation illuminated the instructional strategies of the registered nurses regarding to patient education on Type 2 diabetes medication and healthy exercise routines. The analysis of the data collected through semi-structured interviews allowed me to (a) explore registered nurses' perception of patient education about medication and healthy exercise routines, (b) identify the extent to which registered nurses involve in Type 2 diabetes education, and (c) determine whether the registered nurses would need additional training about diabetes medication and healthy exercise routines.

Medication instruction based on education level. The findings of the qualitative data suggest that registered nurses would change their approach to patient education on medication adherence based on education levels. The literature indicated that largely the prevalence of Type 2 diabetes is inversely related to diabetics' educational levels (Maier et al., 2014). It is higher among individuals with lower education levels compared to those with higher levels of education attainments (Borrell et al., 2006; Brown et al., 2015; Bullen, 2016). In addition, Elliott et al. (2013) reported a link between diabetes' self-care and diabetes education gaps among Type 2 diabetics. Cauch-Dudek et al. (2013) suggested that most of the newly diagnosed Type 2 diabetics either receive inadequate diabetes self-care education plans from healthcare facilities or they do not obtain diabetes self-management education of any kind. In line with the registered nurses' approach on how to educate diabetic adult learners on medication adherence, Jaleh et al. (2013) and Su et al. (2016) reported that diabetes self-management improved due to patients' education attainment and because of diabetes education follow-ups with patients by trained diabetes educators. Approximately half of the diabetic adult learners who received information

on diabetes self-management understand what they are instructed to do (Compean Ortiz et al., 2016)

This finding differs from the result of the quantitative data which suggested gender effect, not education achievement, on patients' medication adherence. The descriptive analysis of the quantitative data indicates greater Type 2 diabetic female medication adherence with or without education level mediation. Positive perceptions to higher educated diabetics were found among the registered nurses alongside insights of how lower educated Type 2 diabetic persons were less adherent to medication regimens. Registered nurses expressed as well the need to use simpler terms to educate patients on medication adherence. They pointed out the necessity of altering the terminology used based on patients' education achievement.

In line with the finding from the qualitative analysis, taking medication as prescribed by physicians has greater efficiency among highly educated Type 2 diabetics (O'Brien et al., 2015). In agreement with this account, a study from Xu et al., (2010) suggested that diabetics with higher education levels were better to self-manage their diabetes than those with lower education levels regarding to healthy behaviors including medication adherence. Peeters et al. (2010) reported that low socioeconomic status (i.e., education level and income) may prevent diabetics from getting access to basic medications and other supplies and resources needed for the disease treatment. Research by Grintsova et al. (2014) suggested that diabetes care among people with low socioeconomic status is worse compared to individuals with higher socioeconomic status. In contrast, Harris et al. (1999) reported that education levels, along with other factors such as income, were not predictive of poor diabetes treatment including medication nonadherence.

Physical activity is individual based. The findings of the qualitative analysis illustrated also how the registered nurses altered their approach to patients' education on healthy exercise

routines. The nurses stated that healthy exercise adherence is individual based. They expressed that patients' gender and education attainment have no influence on healthy exercise adherence. In contrast, O'Brien et al. (2015) reported that college graduate Type 2 diabetic individuals had more resources to use in order to successfully achieve the goals of their lifestyle interventions. These researchers found that since education was directly associated with income in their study group, college graduates' advantages may have delivered to them greater access to physical activity and healthy food than less educated persons. Xu et al. (2010) reported similarly that diabetic persons with higher education levels were better to self-manage their diabetes than those individuals with lower education levels in respect of healthy exercise and medication adherence.

In agreement with O'Brien et al. (2015) and in contrast with the qualitative finding, Mesmar et al. (2011) reported that the level of education attainment among Type 2 diabetics was the main predictor of the level of understanding and practice concerning diabetes self-management behaviors including physical activity routines. Additionally, diabetic persons with low socioeconomic status commonly have "less access to both healthy food choices and opportunities for physical activity" (CDC, 2013b). These diabetic individuals may as well have difficulties to join exercise routines (Grintsova et al., 2014). Males are believed to have significantly greater levels of overall physical activity than females (Alsahli, 2016). In line with this conclusion, the findings from the quantitative data suggested that male type 2 diabetics scored higher in healthy exercise routines than female Type 2 diabetics with or without education attainment mediation.

In agreement with Funnell et al. (2010), the registered nurses expressed that they were involved on a regular basis in patient education on medication and healthy exercise adherence. The findings of the qualitative analysis suggested that the registered nurses' involvement in

diabetic patient education was common from the admission assessment practice to the screening process. According to Funnell et al. (2010), diabetes education has regularly been delivered by registered nurses whom are frequently employed as instructors in giving formal diabetes self-management instructions. The findings indicated that the nurses had enough interaction with diabetic patients regarding to patient education on medication and healthy exercise routines. The result suggested also that the registered nurses would need additional training in order to learn new information including medication and other Type 2 diabetes disease treatment procedures such as physical activity routines.

Andragogical Approach to Study Findings

The significance of the adult learning described in chapter two can be detected in the findings of this investigation. The quantitative results of the primary investigation, though not significant, hinted how patients' self-concept, their experience, and their readiness to learn were far more influential than education achievements. In general, adult learners are "heterogeneous in terms of background, learning style, motivation, needs, interests, and goals" (Knowles et al., 1998, p. 66). Diabetic individuals, as adult learners, are no exception. While the descriptive analysis of the study indicated that female and male diabetics were more prepared and ready to adhere medication and healthy exercise routines in that order, the influence from the patients' behaviors can be greater than education influence on medication and healthy exercise adherence, i.e., their adherence levels were in some measure individual based. This result can be attributed to the variance of the voluntary nature and the different participation levels of the adult learners (Merriam & Caffarella, 1991).

Additionally, the correlation result of the significant inverse relationship between how long patients have been diagnosed with diabetes and their healthy exercise adherence may relate

to the motivation levels on the part of these adult learners, i.e., the influence levels of the external and internal motivators. The prospect to motivate the adult learner depends on taking advantage of the learner's specific internal needs for individual achievement (Knowles et al., 1998). The authors reasoned that such motivation depends as well on how clear the instructors detailed the subject matter at the start of the learning activities. By clarifying learning objectives and the purpose for the instruction, regarding the learner's needs, the learner is essentially ready to properly follow the instruction (Knowles et al., 1998). However, in order for the learner to maintain constant motivation, Knowles (1960) argued that it must be mainly intrinsic motivation. Furthermore, the registered nurses' approach to patient education on medication adherence, unlike healthy exercise adherence, was subject-centered rather than problem-centered. They would alter their approach to patient education based on patients' education achievements rather than analyzing patients' needs to know why they learn, their orientation to learn, and their readiness to learn what they are supposed to learn.

Merriam and Caffarella (1991) argued that one of the reasons for the adult learners' great interest in learning is that, unlike child focused learning, adult centered learning is largely based on voluntary activity. Knowles (1990) agreed to the assessment that adult learning is relatively different than children learning. He argued that adult learners are self-directed learners who can participate in education and assume ownership of learning; that they have a significant reservoir of knowledge on which to build and learn; that they are ready to learn when there is a need to learn; and that they favor a problem-centered learning rather than subject-centered learning (Knowles et al., 1998). As a result, adult learners' self-concept changes from that of dependent character to that of a self-directed nature (Knowles, 1969). While the relationship between the registered nurses and diabetic individuals as adult learners is mutual and important, analyzing

diabetics' learning qualities is essential. Therefore, the registered nurses need to act as facilitators who accept patients' interest to know the benefits of what they are learning and their self-concept as responsible adults. Nurses should also examine patients' readiness to learn and recognize that diabetics, as adult learners, are problem-centered in their orientation to learn as opposed to child-focused subject-centered orientation (Knowles et al., 1998).

Limitations of the Study

This investigation has several limitations. First, the study data were based on patients' and registered nurses' self-reports; therefore, I had no control over how carefully or honestly patients and registered nurses responded to the questionnaire of the investigation and the interview.

Second, similar reliable data reflecting general population were not found to investigate the associations between the present study's variables. Hence, data for the quantitative study will be limited to the information obtained from the preexisting data.

Third, given the small sample size and the narrow regional draw, the limitations include a lack of generalizability of the study findings. Therefore, this study is limited to the population studied and may not be convenient to other populations. Finally, only registered nurses from Terre Haute Regional Hospital were invited to participate in the qualitative phase of the study. As a result, the qualitative part of the study was limited to the registered nurses from Terre Haute Regional Hospital and may not be appropriate to other registered nurses or to other diabetes educators.

Implications and Recommendations

Results from the quantitative investigation suggest several implications for medication adherence among type two diabetics. The results suggest no significant interaction between

gender and education attainment in regard to medication adherence. The findings suggest as well that subjects with less than high school scored highest in medication adherence compared to subjects with post-secondary level who scored second followed by those subjects with high school level who scored the lowest. Overall, the female subjects' medication adherence average score was higher than male subjects with or without education level mediation. It is possible that patients' education attainment had no influence on their medication adherence levels. It is likely also that gender has greater influence on medication adherence than patients' education levels. As a result, it is expected that if registered nurses address and focus on gender impact more than patients' education achievement, when instructing Type 2 diabetics on medication adherence routines, they may successfully help patients improve their medication adherence scores. It is useful as well if the registered nurses examine patients' readiness to learn and adhere medication prescription rather than focusing patients' education achievements.

Similarly, results from the quantitative study suggest several implications for healthy exercise adherence among Type 2 diabetics. The study results suggest no significant interaction between gender and education achievement regarding healthy exercise adherence. It is possible, based on the study findings, that patients' education achievement has less impact on healthy exercise adherence than gender factor as stated in the quantitative data analysis section. The study results indicate that subjects with a high school degree scored highest on healthy exercise adherence followed by subjects with less than high school. Subjects with post-secondary level scored the lowest. Male subjects' healthy exercise adherence average score was also higher than female subjects' average score with or without education level mediation. Thus, it is likely that patients' education attainment may not affect their healthy exercise adherence levels compared to gender. Accordingly, it is possible that if registered nurses address gender impact and assess a

patient's readiness to exercise more than a patient's education attainment, when instructing Type 2 diabetics on healthy exercise adherence routines, they may successfully help patients increase their healthy exercise adherence scores.

The findings from the qualitative data suggest several implications for how registered nurses would alter their approach to patients' education on medication adherence. The results suggest that the registered nurses would alter their approach to patient education on medication adherence based on education levels. The registered nurses would educate both genders the same on medication adherence. Thus, the nurses believed no gender impact on medication adherence. It is likely that the nurses linked medication adherence to the patients' financial stability acquired from their educational achievement. It is also possible that the nurses believed the higher the patients were educated the more they knew better about medication. That means that the higher educated diabetics would better understand about the significance of taking their medication as prescribed by physicians compared to lower educated diabetics. It is likely that the nurses would alter their approach to educate patients based on subject-centered orientation to learn as opposed to problem-centered. However, since the findings of the quantitative analysis suggest that gender influences patients' medication adherence (i.e., females scored greater in medication adherence than males in the average scores), it would be useful for the registered nurses to address the gender effect on medication adherence as well as the readiness and the individual needs to learn as responsible adults. Registered nurses may need also to focus on male type 2 diabetics to improve their medication adherence scores.

The results from the qualitative data suggest several implications for how the nurses would alter their approach to patients' education on healthy exercise adherence. The findings suggest that the nurses would not alter their approach to patients' education on healthy exercise

routines. The nurses believed no gender and no education attainment effect on healthy exercise adherence. However, while the nurses expressed positive opinion toward patients' education attainment, they stated that healthy exercise adherence was individual based. It is possible that the nurses believed that patients were less active regardless of their gender and education levels. Therefore, the nurses likely decided not to alter their approach to patient education on healthy exercise adherence based on gender or education levels. The findings of the quantitative analysis suggest that gender impacts on patients' healthy exercise adherence (i.e., males scored higher in healthy exercise adherence than females in the average scores). Therefore, it would be beneficial if the nurses address the gender influence on healthy exercise adherence. It would be useful as well if the nurses examine patients' readiness to exercise, the level of their motivation to be physically active, and whether patients understand the benefits of adhering to healthy exercise routines. Moreover, registered nurses may need to focus on female Type 2 diabetics to improve their healthy exercise adherence scores.

Recommendations for Future Research

Based on the findings of this investigation, the present study suggests further studies should be done in the following areas.

1. Future studies should be included larger sample size and more representation of male diabetic patients.
2. Since the average age of the subjects in the preexisting quantitative data of this study was 62 years, future studies should recruit younger diabetic patients.
3. This study included one group of diabetes educators, registered nurses; future studies should include other groups of diabetes educators, such as dieticians and pharmacists.

4. This study focused on the interaction of two variables, gender and education level, on medication and healthy exercise adherence. Future investigations should include the interaction between education level variable and other relevant variables such as race, income, and age.
5. Future studies should include more representation of minority groups. The majority of the subjects in the preexisting data were white (89.2%), while 9.0% and 2.0% reported they were Black/African Americans or other, respectively.
6. The majority of the respondents in the preexisting data were subjects from rural areas of Indiana and Illinois. Therefore, future investigations can be replicated on subjects from an urban population.

Conclusion

Knowles's andragogical model and the values of adult learning upon which it is founded are useful in understanding how adults' learning process takes place. The variation between how the registered nurses would change their approach to patients' diabetes education and the factors that affect patients' adherence levels to medication and healthy exercise routines is evident in this mixed methods investigation.

The findings from the quantitative analysis concerning whether the relationship between education attainment and medication adherence is the same for Type 2 diabetic males and females suggest a) no significant interaction between gender and education achievement on medication adherence and b) gender, not education levels, had greater influence on medication adherence among Type 2 diabetics (i.e., in the descriptive analysis, female Type 2 diabetics scored higher than male Type 2 diabetics on medication adherence). In contrast, the findings in the qualitative analysis suggest that the registered nurses would alter their approach to patients'

education on medication adherence based on education levels, not gender. That means that the nurses would focus on patients' education levels rather than gender on medication adherence while data from the patients' account suggest gender influence rather than education level effect among Type 2 diabetics.

The results from the quantitative analysis as regards to whether the relationship between education achievement and healthy exercise adherence is the same for Type 2 diabetic males and females suggest a) no significant interaction between gender and education levels with regard to healthy exercise adherence and b) gender, not education levels, had greater impact on healthy exercise adherence among Type 2 diabetics (i.e., in the descriptive analysis, male Type 2 diabetics scored higher than female Type 2 diabetics on healthy exercise adherence). Quite the opposite, the findings from the qualitative data suggest that the registered nurses would not alter their approach to patients' education on healthy exercise adherence based on gender or education levels. The registered nurses expressed that healthy exercise adherence among Type 2 diabetics was individual based.

The quantitative study provided information about an inverse relationship between how long patients have been diagnosed with Type 2 diabetes and their healthy exercise adherence. The results indicated that there was no significant correlation between how long patients were diagnosed with Type 2 diabetes and their medication adherence.

The registered nurses interviewed in this mixed methods investigation expressed how they would need more training programs in order to learn the new information about diabetes treatment such as new medications and other disease management techniques including physical activity practices. The nurses' involvement in educating diabetics about medication and physical activity routines was frequent from the admission process to the screening procedures. Thus, the

registered nurses had enough patient contact with Type 2 diabetics regarding patient education on medication and healthy exercise schedules. However, the registered nurses' approach to patient education on medication adherence was more like subject-centered rather than problem-centered. Patients need to be an active participation in their learning rather than being passive learners, while nurses need to act as facilitators who can help patients achieve the learning objective. Nurses should evaluate as well patients' needs to know the benefits of what they learn, their orientation to learn, and their readiness to learn. Registered nurses should also understand that diabetics, as adult learners, are self-directed learners who can engage in learning through prior experience they had before the new information (Knowles et al., 1998).

The study suggested that more studies on Type 2 diabetic adult learners would be valuable to understand the influence of the interaction between gender and education levels on medication and physical activity routines. The study recommended that future studies should include larger sample size and more representation of male Type 2 diabetics along with more representation of minority and young Type 2 diabetic populations. In addition, this study suggested future research that includes other diabetes educators such as specialists from dietician and pharmacy groups.

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APPENDIX: INTERVIEW PROTOCOL RESEARCH STUDY

Interview Protocol Research Study: Adult Learning and the Effect of Education and Gender

Interaction on Type 2 Diabetics

Time of Interview:

Date:

Place:

Interviewer:

The main purpose of the current investigation is to examine whether the association between education and medication and healthy exercise (physical activity) adherence among type 2 diabetics are the same for men and women. The purpose also includes exploring whether diabetes educators would alter their approach to patients' education on medication and healthy exercise adherence considering patients' education levels and gender.

Questions

1. How would you alter your approach to patients' education on medication adherence when considering their gender and education levels?
2. Have you considered in the past altering your approach to patient education on medication adherence considering patients' gender and their education levels?