ASSESSING THE OLDER ADULT DIABETIC POPULATION IN THE US: A DESCRIPTIVE LOOK AT THIS POPULATION FROM 2001-2010 FOCUSING UPON EDUCATION AND CLINICAL BEHAVIORS

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The focus of this research study was to gain needed information on the older adult population in the United States who have diabetes. The research method was quantitative retrospective study of American diabetes obtained from the National Health Interview Survey database from 2001 through 2010. The study results confirmed more than one-third of the U.S. diabetics are aged 65 and older. More than 75% of the older diabetic population report clinical limitations/comorbidities. Based on surrogate markers of education, it appears the older diabetic cohort did receive more preventative care visits than did the older nondiabetic population; however, the difference was not robust. I found a slight negative trend between age and emergency room visits in the older diabetic population; in addition, there was a negative association between age and smoking in this population. There continues to be a need for scientific research in this population. Greater numbers need education and more clinical trials specific to the older diabetic should be encouraged.

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CHAPTER 1

INTRODUCTION

The focus of this research study was to gain needed information on the older adult population in the United States who have diabetes. I used a population representative database for the years 2003-20012 to assess magnitude of condition (diabetes), and to explore relationships between the disease, effects of education, and clinical outcome markers. In this chapter, I briefly discuss diabetes, and cite the current concerns in the gerontology care community as it relates to the older diabetic. In subsequent chapters, I will review specifics related to diabetes, such as current epidemiological data, incidence, prevalence, using diabetic education as a form of therapeutic treatment for the disease, and the few clinical trials that have been carried out in the older diabetic population. After the review of diabetes and gerontological concerns, the statement of the research problem, rationale for the study, research purpose, research questions, and clinical significance for practice and policy will be noted.

Diabetes Mellitus (DM)

Diabetes mellitus (diabetes) is a group of endocrine disorders with a complex pathophysiology characterized by abnormal metabolism of carbohydrates, fats and proteins secondary to a disturbance of insulin secretion, insulin action, and resistance to insulin. The end result of these pathophysiologic abnormalities is chronic elevated blood sugar that can lead to devastating changes to the cardiovascular, neurologic, renal, and central nervous systems (American Diabetes Association [ADA], 2015; Crandall, 2007; Srinivasan, Taub, & Owen, 2008).

According to the Center for Disease Control (CDC) in 2011, it is estimated that more than one-fourth (26.9%) of Americans age 65 and older have Type II diabetes. Yet, little is published about this older American diabetic population. In the United States, adults over the age of 60 are excluded from clinical trials—because they are considered an at risk group (Herrera, Snipes, King, Torres-Vigil, Goldberg, & Weinberg, 2010). As a result, the clinical trial researchers that have studied this group are scarce, and current trials regarding older adults with Type II diabetes comprises less than 2% of clinical research cited in the WHO clinical trials registry (Cruz-Jentoft, Caroena-Ruiz, Montero-Errasquin, Sanchez-Castello, & Sanchez-Garcia, 2013). In this manuscript, I have summarized all clinical trials (worldwide) of diabetics age 65 and older since 1960, which was a mere 27 studies in the last 55 years.

The literature shows education of the older adult with diabetes is the cornerstone of management—creating an expert patient. After education, blood sugar control appears to be better, there are fewer complications, fewer hospitalizations, less harmful health behaviors, such as smoking, and the health-care costs are less. In spite of these positive benefits, less than 60% of older diabetics receive diabetic education (Beaser, Weinger, & Bolduc-Bissell, 2005).

Many theorists have assessed what the ideal foundation for diabetic education in the elderly is. No specific philosophy has been identified as being superior. The concept of self-efficacy seems to this researcher to be particularly applicable to the older Type II diabetic. In the late 1990s, a research tool that assessed self-efficacy in the diabetic was developed (Van der Bijl, Van Poelgeest-Eeltink, & Shortridge-Baggett, 1999). This tool assessed dietary behaviors, exercise, self-monitoring of blood sugars, and accessing a health care provider as behaviors that correlated with high levels of self-efficacy and effective self-management in the diabetic (van der Bijl et al., 1999). However, this tool and its parameters have not been studied in the older diabetic population. A schematic of these suppositions regarding diabetic education, treatment, and outcomes is in Figure 1.

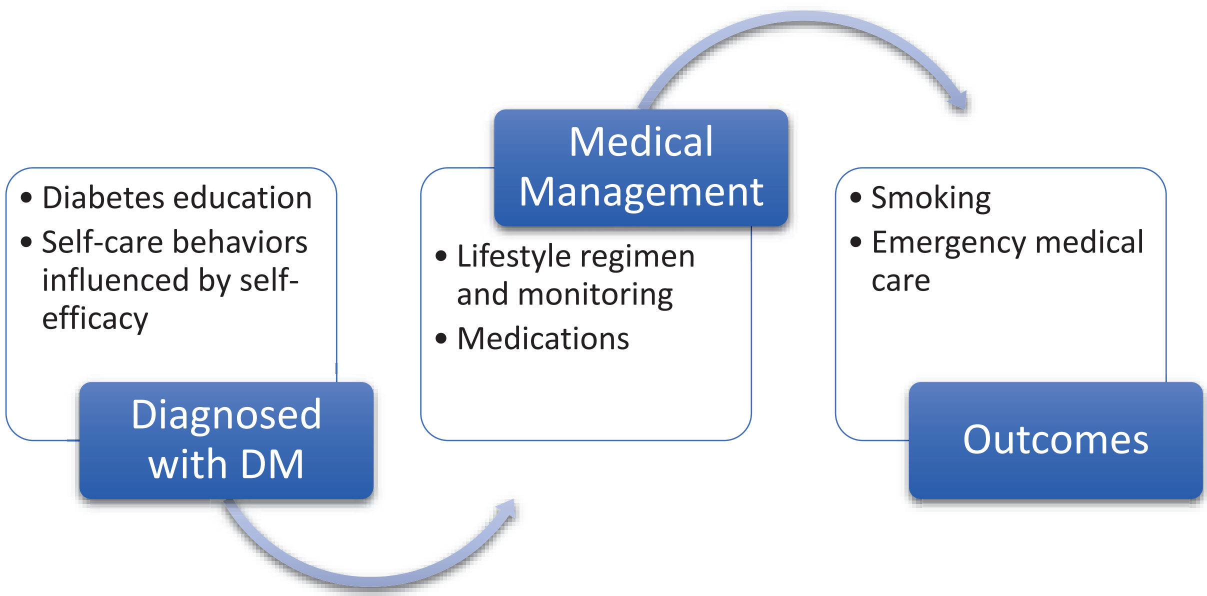

Figure 1. Management of diabetes.

In addition, the management of diabetes in the elderly can be complicated by other chronic health conditions (Meneilly & Tessier, 2001). The gaps in data regarding this older diabetic population are enormous. The randomized controlled trials are few, the published case controlled trials are near nonexistent, and the percentage of older diabetics who receive the needed education (for successful self- management) is not acceptable. At best, only six out of every 10 older diabetics receive this education (Beaser et al., 2005). In those that do receive education—does it change behaviors? Are these diabetics active in controlling their disease, with healthful behaviors, such as regular exercise, routine self-monitoring of glucose, examining of their own feet, following a healthy diet, and the like? This research project will focus upon gaining needed information on this group utilizing a population representative database—the National Health Interview Surveys.

Statement of the Research Problem

In 2001, there were 150 million diabetics worldwide; this amount is expected to double by 2025 (International Diabetes Federation, 2001). In industrialized areas, the majority of the new cases are Type II diabetics, and they are older than 60 years (International Diabetes Federation, 2001). In the United States, in 2000, it was estimated that 40% of all diabetics were 65 years or older (Gerontological Society of American and National Academy on an Aging Society, 2011). Projections for the United States are profound—diagnosed cases are expected to increase 198%—from 16.2 million cases in 2005 to 48.3 million in 2050 (Narayan, Boyle, Geiss, Saaddine, & Thompson, 2006). Data from the CDC through 2010 suggest that prevalence of diabetes was seven times higher in those 65 and older compared to adults younger than 45 years (CDC, 2012).

These numbers are synonymous with exponential costs. In 2007, $174 billion were spent on diabetic complications (CDC, 2011). These costs have serious implications for U.S. healthcare spending. Based on information from national surveys, Medicare files and commercial insurance databases—the United States spent $245 billion on diabetes in 2012. This value was 41% higher than in 2007, when the value was $174 billion (ADA, 2013).

In addition, the human cost of diabetes is marked. In 2007, adult life expectancy was 77.9 years (Xu, Kochanek, Murphy, & Tejada-Vera, 2010). The diabetic adult is expected to live five to seven years less than a non-diabetic. Incidence of heart disease, stroke, impotence, and chronic kidney disease is at least two times higher in the diabetic population (Roberts, 2006).

Rationale for the Study

In this retrospective population study, I used the conceptual model presented in Figure 2 to assess factors that may be important in the self-management of Type II diabetes in the patient that is 65 and older. In this model, I am assuming health education, as assessed by surrogate markers—preventative care visits, can have a positive impact on the older diabetic's general health and diabetes control. From a theoretical perspective, health-efficacy is fostered via the education process and as a result the older diabetic feels more involved and capable of self-care measures, such as preventative care visits, exercise, eating healthy, self-monitoring, and avoiding harmful behaviors, such as smoking (N. M. Clark & Gong, 2000; Hill-Briggs & Gemmell, 2007; Loveman, Frampton, & Clegg, 2008; Norris, Engelgau, & Venkar Narayan, 2001; Suhl & Bonsignore, 2006).

In 2001, when Medicare began reimbursing for diabetic education programs, one began to see preliminary data regarding the importance of self-care in the older diabetic. The older diabetic who participates in an educational venue cost 14% less to care for than those who have not participated (Duncan et al., 2009). The Center for Medicare and Medicaid Services (CMS) cites the educated older diabetic uses more preventative services, yet they use fewer emergent services and have fewer complications (ADA, 2012a; Duncan et al., 2009; Robbins, Thatcher, Webb, & Valdermanis, 2008; Suhl & Bonsignore, 2006).

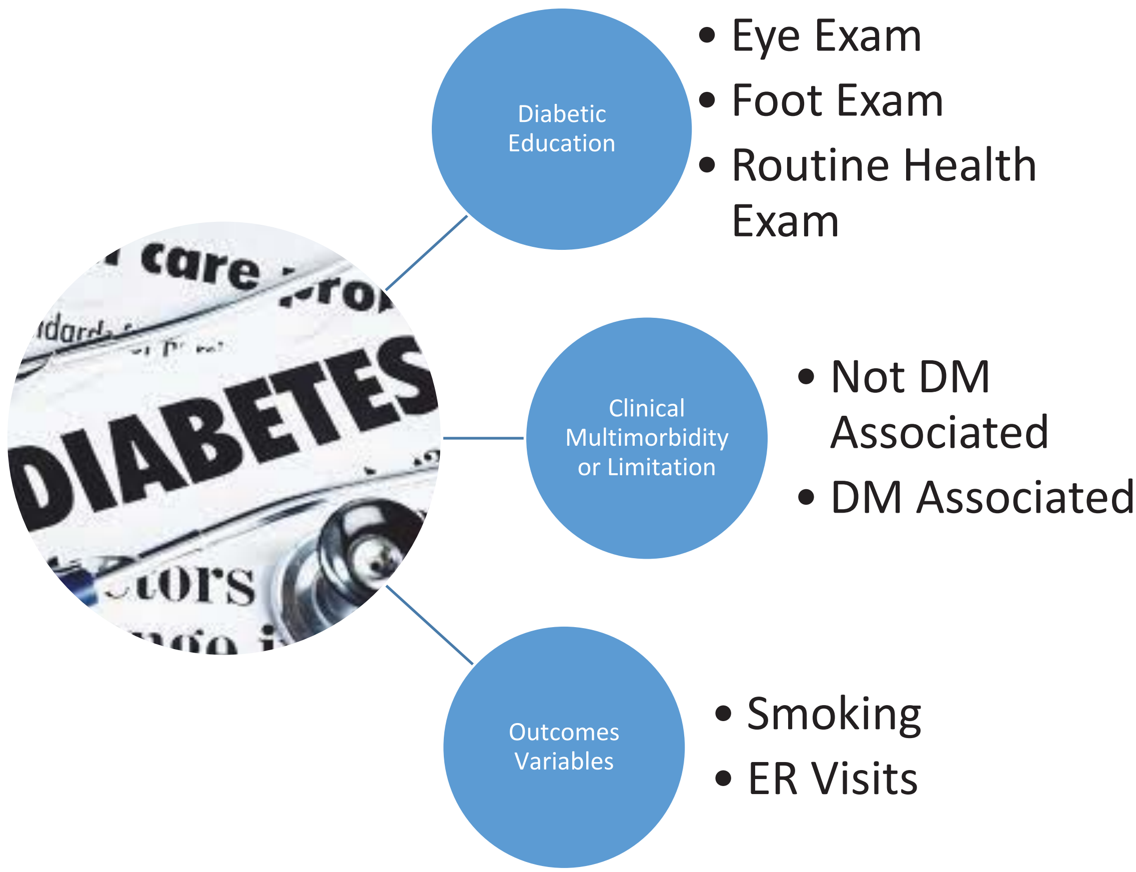

Figure 2. Considerations/variables assessed in diabetes management.

Statement of the Purpose

The purpose of this study was to explore the older American diabetic population. By exploring a decade of American diabetics from a population representative sample, what is the distribution of diabetes by age group, what is the frequency of clinical multi-morbidity/limitation, how common are self-care behaviors (these behaviors will be viewed as surrogate markers of education), and what correlations are present in the population—as it relates to self-care and outcome measures. The study hypothesis is education in the older diabetic correlates with more frequent self-care behaviors and improved clinical outcomes—such as fewer urgent care visits and nonsmoking status.

Research Questions

This study was designed to answer nine quantitative questions, six descriptive and three correlational:

Descriptive Questions

1. What is the estimated percentage of the U.S. population diagnosed with Type II diabetes?
2. What is the distribution of diabetes by age group in the U.S. population?
3. What percentage of the U.S. population reports a clinical comorbidity or clinical limitation?
4. What percentage of the diabetic U.S. population reports a clinical comorbidity or clinical limitation?
5. In the U.S. diabetic population that reports a clinical comorbidity or limitation, what percentage is attributed to the diabetic disease?
6. What percentage of the U.S. older diabetics report markers of diabetic education—annual visits to an eye doctor, visits to a foot doctor, visits for a routine health visit.

Correlational Questions

7. Is there an association between age and markers of surrogate diabetes education—visits to an eye doctor, visits to a foot doctor, routine health care visits?
8. Is there an association between age and Emergency Department visits in the diabetic population?
9. Is there an association between age and smoking status in the diabetic population?

Practice and Policy Significance

In this study, I generated information about prevalence and behavior patterns in a cohort of individuals aged 65 and older with diabetes. During the past 65 years, there have only been 26 studies published world-wide focusing upon the older diabetic. More research has been needed in this patient population to describe their behaviors, their blood sugar control, their participation in diabetic education, and clinical outcomes—as it relates to smoking, complications, use of health care services, and costs. This research project is the beginning step to quantify needed data to share with gerontological health care providers. Is this population exposed to the data needed to self-control their control metabolic illness, and if not, where is the deficiency? Most certainly, this is just an initial exploration, but the data is critical; as Americans are living longer, there will be a larger percentage of the older population with this life-changing chronic disease—diabetes mellitus (DM).

CHAPTER 2

LITERATURE REVIEW

The focus of this chapter is a presentation of the literature regarding older diabetics and self-care management. This chapter is broken down into three sections—the current status of diabetes, use of education as a treatment for the disease, and review of the literature as it relates to education of the older adult diabetic.

Current Status of Diabetes

1980-1989

As early as 1980, the literature cited data on the sequelae of uncontrolled diabetes. In 1980, in the state of Maine, in an audit of 898 diabetics, 16.5% had to be hospitalized secondary to lack of knowledge about their disease (Staff—MMWR, 1982). In 1986, the average prevalence of diabetes in those 60 years and older was 10-20%. These percentages had doubled since 1955 (Wilson, Anderson, & Kannel, 1986).

1990-1999

In the early 1990s, Fain (1991) documented the number of diabetics in the United States was doubling every 15 years because of increased longevity. Two years later, the results of the Diabetes Complications and Control Trial (DCCT) were released (CDDT Research Group, 1993). This multi-centered randomized controlled trial followed 1,441 Type I diabetics for 6.5 years. This study proved that intensive management of diabetes (compared to conventional control) effectively delays the onset and slows the progression of microvascular complications (DCCT Research Group, 1993). Although this study was monumental, the subjects were younger (average age 20 years). Experts could not speculate if these results could be extrapolated to older patients. A few years later, analysis of the NHIS database (Coonrod, Betschart, & Harris, 1994) and work published by Stam and Graham (1997) cited only 35% of adult diabetics had ever attended a diabetic education class after they were diagnosed with the disease.

In 1996, Nicolucci and colleagues in Perugia, Italy published a case controlled trial regarding risk factors for the development of diabetes complications. These researchers compared 886 adults with diabetic complications and 1,888 adults without complications. Thirty-nine percent of the subjects (*N* = 349) were 71 years of age or older; while 40% (*N* = 753) of those without complications were 71 years or older. Regression analysis was used to depict factors associated with development of diabetic complications. Male gender (OR 1.8; 95% CI, 1.4-2.3), age over 50 years (OR 1.7; 95% CI 1.2-2.4), and lack of a diabetes educational intervention (OR 4.1; 95% CI, 1.7-9.7) were all associated with increased risk of diabetic complications (Nicolucci et al., 1996). Diabetes duration did seem to have an effect on complications; those with the disease 10-20 years had a 45% increased risk of developing complications (Nicolucci et al., 1996).

In 1998, the United Kingdom Prospective Diabetes Study (UKPDS) was published (ADA, 1998a). This multi-centered randomized controlled trial followed 5,102 Type II diabetics (average age 54 years) for 10 years. This study showed for every 1% reduction in A1C, overall microvascular complications were reduced by 25% and risk of complications was reduced by 35%. Blood sugar reduction did not significantly reduce cardiovascular complications; however, it did decrease the risk of fatal and non-fatal myocardial infarctions by 16%. Blood pressure management reduced stroke, diabetes related deaths, blindness, heart failure, and microvascular complications (ADA, 1998b). These findings accentuated the need for the patient to become an expert manager of their disease in order to ensure longevity and good health.

In 1998, Rosenthal, Fajardo, Gilmore, Morley, and Naliboff noted seven million people over the age of 65 had diabetes, and that 40% of those 81 and older had the disease. Yet, there was only on prospective longitudinal trial assessing survival of older diabetics, and this study did not evaluate prognostic factors (Croxxson, Price, Burden, Jagger, & Burden, 1994). These researchers attempted to add to what was known about elderly diabetics. They followed 135 diabetic veterans, average age 70.4 years, for 36 months; this study group was compared to a similar group of veterans that did not have diabetes. Using multiple regression analysis, four factors were associated with death—poor diabetes control, coronary events, infection, and having a surgical intervention. Mortality rates from these factors seemed to be highest in diabetics over 75 years. This study further points to the need for diabetics to be experts in their disease management (Rosenthal et al., 1998).

2000-2009

Butler's work (2002) reminds U.S. that in the absence of disease and social problems, older adults tend to be productive and involved in life, including continuing to work. The ability to change and adapt has more to do with their character than their biological age. In 2002, 81% of those 65 years and older were fully ambulatory, live in the community, and they move about independently (Butler, 2002). Only 5% of those 65 and older were in a nursing home, chronic disease hospital, or other institution.

However, health care providers must consider the issues of morbidity in the older diabetic population. Cross sectional and longitudinal studies of older adults from the Health and Retirement Study (HRS) and the Study of Assets and Health Dynamics among the Oldest Old (AHEAD) followed subjects for two years (Wray, Ofstedal, Langa, & Blaum, 2005). These studies' results suggest diabetes is strongly linked to most types of disability—strength, mobility, personal and household maintenance, and incidence of falls (Wray et al., 2005). Sixty-three percent of diabetic women and 39% of diabetic men report disability in at least one physical task—walking one quarter of a mile, climbing stairs, or doing housework. If these numbers are applied to U.S. population estimates—near 71.2 million older Americans with diabetes cannot walk one fourth of a mile, climb stairs, or do housework (Gregg et al., 2000). These facts in isolation are a call to action for education and prevention.

Based on the 2001 Behavioral Risk Factor Surveillance System, since 1991 obesity prevalence has increased from 7.2% to 12%, and the prevalence of diabetes in U.S. has increased by 7.9% (Mokdad et al., 2003). Obesity is significantly linked with diabetes, hypertension, dyslipidemia, asthma, osteoarthritis, and fair to poor health (Mokdad et al., 2003). In 1994, only 44% of Type 2 diabetics in the U.S. were controlled; most recently (using NHANES 3 and NHANES 1999-2000) only 36% of U.S. Type II diabetics were under good glycemic control (Koro, Bowlin, Bourgeois, & Fedder, 2004). However, this data revealed that older patients had better blood sugar control than did younger counterparts (Koro et al., 2004). The National Health and Nutrition Examination Survey data for two years reported in 2002 showed 42.3% of all adult diabetics had an A1C of 7% or less; 14% had an A1C of 10% or more, while 1 in 5 diabetics (2.2 million) had an A1C > 9% (Saaddine et al., 2006).

According to CDC (2009) Diabetes Statistics – 2000-2008, 55.4% of those 18 and older that had been diagnosed with DM had ever attended a diabetes self-management class; only

62.2% of these individuals had ever undergone a dilated eye exam (CDC, 2009). The American Academy of Clinical Endocrinologists (AACE) in 2005 found similar alarming results (Tibbetts, 2006). They conducted a survey of 157,000 Type II diabetic adults. This survey revealed 61% of those surveyed did not know what an A1C blood test was (Tibbetts, 2006).

Patients must become experts in the management of their own condition—diabetics need to be engaged and play a key role in their management (Skovlund & Peyrot, 2005). Follow up data on a subset of patients in the original UKPDS was assessed. This prospective observation data followed 4,585 adults (average age 53) for 10 years. The study results further confirmed A1C reductions of 1% were associated with 21% RR for any diabetes endpoints (95% CI, 17-24%, $p < 0.00001$); 21% RR from deaths related to diabetes (95% CI, 15-27%; $p < 0.0001$); decrease of 14% RR for MI (95% CI, 8-21%, $p < 0.0001$), and a decrease of 37% RR for any microvascular complication (95% CI, 33-41%, $p < 0.00001$) (C. M. Clark et al., 2001; Stratton et al., 2000).

2010-2015

Based on systematic review of effectiveness and economic efficiency of disease management of Type II diabetes, it is the seventh leading cause of death in US—primarily secondary to CAD; diabetes increases the risk of stroke two to four times; 60-70% of diabetics will develop neuropathy (Norris et al., 2002b). In spite of an increased number of cases of diabetes, the percentage of some of its complications had declined. From 1988-2008, National Hospital Discharge Survey and NHIS data showed the percentage of change of lower extremity amputations fell from 11.2/1000 persons in 1996 to 3.9/1000 persons in 2008. Unfortunately, the lower extremity amputation rates remained highest amongst those aged 75 and older (Li, Burrows, Gregg, Albright, & Geiss, 2012).

Based on the latest data from CDC (2011), 26.9% of those 65 and older are diabetic; if A1C or fasting blood sugars were used to diagnose, then one third of older diabetics are undiagnosed. There is a marked lack of data for diabetes in the senior population; treatment decisions are often made with some uncertainty. When seniors are asked about their health care goals, most older diabetics focus upon functional status and independence. In addition to randomized controlled trials (RCT), we need more sophisticated observational or comparative effectiveness data from real life clinical settings (Kirkman et al., 2012).

In 2013, the World Health Organization (WHO) clinical trials registry was examined for Type II DM trials through July 31, 2011—440 trials were found, 65.7% (289 trials) excluded older adults (Cruz-Jentoft et al., 2013). Exclusions were due to comorbid illness (76.8%), polypharmacy (29.5%), or short life expectancy (8.9%). There were six trials specific for diabetes in those 65 and older (1.4% of diabetic clinical trials in WHO database), yet more than 20% of this population has the disease. Such exclusions limit the value of the evidence that clinicians have to use when they are treating older, more complex, and/or the frail older adults. Twenty-one percent of community dwelling adults 64 and older have diabetes. As life expectancy increases, the number of older diabetics is expected to rise; older adults and society should promote the idea that fair research includes the older adult (those 65 and older) as it will meet a societal need (Cruz-Jentoft et al., 2013).

Current Statistics

The epidemic of diabetes in the United States and worldwide continues to astound most health care providers. It was only in the late 1990s that organizations, such as the WHO and the CDC, began detailed record keeping on this health care issue. Some of the most important details will be summarized in this section. From a global perspective, there were 150 million diabetics worldwide in 2000. This number is expected to double by 2025. In industrialized nations, most new cases of Type II diabetes are in those aged 65 and older. Patients with diabetes are 2-4 times more likely to develop cardiovascular disease than are nondiabetics (International Diabetes Federation, 2001). Patients must become experts in the management of their own condition—diabetics need to be engaged and play a key role in their management. The WHO predicts if current trends continue, the number of folks with diabetes will double from 2005 to 2030 (176 to 370 million) (Skovlund & Peyrot, 2005). Other pertinent statistics are listed in tabular form.

U.S. Numbers and Percentages of Older Adults

- In 2000, 40% of all diabetics were 65 years or older (GSA & NAAS, 2011).
- Five years later, 50% of diabetics were 60 years of age or older; the overall prevalence is 25% in those 60-74 years based on CV Health Study of Older Americans (Blaum & Halter, 2005). At diagnosis, most seniors are high functioning and active—they should be treated with the same attention as the younger patient. Although many seniors have chronic conditions, as do their support systems, they may be retired and have ample time and knowledge base to handle diabetes self-management education perhaps, better than younger patients (Blaum & Halter, 2005).

- Projections of diagnosed cases of diabetes in the United States will increase 198% (from 16.2 million in 2005 to 48.3 million in 2050) (Narayan et al., 2006). The causes of the increase are obesity, aging of the population, and a longer life expectancy for diabetic patients (Virally et al., 2007)
- According to ADA (2008), there are 17.5 million cases of diabetes in the US; one million new cases are diagnosed every year; as of 2007, this number was 7.8% of the U.S. population—seventh leading cause of death on U.S. death certificates in U.S. (ADA, 2008)
- In 2010, 25.8 million people had diabetes (8.3% of U.S. population); 18.8 million were diagnosed; 7 million were not diagnosed. In the 65 and older aged group, there were 10.9 million diabetics; this number reflects 26.9% of the older U.S. population as having diabetes (CDC, 2011).
- As of 2013, 10% of adults in the United States have diabetes (1 out of 4 are unaware). According to NHANES, NHIS, Indian HS and 2012 U.S. resident population estimates, there are an estimated 29 million (8.1 million are undiagnosed) American adults with diabetes—a 3 million increase since 2010 (CDC, 2014a; Tucker, 2014)

Incidence

- Based on National Health Interview Survey (NHIS) data from 1997-2003 adults from aged 18 to 79 years were analyzed for diabetes. The incidence of self-reported diabetes increased 41% during these six years (from 4.9 to 6.9 cases per 1,000 population); in the 65-79-year-old group, this incidence increased 65% (10.2 cases per 1,000 population) (Geiss et al., 2006).

Prevalence

- The lowest rates of diabetes are in rural communities where people have lifestyles that are very active. Estimates are 6.3% (333 million) of all adults will have diabetes by 2025; currently in the US, the prevalence is 7.9% of North Americans—this prevalence is expected to be 9.7% in 2025—this percentage will equate to 147 million diabetes aged 60 and older by the year 2025 (Unwin, Whiting, Gan, Jacqmain, & Ghyoot, 2009).
- Data through 2010 revealed the prevalence of diabetes was seven times higher among those 65 and older, compared to those aged 20 to 44 years. Between 2007-2009, the prevalence in those 65 and older was 18.9% (CDC, 2012).
- Data from NHIS 2009-2001 and the National Nursing Home Survey 2004, the prevalence of diabetes increases with age; it is higher for men than women (Geiss et al., 2006); 13.4% of the Medicare population has been diagnosed with diabetes (ADA, 2013).

Costs

- In 2007, $174 billion was spent on diabetic complications. The six most common complications: a) coronary artery disease or stroke; b) hypertension; c) blindness or other ocular issues; d) renal disease; e) neurological disease, and f) lower extremity amputation (CDC, 2011).
- These costs have serious implications for U.S. health care spending. Based on 2007 data, $174 billion was spent on this disease (where prevalence was 8 cases per 1,000 people). If incidences decline while diabetes mortality increases the projection is there will be a 14% increase in diabetic cases by 2010 and a 21% increase in cases by 2050. If incidences continue to rise while diabetic mortality declines (which is current the

scenario), the projected increase in the number of cases is 14% in 2010 and 47% by 2050 (Boyle, Thompson, Gress, Barker, & Williamson, 2010). Such increases guarantee marked spending to care for these individuals.

- Based on information from national surveys, Medicare files, and commercial insurance databases, the United States spent $245 billion on diabetes in 2012. This amount was a 41% increase from the $174 billion spent in 2007 (ADA, 2013).
- The human cost of diabetes is marked. In 2007, normal life expectancy was 77.9 years (Xu et al., 2010). The Type II diabetic is expected to have five to seven fewer years to live. Diabetics have heart disease rates two-four times higher than nondiabetics; their stroke rate is two to four times higher; impotence may affect up to 50% of men with longstanding disease and 30% of Type II diabetes will develop chronic kidney disease (Roberts, 2006).

Diabetes Education as a Treatment

In 1959, Joslin stated,

> It is perfectly true that diabetes is a chronic disease. The important item is that it is susceptible to treatment. Effective treatment however, rests in the hands of the patient. . . . There is no disease in which an understanding by the patient of the methods of treatment avails as much. (p. 14)

Another expert in the field, Dolger, is noted to have said:

> The diabetic should know everything that can be known about his ailment, its history, nature, how it develops, the problem it creates and how it is treated. He should be able to distinguish medical fact from popular fancy, prejudice from sound practice. Knowing these things, he will be better able to cope with his disease every day of his life. (Dolger & Seeman, 1958, p. 23)

These two well-known endocrinologists fostered the idea that patient education is the mainstay of diabetic management. Joslin created the idea of diabetes teaching in 1929 at the

Massachusetts General Hospital (Maldonato, Bloise, Ceci, Fraticelli, & Fallucca, 1995). Margherita Lupenna organized courses for diabetes in Rome in 1953 (Maldonato et al., 1995). However, no organized diabetes self-management programs existed in the United States until 1980. In spite of this untimely delay in formalized programs, early data showed hospitalizations decreased after patient education, and the rate of amputations fell from 85% to 44% after diabetic education (Maldonato et al., 1995).

Before 1970, education was not recognized by the American Medical Association as an integral part of patient care. Yet, patient education for diabetes should begin at the time of diagnosis; education is part of how a diabetic survives, and it should continue throughout their life (Etzwiler, 1986). As early as 1977, Sehnert wrote about the “activated patient.” He described five steps in development of such a patient—“appropriate use of the health care system; heath partnership; observation/treatment methods; increased patient responsibility, and self-regulation” (Sehnert, 1977, p. 43). A few years later, Anderson (1982) reminded the U.S. that diabetes is an intruder into a person’s life, and the person with the disease should be the central team member, as the patient has to live with the magnitude of its consequences and therapies.

As of 1983, there were few studies to evaluate education as a treatment for diabetes. Berger and Jörgens (1983) point out that when diabetic patients are educated, the long term effects of the disease should be evaluated—metabolic control (A1C, DKA, hypoglycemia) and complications (hospitalizations, diabetic foot disease), not just a change in knowledge (Assal, Jacquemet, & Morel, 1997). True efficacy of the program should be assessed by its effect on incidence of complications (Maldonato et al., 1995).

When diabetic education is considered, the question is whether it should be done in a group setting or in individual meetings with a single patient. Assal et al.'s (1985) research points to some advantages of group diabetic education—more patients can be taught at the same time and an interaction process occurs between the patients. These researchers found that in matched pairs of older adults, those that had participated in group diabetic teaching programs did eat out more often and did entertain friends at home more often compared to those who had not participated in group education ($p < 0.005$).

Barriers to diabetic education are often noted in the literature. The patient's ability to learn and assume an active role in their health may be an asset or a barrier. The health care provider's willingness to motivate their patients and the issue of how to best use a health care team, group sessions versus individual interactions, are arenas that must be focused upon. All three of these issues may interfere with successful diabetic self-management programs (Assal et al., 1985). Another obstacle in educating diabetics is the chronicity of the illness. The patient is told if they perform certain tasks for the next one to two decades, then they will not get a complication; there is no reward in the moment for taking care of themselves (Etzwiler, 1997).

When a patient is diagnosed with diabetes, their attitude about what is normal must change. This new level of normalcy is a desired outcome of diabetes education; it is enhanced by group interaction (Dunn, 1986). In the mid-1980s, the American Diabetes Association endorsed third party payment for outpatient diabetes education and nutritional counseling as part of the diabetic treatment regimen (Kaplan & Davis, 1986). The focus should be on activating the patient and to improve their autonomy in disease management, not to just know more about their disease (Assal, 1988).

According to Carter, McKenna, Martin, and Andresen (1989), education of the older diabetic should be defined as something that improves functional independence while decreasing the chance of dependence. Lessons that have come from drug adherence literature that can be applied to the older diabetic population: a) group discussion and self-monitoring will increase adherence and change behaviors and b) keep the educational session simple.

As of 1991, there was little empirical data on how best to manage chronic disease in the older adult. Ashworth, Longmate, and Morrison's (1992) work suggests that involving the patient in their own care leads to greater efficacy of the education. Self-observation, self-evaluation, and self-reaction are avenues that assist patients in dealing with complex environments and developing effective problem resolution (Clark et al., 1991). Work done by Vijan, Hofer, and Hayward (1997) revealed older diabetics may benefit less from intensive glycemic control when compared to younger adults; however, the short term risks and the benefits of education seen in the older patient are appreciable. In fact, older patients have benefits that are equal too, or greater than, the benefits gained in the younger adult (Vijan et al., 1997).

Studies done by Clement (1995) and Levetan and Ratner (1995) cited many missed opportunities. These authors found 50% of diabetics receive limited or no diabetic self-management education; 76% of Type II diabetics have never even attended one education class.

By 1995, there were several nonrandomized controlled trials and short-term randomized trials of diabetes self-management programs. Some important information that was evident from these studies: a) diabetes knowledge is necessary but not reason enough to ensure change in behaviors, such as glycemic control, weight loss, self-monitoring; b) programs that do not include follow up education are less likely to promote long term success; c) structured education and treatment programs that combine education and behavioral change strategies improve blood sugar control—regardless of how the patient chooses to monitor, and d) older adults are avid learners and they are able to make lifestyle changes; peer support, encouragement to attend, and participation from the patient's significant other does increase learning (Clement, 1995).

In addition, Clement (1995) evaluated 14 older hospital based studies, using historical controls. Clement reported a 19% to 87% reduction in hospital admissions after the adult diabetics received either diabetes education or self-management education. More current studies of hospitalization rates of older adults link it closely with glycemic control. Each 1% rise in the glycosylated hemoglobin increases risk of hospitalization (OR 1.16; 95% CI; 1.06-1.29); while lowering the A1C by 1% reduces hospitalization rate by 14-20%. If this reduction is annualized, it could save as much as $4-5 billion in health care costs annually (Moss, Klein, & Klein, 1999).

By 2000, more data was known about older diabetics in the United States. Sixty percent of these individuals have another chronic disease (Charman, 2000). Group consultations with older adults have found that these patients were more satisfied, more current in preventative care, and used health care services less often than comparison patients (Beck, Jackson, Gade, and St. Cowan, 1997). Effective educational interventions tend to focus upon acquiring new skills (Wagner, 2000), less emphasis should be placed on didactic information; the priority should be assisting the learner interact with the material and peers in a group fashion (Day, 2000). When patients develop confidence to enact an effect behavior, they are developing self-efficacy (Clark & Gong, 2000).

In 2003, the California Healthcare Foundation (CHF) and the American Geriatric Society (AGS) Panel on Improving Care for Elders with Diabetes published evidence based recommendations for diabetics aged 65 and older. Randomized controlled trials have shown that multidisciplinary group interventions related to the disease, medications, self-monitoring of blood sugars, and signs and symptoms of low and high glucoses does improve long term glycemic control. The guidelines suggest teaching and observing older diabetics as they monitor themselves (CHF/AGS, 2003). Other researchers reiterate that group education is less about the group and more about engaging the patient, so they can change behaviors (Mensing & Norris, 2003). In the older population, compliance with new behaviors and monitoring is inversely related to the number and magnitude of the changes that the patient must make (Golay, Bloise, & Maldonato, 2003).

Two reviews assessed the effectiveness of education as a treatment for diabetes. Norris et al. (2001) appraised 72 studies in the first review between 1980 and 1999. Finding a representative sample in the older population is difficult (Forbes, Berry, While, Hitman, & Sinclair, 2002), as only six of the studies in the Norris et al. (2001) review contained older adults. The meta-analysis showed diabetes self-management that involved patient collaboration, group work, and modeling increased self-efficacy, which was most effective in glycemic control (Norris et al., 2001). Two of the senior focused studies found education strategies that focused on individual needs and self-efficacy were most effective (Padgett, Mumford, Hynes, & Carter, 1988; Wagner, Austin, & Von Korgg, 1996).

The second analysis, conducted in the United Kingdom, reviewed six randomized controlled trials and two case controlled trials (National Institute for Clinical Excellence [NICE], 2003). This review found general diabetic education has a limited impact on clinical outcomes; however, the effect of diabetic education on A1C is more evident with longer duration of education given with shorter follow up intervals (NICE, 2003).

Researchers at the University of Chicago found older adults describe health care goals in functional terms, not biomedical ones; their goals related to daily life events, not specific diabetes care (Huang, Basu, O-Grady, & Capretta, 2009). In the 75 years and older that were queried, they desired independence in their daily activities as their highest health priority. In terms of diabetes self-care, the older patients focused upon self-monitoring of blood sugar and taking medications; they did not devote significant time to exercise or their dietary regimen (Huang et al., 2005).

In 2001, the Center for Medicare and Medicaid Services (CMS) began paying for Medicare patients to attend group diabetes education programs and medical nutritional visits; in spite of this reimbursement, 60% of diabetics in this age group get little or no diabetes education (Beaser et al., 2005). Those Medicare patients who get diabetes management education cost 14% less ($p < 0.0001$) than those Medicare patients who did not attend education (Duncan et al., 2009). Diabetes education is associated with increased use of primary and preventative services but decreased use of acute, inpatient hospital services (ADA, 2012b; Duncan et al., 2009; Robbins et al., 2008). Those without education have a four-fold increased risk of major complications (Suhl & Bonsignore, 2006). In spite of the data that is known about education as a treatment in the older diabetic population, the older patient is still under-represented in diabetes education research (Suhl & Bonsignore, 2006; Tang, Funnell, & Anderson, 2006).

Two meta-analyses have been published in the area of education as treatment for diabetes. The first study, published by Hill-Briggs and Gemmell (2007) reviewed RCT done from 1990-2007. The important findings were: a) only 50% of the adult studies showed a decrease in A1C and b) self-management outcomes in older adults do markedly improve after self-management education.

Loveman et al. (2008) in the second analysis examined 13 published education studies between 2002 and 2007. These researchers found education delivered by a team in a group environment provided more opportunity for improved outcomes. Because the natural evolution of the disease is that control worsens over time, it is imperative to increase the patient's self-efficacy for their own monitoring of blood sugar, weight, blood pressure, exercise, and other self-care activities (Loveman et al., 2008). The researchers remind providers that patients in these studies to some degree are self-selected, as they opt for diabetes self-management education versus those who do not; in addition, usual care (which is what the control group received) is not clearly defined in any of these studies (Loveman et al., 2008).

In conclusion, diabetes self-management education has evolved from didactic presentations to theory based self-efficacy that encourages the patient to be activated and empowered (Funnell et al., 2012). In addition, there is not one best educational approach as long as behavioral strategies that are age appropriate are carried out in a group format (whenever possible) and demonstrate improved outcomes. The patient required ongoing assessment and support to sustain their role as a disease manager (Funnell et al., 2012).

Theoretical Underpinnings of Education as Self-Treatment

Upon review of the literature related to chronic disease education, many theoretical models were cited. The two models that appeared most applicable to diabetes were the health belief model (Rosenstock, Stretcher, & Becker, 1988) and Bandura's (1982) self-efficacy model. The health belief model suggests that in order for a patient to be interested in learning about their illness and committed to being active managers of their illness, they must view their disease as a threat. The patient must believe they are at risk for complications, the complications are serious, and the complications could be controlled or prevented by prudent self-care behaviors (Rosenstock et al., 1988). The social and monetary costs of the treatment or the behaviors should be less than the benefit that the diabetic will obtain from their behavior changes in order for the patient to be interested in persevering (Assal et al., 1997).

Although, the health belief model seems applicable to diabetes education, researchers and educators have written multiple times that knowing what needs to be done and the reward that will follow does not mean that behavior change will happen. The premise of self-efficacy is the actual execution of a behavior, not the underlying basis for it. According to Weinberg, Gould, and Jackson (1979), self-efficacy is the strength of one's conviction that he or she can successfully carry out a behavior required to produce a certain outcome. Perceived self-efficacy does not discount skill level or motivation. Self-efficacy asserts that actual performance will be determined by the person's belief in their own competence. Self-efficacy is not a personality trait or a person's self-esteem (Lawrence & McLeroy, 1986; Weinberg et al., 1979). Self-esteem focuses on feelings of self-worth, while self-efficacy focuses upon performance (Lawrence &

McLeroy, 1986). Self-efficacy expectations may change, depending upon the situation, the task, and previous experiences. Efficacy expectations can be modified (Bandura, 1982).

Levels of self-efficacy can be modified from four sources: a) accomplished performances; b) vicarious experiences; c) verbal persuasion, and d) emotional or physical states (Bandura, 1982; Lawrence & McLeroy, 1986). The first source is the most powerful; when a person successfully accomplishes a behavior, it markedly increases their level of self-efficacy (Bandura, 1982). Vicarious experiences may also increase self-efficacy. When a person sees similar others perform a task or behavior successfully, it may foster feelings in the observer that they too may have those same capabilities (Bandura, 1982). The third source, verbal persuasion is convincing the patient that they can do a task by telling them that they are capable and qualified to complete it (Lawrence & McLeroy, 1986). And the last source of self-efficacy modification is the patient's emotional and/or physical state. The patient's perceived strength, vulnerability, anxiety, or their perceived lack of may affect their ability to perform a behavior or task (Bandura, 1982; Lawrence & McLeroy, 1986). This theoretical foundation and the modifying sources seem applicable to the skills based behaviors that are needed in diabetic self-management (Kingery & Glasgow, 1989).

As mentioned, people often know full well what to do, but they often do not behave in a beneficial manner. When faced with difficulties, patients who possess serious doubts about their capabilities slack off on efforts or give up. Those with a strong sense of self-efficacy exert more effort to master challenges. If during task completion a person discovers something that intimidates or suggests limitations to their mode of coping, they experience a decline in self-efficacy, despite their successful performance (Bandura, 1982). If self-efficacy is lacking, people tend to behave ineffectively, even though they know what to do. Mastering problem scenarios strengthens self-efficacy. The strength of group interactions is an increase in self-efficacy of the group's membership (Bandura, 1982). The concept of self-efficacy can be related to health beliefs about capabilities of performing specific behaviors in particular situations. Self-efficacy also affects the amount of effort a patient will expend on a task and the length of persistence. Patients may attempt to develop self-efficacy in activities that give them a sense of self-worth (Stretcher, DeVellis, Becker, & Rosenstock, 1986). A person's self-efficacy influences motivation, initiation, participation, and adherence to self-management, and it can affect control of diabetes (Po, 2000). Where a health practice is believed to lead to desired consequences but the change is difficult, self-efficacy is paramount. The strength of self-efficacy is the direct applicability to the practice of changing health behaviors (Stretcher et al., 1986). By observing others, a patient can form a concept of how new behaviors are performed. The strength of a person's convictions in their own effectiveness is likely to affect whether they will even try to cope with the situation or circumstance (Bandura, 1977).

In diabetes self-management, the goal is to enhance active involvement of the patient to become partners in their health care. There is no correlation between age and educational outcomes. In a self-efficacy model providers work as partners with their patients; the desired outcome is to develop a patient that is an expert (Cooper & Gill, 2003).

Primary care providers are experts in the disease of diabetes, but the patients are the experts regarding their own lives (Jack, Airhihenbuwa, Namegeyo-Funa, Owens, & Vinicor, 2004). The primary characteristics of successful self-efficacy strategies for people with chronic disease includes: collaboration, active participation, and small group (and in some scenarios individual) intervention approaches (Marks, Allegrante, & Lorig, 2005). Variations that can affect a person's confidence or ability to carry out self-management are important; one of these variables is self-efficacy (Glasgow et al., 1999). Group dynamics is another variation. Group discussion increases participatory learning; groups allow patients an opportunity to learn from others. In individual therapies, the patient may not understand the complexity of the disease, and they may become dependent upon the expert's knowledge, which does not allow the patient to see an association between their lifestyle habits and their symptoms (Adolfsson, Starin, Smide, & Wikblad, 2008).

Diabetes self-management research has proven that education is this arena has been effective. Optimal treatment requires patients to adopt often complex medical regimens and lifestyle changes. Self-efficacy provides a useful framework to understand and predict adherence to self-care in a medical regimen (Via & Salyer, 1999). The goals of diabetes treatment and education are optimal metabolic control, prevent acute and chronic complications, improve quality of life, and keep the costs acceptable. Health care providers must offer the diabetic the chance to live their lives as normal as possible. The aim of diabetes education is to establish active self-care behaviors. Self-efficacy theory seems most applicable (De Weerdt, Visser, & Van der Veen, 1989). The literature regarding self-efficacy was so predictive of self-care that interventions to increase diabetes self-efficacy and measure such behaviors should be evaluated. Self-efficacy allows patients to make the most of their skills; when people believe they can master something, they will devote the necessary effort to succeed (Hurley & Shea, 1992).

Education programs to increase self-care should focus on fostering self-efficacy, providing opportunities to perform successfully, and learning vicariously through modeling (Aljasem, Peyrot, Wissow, & Rubin, 2001). An attractive feature of self-efficacy is the person's efficacy expectations can be increased to promote beneficial change in health behaviors. Regarding older adults, they generally underestimate their competencies; self-efficacy and outcome expectations do not decrease with age (Grembowski et al., 1993). Diabetics should not be threatened by what they may lose; they should be challenged by what they could gain (Schwarzer & Fuchs, 1995).

In 1999, a self-efficacy tool for diabetes was published (Van der Bijl et al., 1999). The internal consistency of the total scale was alpha = 0.81 and the test-retest reliability with a five-week time interval was $r = 0.79$ ($p < 0.001$). This tool was developed at Stanford University; it assesses diet, exercise, self-monitoring of blood sugar, and visiting the health care provider (van der Bijl et al., 1999). In a study published the next year, Senécal, Nouwen, and White (2000) found self-efficacy was associated with self-reported adherence to self-care activities ($\beta = .54$) and with life satisfaction ($\beta = .15$). Self-efficacy was more significantly associated with adherence than self-autonomous regulation of behaviors (Senécal et al., 2000).

Self-efficacy may be the mediating link between knowledge and skill and actual task engagement. In a study done with 97 Hispanics (median age 60) with a 13-year history of having diabetes, Bernall, Woolley, Schensul and Dickinson (2000) found that having services from home health care was associated with an increased sense of general self-efficacy and having attended diabetic classes was associated with increased dietary self-efficacy. The presence of diabetic complications in this study was associated with a decreased sense of self-efficacy (Bernall et al., 2000). The measurement of self-efficacy should be matched to behaviors in question, rather than a general measure of self-efficacy. It should be domain specific (Holloway & Watson, 2002).

Self-efficacy is linked strongly to behavior performance. Measures of self-efficacy can be the relevant behaviors, such as: a) self-monitoring of blood sugars; b) reduction of A1C; c) hospitalization rates and the like (Lawrence & McLeroy, 1986). The greatest effect of participatory education programs in RCT thus far have been in short-term follow up (Adolfsson, Walker, Engström, Smide, & Wikblad, 2006). Self-efficacy has not been studied in older patients (Clark & Dodge, 1999). It is not known what level of self-efficacy is associated with the best diabetes management, just that patients who have repeatedly demonstrated self-efficacy appear to have higher levels of self-efficacy (Corbett, 1999). Studies are needed to assess levels of success in group education of older diabetics. This theoretical foundation to assess diabetic self-management seems like a reasonable venue to assess older Americans.

Review of Clinical Trials

Review of literature was done using the scientific databases (medical/nursing/education and allied health) that were available from their inception in the early 1960s through 2015. I reviewed studies by decade in Type II diabetics over the age of 60. The studies cited in this review will be those using group based structured education. Studies on younger patients, those with Type I diabetes and those that did not use group based teaching methods were excluded.

1960-1969

One small inpatient study of adult diabetics was done during this decade (Bowen, Rich and Schlotfeldt, 1961). It used a small sample ($N = 51$). These diabetics were under poor control, and they had a history of infections. A control group of 28 was compared to the treatment group of 23 that received education by registered nurses. Although the treatment group increased their knowledge of diabetes, medications, and self- care, there was no statistical difference between the groups. In fact, the control group showed better blood sugar control than those that received education. The study did not cite the average age of the study subjects, it just stated they were adults (Bowen et al., 1961).

1970-1979

During the next 10 years, there were no studies using education with adults 60 years and older. The literature review revealed one study that was somewhat applicable. Whitehouse, Whitehouse, Smith, and Hohl (1979) conducted this study at the Henry Ford Hospital in Detroit, Michigan. These researchers followed 371 adults for five years after they had completed a formal diabetes education program. Of the 371 that completed the education, 178 of them opted for follow up assessments, which included annual education follow-up visits. At the end of the five-year surveillance period, the researchers found regardless of the length of follow up ($N = 88$, 5 years of follow up; $N = 90$, 1-2 years of follow up), there was no significant difference in the groups. Those with shorter follow up had a higher hospitalization rate ($p < 0.01$), yet the group with longer follow up still had hospital readmissions for education related reasons—elevated blood sugars, foot infections and hypoglycemia.

1980-1989

The decade of the eighties revealed nine studies that evaluated Type II diabetics 60 years of age and older that received diabetes education. In the first study, Nelson et al. (1984) compared 13 sessions of diabetes group education to a lecture that consisted of 2 hours of information related to diabetes. In this study, the *N* = 330, with 126 patients in the control group and 204 in the treatment group. The average age of the patients was 71 years.

Nelson et al.'s (1984) study revealed both groups showed substantial improvements in knowledge, performing diabetes skills—glucose evaluation, foot exams, and in lifestyle behaviors—meal planning and exercise. These improvements remained one year after the study concluded.

In Sweden, Falkenberg, Elwing, Göransson, Hellstand, and Riis (1986) conducted a population based study of diabetics. These researchers compared group diabetes education over a 90-day period to a didactic lecture on diabetes self-management. Participants were between the ages of 55-73 years of age. Although this study was small in size (*N* = 45), it revealed statistically significant improvement in knowledge and hemoglobin A1C (A1C) in the group education group.

In another small study done at the Tucson VA Medical Center, White, Canahan, Nugent, Iwaoka, and Dodson (1986) studied Type II diabetics for six months. The study included 41 patients—the treatment group was comprised of 20 subjects (average age 62), while the control group was comprised of 21 subjects (average age 60.7). In this study, group education was compared to usual care for diabetics in an outpatient setting. In the treatment group, the A1C decreased to a statistically significant degree (10.9 % +/- 3.1% down to 9.4% +/- 2.4%)

where $p < .05$. Knowledge did significantly increase in both groups, yet this knowledge change did not correlate with change in A1C.

In 1987, Wilson and Pratt studied 79 older adults with Type II diabetes. The average age of the subjects was 68.2 years. These patients were randomly assigned to diabetic education in a didactic format, diabetes education groups with peer support or no specific treatment. The subjects resided in rural Oregon communities. The study revealed only the group education with peer support showed significant decrease in weight and A1C. The other groups had no significant change in any diabetic parameter.

In a second Swedish study, Rosenqvist, Carlson, and Luff (1988) followed 196 older diabetic patients. The treatment group (*N* = 76; average age 64 years) received four 30-minute education sessions over 2-3 weeks, while the control group (*N* = 120; average age 67.5) received usual care at their community based clinic. These subjects were followed longitudinally for four years. There was no change in A1C in either group.

An impressive study done in Germany, followed in the latter part of 1988 (Kronsbein et al., 1988). These researchers followed 99 adult Type II diabetics for one year. The research protocol compared a structured treatment and teaching program (four group sessions) to usual clinic care in the German national health system. The treatment group (*N* = 50; average age 65) showed significant improvement compared to the controls (*N* = 49; average age 63).

At the end of one year, those receiving the group sessions, decreased their use of sulfonylureas by 30% (95% CI, 16-44%); lost an average of 2.7 kg (95% CI, 1.6-3.8 kg), non-fasting triglycerides declined by 77 mg/dL (95% CI, 35-119 mg/dL); however, there was no change in the A1C in the treatment group (Kronsbein et al., 1988). The control group showed no such changes, in fact, 10% in the control group had to start insulin.

In 1989, Malone, Snyder, Anderson, Bernhard, Holloway, and Bunt conducted a second study at the Tucson VA Medical Center. This study was a randomized control trial of Type II diabetics (average age not cited). The research question was whether group education had an effect on the incidence of lower extremity amputation. For two years, the researchers followed 203 veterans (CG = 100 patients; TG = 103 patients). After the educational intervention (the control group received usual care in the Tuscon VA diabetes clinic), these veterans were followed for two years. Statistical analyses revealed the amputation rate was three times higher in the control group (p < /= 0.025); the foot ulcer rate was three times higher in the control group (p < /= 0.005). These findings correlate with a 67% decrease in the incidence of amputations in the group that received education.

Chuang, Lin, Wu, Chen, and Tai (1989) conducted a study in Taiwan of diabetic men and woman (average age 60 years in control group; 61.6 in treatment group) assessed the effect of community based diabetic group education on knowledge and metabolic control. The educational cohort was compared to individual office care with a medical provider, without any group education. At the one and two year follow up assessments, there was no statistical change in the control group.

However, the treatment group showed increased knowledge scores that persisted at one and two years; the body weight was statistically lower at both 1 and 2 years. The decrease in the A1C was significant at both one and two years post study—7.47% (+/- 1.8%) declined to 7.23 (+/- 1.68%) and 6.88% (+/- 1.3%) respectively (Chuang et al., 1989).

1990-1999

In the next decade, there were seven studies that evaluated group diabetic education in older adults. In Perth, Australia, Gough, McCann, and Stark (1990) studied veterans older than 65 years (N = 51). All of the patients were given 2.5 hours of diabetic education (in groups of 7-10 individuals) every week for three weeks. The patients were assessed for weight, height, BMI, A1C, and diabetes knowledge at baseline and at 12 weeks. Although most of the study subjects had received some individual diabetic education, at the 12-week point, diabetic knowledge had increased ($p = 0.001$); in those that were obese, weight had decreased ($p = 0.009$) and A1C had decreased in all patients (0.2%-.88%) (Gough et al., 1990).

Glasgow, Toobert, and Hampson (1991) studied 102 diabetics over the age of 60 years. This randomized controlled trial was designed in a wait list design—where the subjects received group diabetic education intervention as soon as the study commenced or after a delay period. Eighty-eight percent of the subjects in this study had other medical co-morbidities—mainly hypertension and/or osteoarthritis. The subjects were evaluated on dietary patterns, exercise patterns, care, and self-monitoring of blood glucose. The immediate intervention group showed a decrease in the intake of calories and fat, decreased weight, and increased monitoring of blood sugars. These findings were statistically significant when compared to the controls. When the control group then received the intervention, they also showed improvement in the aforementioned parameters (weight decreased on average from 188 pounds to 182.2 pounds; A1C decreased from 6.8% to 6.3%; both with a $p < 0.05$). Glasgow et al. (1991) concluded older adults with diabetes can make lifestyle changes if they are provided with support.

After their study was complete, Glasgow et al. (1992) conducted a secondary analysis. This analysis was to evaluate who participated versus who chose not to participate. These researchers found age was inversely related to participation; duration of disease, use of medications, and history of previous education had no effect on participation.

In 1993, Redhead, Hussain, Golding, and McCullough compared diabetes knowledge and control in older diabetics (mean age = 63 years). In this study, the treatment group ($N = 141$) received five sessions of structured education in groups of 10-12 subjects. These classes were 60-90 minutes long and occurred approximately once per week. These subjects were compared to patients who received their diabetic care in the community hospital diabetes clinic ($N = 17$). At the 6-month mark, both groups had significant increase in knowledge, but only the treatment group showed a change in diabetes control (A1C decreased from 10.7% to 9.6%; $p < 0.01$).

Later in 1993, Gruesser, Bott, Ellermann, Krosbein, and Joergens published the results of their community based randomized controlled study of group education in older adults. The researchers evaluated the effects of four weekly education sessions (90-120 minutes in duration for groups of 4-10 subjects). Gruesser et al. evaluated the 179 participants five months after the educational intervention. Body weight and BMI had decreased (average weight 80.3 kg down to 77.5 kg; average BMI fell from 28.4 to 24.4 kg/m2). These reductions were statistically significant at $p < 0.0001$; these reductions enabled patients and providers to use 50% less oral medication to control the diabetes.

Diabetes control improved significantly (average A1C fell from 8.11% to 7.47%; $p < 0.0001$). This improvement reduced the number of patients requiring oral medications from 63% (before intervention) to 42% after the group education ($p < 0.0001$).

Three years later, in Havana, Cuba, Garcia and Suárez (1996) published the results of their five-year interactive educational study. This study enrolled 148 Type II diabetics to receive 60 monthly scheduled educational sessions of 90-120 minutes (average age = 72 years). The subjects were compared before and after the 60 months of education sessions. There were fewer diabetes related emergency services and hospital admissions in this group after the intervention. There were statistically significant improvements in diabetes knowledge and self-care skills ($p < 0.001$; significant reduction in weight ($p < 0.01$), and A1C (average pre-treatment A1C 12.4% declined to an average of 7.9% post-treatment; $p < 0.02$).

Lazano and Armalé (1999) followed 243 Type II diabetics after an education intervention in a study of Spanish diabetics. The researchers described a randomized control trial of older diabetics (average age 64 years) where 123 of the participants received educational classes (in a group format) and ordinary diabetic care while the control group ($N = 120$) received ordinary diabetic care. The study showed no significant change in BMI for either group. Diabetic control improved in the education group (A1C was reduced by 0.3%, which was statistically significant, $p < 0.005$). The researchers cited that although the educational effect was significant, it does wane over time. Lazano and Armalé (1999) suggested annual education updates to help maintain the positive effects.

Ridgeway et al. (1999) conducted a small randomized controlled trial of 38 Type II diabetics (controls = 20, average age 65 years; treatment group = 18, average age 62 years).

The treatment subjects received six months of structured group classes in a health care provider's office, while the control group received usual care in an office setting. Three months after the intervention, the treatment group had a significant decline in average weight ($p < 0.0166$). Six months after the intervention, both groups had a significant reduction in A1C (control group $p < 0.0123$; treatment group $p < 0.0034$). The treatment group also derived a statistically significant reduction in fasting blood sugar ($p < 0.0244$) and total cholesterol ($p < 0.0129$).

2000-2009

In the next 10 years, seven studies and three meta-analyses were published related to diabetes education in the aged. Consistent with earlier decades, few of these studies were limited to only those that were 65 or older; however, studies with an average age of 60 or greater were included.

In 2002, Raji, Gomes, Beard, Macdonald, and Conlin followed 156 Type II diabetics, average age 60 years, for 12 months. These researchers compared two different methods of diabetic education with a control group who did not receive any education, but were followed with diagnostic laboratory parameters. The intensive education group received 3.5 days of a structured diabetic curriculum in a group setting; the passive education group received diabetic materials in the mail every 90 days while the control group received nothing. All three groups continued medical care with their diabetes provider at baseline, three, six, and 12 months. Upon conclusion of the study, both treatment groups had a statistically significant reduction in A1C—near 2% ($p < .001$). There was no significant difference between treatment groups at any evaluation period. It was interesting to note that even the control group had some improvement in diabetes control (A1C decreased 1.2%); however, this change was not statistically relevant.

Two years later, Maislos and Weisman (2004) completed a six month randomized controlled trial using interactive education with 82 poorly controlled older (average age 63 years) diabetics. In this study, the treatment subjects received interactive group diabetic education while the control group received their usual diabetic care. The baseline diabetic control was poor in both groups with the average A1C being >10%. Upon completion of the six-month study, patients in the treatment group had an average reduction of 1.8% in their A1C, which was statistically significant (p = 0.00001). The control group showed no change in the control of their diabetes. Although the treatment did not bring the diabetes control into the normal range, the improvement will have marked positive benefits. As the aforementioned data cited, a 1% reduction in A1C is consistent with a 21% reduction in risk of any diabetic complication (Stratton et al., 2000).

Goudswaard, Stok, Zuithoff, De Valk, and Rutten (2004) followed 54 patients aged 39 to 75 years (average age 60.5 years) for 18 months in a second study in 2004. This randomized controlled trial assessed uncontrolled Type II diabetics on maximum medical therapy. The intervention group of 24 subjects (average age 62.6 years) received group diabetic education from a registered nurse for six months, while the treatment group of 25 individuals (average age 58.2 years) continued with usual care with their medical provider. Six weeks after the intervention, both groups showed an improvement in diabetes control. Average A1C had declined in the treatment group from 8.2% to 7.2% and those in the control group had an average reduction of .4% (from 8.8% to 8.4%); these numbers reflected 95% CI 0.1, 1.4.

An interesting finding of Goudswaard et al.'s (2004) study was 60% of the treatment group achieved an A1C of 7% or less and 17% of the control group achieved this same normal result ($p < 0.01$). However, 18 months after conclusion of the study, there was no significant difference in the two groups. From this study, it appears education is helpful for older Type II diabetics, but one year after the last education session, most of the effects have waned. This deterioration of treatment effect is similar to what was described by Norris et al. (2002a) in the meta-analyses done earlier in this decade. These meta-analyses were not cited here as these researchers reviewed all educational trials of diabetics, the majority of which were in younger individuals.

In the latter part of 2004, Trento et al. published the final results of a five year randomized controlled trial of 112 older diabetics (average age 61 years). This multi-year study followed two groups of patients and assessed status at one, two, and five years. The treatment group ($N = 56$) received group education visits throughout the duration of the study window; the control group ($N = 56$) was seen every 90 days, or more often if they experienced a diabetic problem, in the diabetes clinic at the University Hospital in Tunn, Italy. Both groups had been diagnosed with diabetes an average of 4.8 years prior to beginning the study. At the one-year mark, diabetic knowledge and use of problem solving behaviors had increased in the treatment group, but it had decreased in the control group ($p < 0.001$) (Trento et al., 2001).

At the two-year assessment, quality of life scores had improved in the treatment group while declining in the control group ($p < 0.001$) (Trento et al., 2004). Diabetes control was unchanged in the treatment group (A1C had declined, on average .3%), but it had deteriorated in the control group (A1C increased on average 1.36%) which was statistically significant (p <

.001). Retinopathy had progressed less in the treatment group (*p* < .009). Body weight and BMI had significantly improved (*p* < .001); in addition, HDL cholesterol had improved (*p* < .001); there was no change in the control group regarding weight, BMI, or HDL cholesterol. Upon secondarily analysis, only A1C remained significantly improved at this assessment when the researchers controlled for age, duration of illness, and educational level (Trento et al., 2002).

At the five-year evaluation, diabetic control had remained stable in the treatment group (A1C had increased an average of .1%; 95% CI, -.5% - .4%) but it had deteriorated in the control group (average increase in A1C of 1.7%; 95% CI, 1.1% - 2.2%); the average BMI had decreased in the treatment group by 1.4 kg/m2 (95% CI, -2 to -7). In addition, the treatment group showed an average increase in the high density lipoprotein level (HDL or good cholesterol) of 0.14 mmol/L (95% CI; 0.7 to .22) (Trento et al., 2004).

In multi-variant analysis, this multi-year RCT of older Type II diabetics showed group education per se was favorably associated with improved knowledge, improvement in amount of problem solving behaviors, and improvement in perceived quality of life (*p* < 0.001). These improvements were maintained for 51.2 months. Another monumental finding of this study was group education seemed to prevent deterioration of blood sugar control (Trento et al., 2004). The findings from this study suggest interactive groups tend to counteract patients adapting and becoming complacent to their chronic disease. Trento et al. (2004) point out complacency with diabetes can facilitate an increase in A1C and contribute to complications.

Two years later, Deakin, Cade, Williams, and Greenwood (2006) published the 14-month Diabetes X-PERT study results. For 14 months the researchers followed 314 older (average age 61.5) Type II diabetics. The treatment group received six 2-hour group diabetes education and self-management classes while the control group received usual care from their diabetes health care provider. All subjects were assessed for diabetes control, weight, BMI, waist circumference, total cholesterol, triglycerides, self-efficacy, diabetes knowledge, activity level, and self-care behaviors at the beginning of the study, at four months, and then at 14 months.

Upon conclusion of the study period (14 months), the treatment group had significant improvement in diabetes control (repeated ANOVA, $p < .001$) (Deakin et al., 2006). In addition, statistically significant improvements were seen for the treatment group in all of the aforementioned parameters. No such improvements were seen in the control group (Deakin et al., 2006).

This study included a number needed to treat (NNT) analysis regarding medication usage. Deakin et al. (2006) found for every seven patients that received the educational intervention, one patient could expect to have their medication regimen reduced (95% CI; 5, 11).

Boegner, Fontbonne, Gras Midal, Mouls, and Monnier (2008) published the sixth study. This study was a six-month diabetic education study done in Montpellier, France. Although these researchers did not design a RCT, they instituted a group education program for older diabetics. They enrolled the first 427 patients (obtained from private practices in the Montpellier region) interested in diabetes education. These subjects participated in multidisciplinary group education sessions. The participants were evaluated at baseline and again six months after the conclusions of the educational sessions. The researchers assessed diabetes knowledge, fasting blood sugars, diabetic control (A1C), and percentage doing daily foot exams. Six months after the intervention, diabetic knowledge had improved. But these researchers were most interested in tangible parameters—better diabetic control and more self-care practices. The intervention proved effective with average fasting blood sugar decreasing from 146 mg/dL to an average of 142 mg/dL ($p < 0.04$). Average diabetic control was better—pretreatment average A1C of 7.57% fell to 7.41% after the education ($p < 0.01$). Another impressive finding was the percentage of patients that performed daily foot exams increased from 66 to 77% ($p < 0.001$). Unfortunately, the researchers did not publish any longer term results on these subjects.

The seventh study, a prospective multi-center randomized controlled trial, took place in Germany (Braun et al., 2009). This study randomized 155 senior citizens (average age 76) to either standard care (diabetic education of hours a day for 5 days) or geriatric structured teaching for diabetes (7 group education classes of 45 minutes each). The treatment was senior focused and it relied upon repetition. The researchers excluded those with cerebrovascular disease, myocardial infarction, or cognitive dysfunction. All subjects were assessed at baseline and then again six months later. The results were similar to the previous six studies reviewed. There was no significant change in the control group. However, the treatment group showed fewer complications ($p < 0.009$) and improved diabetes control (average A1C fell from 8.3% to 7.7%; $p=0.01$) (Braun et al., 2009).

Three meta-analyses were published during this 10-year window of time. Deakin, McShane, Cade, and Williams (2005) published the first analysis. In this review, the researchers evaluated group based patient centered education for Type II diabetics (Deakin et al., 2005). Randomized controlled trials and case controlled trials of six months or longer were evaluated. This review included 11 studies; the subjects ranged in age from 30 to 85 years. Participating in the 11 studies were 1,532 individuals; the educational interventions ranged from 3-4 hours per year (for two years) up to an average of 6-15 hours per year (for four years). The intervention groups were compared to usual periodic diabetes medical care.

The meta-analyses revealed results similar to what is cited previously in studies focused on older adults. Mortality rate, blood pressure, cholesterol, triglycerides, quality of life, was not affected by the educational intervention at 12-14 months after the intervention (Deakin et al., 2005).

However, diabetes control (A1C), body weight, diabetes knowledge, self- management behaviors and complications were significantly improved at 14 months in the treatment subjects (Deakin et al., 2005). A1C had declined on average .8% (95% CI, 0-1.6; Z = 2.07; p = 0.04); self-care behaviors had improved—more frequent exercise ($p < .001$), more frequent home glucose monitoring ($p = .009$), and more frequent foot exams ($p = .008$). Deakin et al. (2005) concluded the meta-analysis proves individual care and education is less efficacious than group education and self-management regimens. They point out the reduction in A1C that occurred in the treatment subjects equates to a relative risk reduction in diabetes complications of 21%, based on UKPDS criteria (Deakin et al., 2005).

The second meta-analysis, published by Chodosh et al. (2005) reviewed 26 randomized controlled trials from 1998-2004 comparing outcomes for self-management education of Type II diabetics to those who received usual care. These researchers found statistically and pooled effect size favored the intervention groups for A1C (ES = -0.36; 95% CI, -0.52 to -0.21). This effect size is equivalent to a reduction in A1C of 0.81%. Again, these findings are comparable to those of the seven published studies previously reviewed.

Loveman et al. (2008) published the third meta-analysis. These researchers analyzed 13 randomized controlled trials of diabetes education from 2002 through January of 2007. Details of this meta-analysis are not reviewed in this manuscript, as the majority of the studies reviewed were adults less than 60 years of age. The studies where the average age of the population was 60 years or greater, have been summarized. It is important to note Loveman et al. (2008) did not find any conclusions that differed from previous systematic reviews.

2010 to Present

Two randomized controlled trials and two meta-analyses have been published in the last six years focusing on outcomes for group education in older Type II diabetics. The first study, conducted by Piatt et al. (2010), was a multi-level clustered randomized controlled trial of 118 older diabetics (average age 65 years). The researchers divided the subjects into three groups; the first group received group diabetes education weekly for six weeks, followed by monthly support group meetings for 10 months. The second group received diabetes care and individual diabetes education from their health care provider, while the control group received usual health care, with no specified diabetes education component.

Upon completion of the one-year study, diabetes control had improved in the three groups, A1C had decreased by -0.5%; blood pressure fell on average, 4.8 mm and proportion of those who monitored their blood sugars ranged from 86.7-100%. The researchers found only those in the group education group sustained these improvements at 36 months (Piatt et al., 2010).

The second study was a secondary analysis of older diabetics compared to younger adults after both received group education for diabetes (Beverly et al., 2013). The older group consisted of 71 older adults, average age was 67 years. The younger group was comprised of 151 younger adults; their average age was 47 years old. The subjects were block randomized to receive either structured group education, attention control education on diabetes, or one-on-one diabetes education. Diabetes control and self-efficacy measures were in all groups at baseline, three months, six months and 12 months. This study showed all groups had a reduction in A1C that was equal over time; however, the group education subjects (both older and younger ones) experienced the most improvement; this improvement was maintained for 12 months (Beverly et al., 2013). Self-efficacy markers improved in both the younger and older groups.

Beverly et al. (2013) suggest older adults benefit as much as their younger counterparts from diabetes education, as it relates to glycemic control. In fact, this study showed in group scenarios, older adults gain more improvement in blood sugar control than do younger adults (block randomization X2 used for analysis).

Although these researchers uncovered important data regarding older adult diabetic education, the limitation of this study was adults 76 and older were excluded from this trial. Beverly et al. (2013) emphasized over the last three decades, only minimal progress has been made in development of evidence for successful interventions for older patients with diabetes—in spite of the enormous improvement in educational venues for younger diabetics. These researchers stressed older diabetics need evaluation, especially the group 75 years and older (Beverly et al., 2013).

Two recent meta-analyses have been conducted in the area of diabetic education. The first analysis conducted was by Heinrich, Schaper, and de Vries (2010). This study was a retrospective review of 14 diabetes intervention trials done between 2000 and 2010. Detailed findings will not be cited here as the majority of the studies involved one-on-one diabetes education and all of the studies were in subjects with an average age of less than 65 years. However, it should be stated that these researchers found group interventions had the greatest potential to improve metabolic control. These findings were consistent with Deakin et al.'s (2005) work.

The second meta-analysis was done by Steinsbekk, Rygg, Lisulo, Rise, and Fretheim (2012). The researchers reviewed diabetic RCT completed since Deakin's (2005) Cochran review. Twenty-one studies were analyzed; these studies captured 2,833 participants in some sort of diabetic educational intervention. The baseline pooled age was 60 years (*SD* 9.5 years); the average duration of disease was 8.1 years (*SD* 7 years). Pooled average A1C for both groups was over 8%. On average, the follow up in these studies ranged from 8 to 24 months.

This analysis revealed the educational intervention duration ranged from three hours per year to a maximum of 96 hours over six months (Steinsbekk et al., 2012). On average, the subjects received 6-20 hours over 1-10 months . Five of the trials did cite a theoretical basis; the theories included cognitive therapy, empowerment, discovery learning, systemic education, and self-efficacy. Of the 21 studies in this analysis, eight had a mean age of more than 60 years (Steinsbekk et al., 2012).

The results of the review showed education had a positive effect on blood sugar control at six, 12, and 24 months (decreased .44%, p = 0.00001; decreased .46%, p = 0.00001; decreased .87%, p = 0.00001, respectively) (Steinsbekk et al., 2012). Self- management behaviors increased in the treatment groups at six (standardized mean difference (*SMD*) 0.83,

p < .00001), 12 (*SMD* .85, p < 0.00001) and 24 months (*SMD* 1.59, p = 0.03). Significant improvement was seen in self-efficacy measures at six months (*SMD* 0.28, p = 0.01; 95% CI, 0.06 to .5). There was no change in quality of life measures for any group upon conclusion (Steinsbekk et al., 2012).

Meta-analysis at all points from six months to five years showed significant improvement in the intervention groups that received group based diabetes self-management education. This improvement revealed a higher effect size than what was seen in the earlier Cochran review by Deakin et al. (2005).

In summary, this data suggests group based diabetes self-management helps improve blood sugar control; the more hours of education spread over longer periods seemed to have the most robust effects. The authors also point out the studies that reported a theoretical foundation seemed to have less improvements. That being said, they believe a theoretical underpinning is not absolutely necessary for diabetic educational interventions to have positive effects (Steinsbekk et al., 2012).

As is evident from this review of 55 years of data, we do not have adequate information about the older diabetic population in the United States. The frequency and effect of education and subsequent health associated behaviors is unknown. The goal of this research was to assess descriptions and any correlations in a large representative sample of older U.S. diabetics—as they apply to diabetic self-care and clinical outcomes.

CHAPTER 3

METHOD

In Chapter 3, I relate the design and research methods used to describe the older diabetic population and associations between age, surrogate markers of education, and assess a small sample of clinical outcome measures. I also give a description of the sample size, procedures for sample recruitment, and data collection. Human right protection will be briefly discussed as well. The study variables and data analysis procedures will be cited.

Research Methodology and Design

This document is a quantitative retrospective study of American diabetics obtained from the National Health Interview Survey database. The main purpose of the study was to describe and secondarily analyze a 10-year cohort of older diabetics—that could be viewed as representative of the U.S. diabetic population. The population was assessed for education, via surrogate markers, clinical multi-morbidity or limitation, and outcome variables—areas of concern in this population—current smoking and urgent health care visits. The data collected was from electronic databases (NHIS, 2001-2010) that are available to the public; the data that is available is in numeric format to allow statistical analyses.

Sample

I used national results from the National Health Interview Survey databases from 2001 to 2010. The inclusion criteria were adults aged 18 and older. The NHIS survey is a national telephone survey done annually in the United States. This survey contacts a representative sample of the U.S. adult population and asks the participants a number of health related questions. Although this data is representative of the U.S. population at a given point of time each year, there is a degree of self-selection bias. The adult that opts to participate in the survey may well be different, in terms of health behaviors, that those adults who decline to participate.

Sample Size

This 101-year cohort of adults, obtained from NHIS data surveys from 2001 through 2010 included 282, 313 U.S. adults. This sample was categorized into three age groups—18 to 44 years of age; 45 to 64 years, and 65 and older. The focus of this study was the latter group.

Human Rights Protection

The study was approved for expedited review by the University of North Texas. The data was retrieved from public access files from the world wide web, and these file locations have been cited in the reference pages. These data files have no identifying data that could be used to link the information to a given individual residing in the United States, so are not subject to human subjects review. The data were retrieved and assessed using the Statistical Analysis System (SAS).

Data Collection Procedure

The data files were downloaded and accessed on the Gerontology Department computers. The data extraction was from the adult household data files, based first on age, then reassessed focusing on the variables of interest. A variety of descriptive variables were obtained for later study, such as gender, race, education, ethnicity, but for purposes of this initial study, stratification was done by age, disease, and diabetic specific variables.

Variables

This study is retrospective and descriptive in nature. Many different variables were examined—age; having been diagnosed with diabetes; reporting a clinical multi-morbidity or limitation; preventative exams—of the eyes, feet, or in the form of routine health visits (these are used as surrogate markers of diabetic education, as these are delineated in the ADA (2012a) education standards); smoking status; and emergency department visits.

Smoking status and number of emergency room visits could be classified as dependent variables; however, in this setting they are a better corollary to outcome measures. Diabetic education, as measured by surrogate markers—eye doctor visits, foot doctor visits and routine health care visits could be viewed as the independent variables.

Statistical Analysis

Statistical analyses are conducted using a current edition of SAS software (SAS Institute Incorporated, 2013). Nonparametric tests are employed for analyses. Descriptive statistics are used to answer descriptive questions. To assess the data from a correlational standpoint, I used cross-tabulations to discern associations between diabetes and markers of education and other variables of interest, i.e., smoking, frequency of visits to the emergency department.

CHAPTER 4

RESULTS

Sample Characteristics

The sample is comprised of 282,313 adults contained in the National Health Interview Surveys (NHIS); the sample included individuals that participated in the survey from 2001 through 2010. These annual surveys are cross sectional data that is population representative. The same population was used to examine all of the parameters that will be described below. Table 1 presents the sample, broken down into age categories, and the distribution of diabetes in the U.S. population in each age group.

Table 1

Population by Age Category during 2001-2010

Age Category	% of U.S. Population	Actual Sample Size	Distribution by % of Diabetes in the U.S. Population Based on Age Group
18-44 years	50.47	136,566	1.16
45-64 years	33.24	91,262	3.55
65 and older	16.29	54,485	2.92

From these data, it can be noted that 7.63% of U.S. adult population has been diagnosed with diabetes; 38.27% of all U.S. adult diabetics are 65 and older—thus the need to focus upon this population with this chronic health condition.

Table 2 reflects the percentage of the U.S. population during 2001 through 2010 that were ever diagnosed with diabetes. The data suggests those 65 and older are 68% more likely to have diabetes than those aged 45 to 64 years. In addition, 65 and older are near eight times more likely to have diabetes than those aged 18 to 44 years.

Table 2

Percentage of Population Ever Been Diagnosed with Diabetes

Age Category	% in Sample	Weighted & for the U.S. Population
18-44 years	2.36	2.30
45-64 years	11.17	10.67
65 and older	18.22	17.91

The population was then assessed for multi-morbidity or clinical limitations, which could mean a variety of things—other comorbid medical problem or loss of limb. Table 3 demonstrates those that reported clinical limitation or multi-morbidity increased with age.

Table 3

Percentage of Population with a Clinical Limitation/Comorbidity

Age Category	% in Sample	Weighted & for the U.S. Population
18-44 years	18.30	18.31
45-64 years	39.79	38.92
65 and older	63.62	63.00

Table 4 documents the percentage of the population with a clinical limitation/comorbidity attributed to diabetes. As can be seen, in the general population, clinical comorbidities attributed to diabetes are less than 1%.

Table 4

Percentage of Population with a Clinical Limitation or Comorbidity Attributed to Diabetes

Age Category	% in Sample	Weighted & for the U.S. Population
18-44 years	0.03	0.02
45-64 years	0.29	.22
65 and older	0.47	.42

At this point, the sample was assessed from two vantage points, the entire sample and the sample with diabetes. Henceforth, the results will be described in that fashion. Table 5 shows the percentage of diabetics that report a clinical limitation or comorbidity. Although 63% of those aged 65 and older have a clinical limitation/comorbidity of some sort (hypertension, obesity, coronary artery disease, cancer, amputated limb, or stroke) as noted in Table 3, clinical limitations are more common in those with diabetes—near 76% of diabetics over 65 report some clinical limitation. It is important to note, the diagnosis of diabetes is associated with clinical limitations across all age categories. Of those 65 and older with diabetes, they are 12% more likely to have a clinical limitation. It is worth noting, in those less than 65 that have diabetes—the percentage with a clinical limitation is greater than the nondiabetic older population as a whole.

Table 6 reports the percentage of the diabetic population that attributes a clinical limitation/comorbidity to the disease. Although less than 1% of the total population reports a clinical comorbidity being related to diabetes (Table 4), those that had the illness cited a larger percentage of association; more than 25% of those 65 and older with a clinical limitation associated it with diabetes. This large difference appears across younger and middle-aged adults.

Table 5

Percentage of Diabetics in the Population with Clinical Limitation/Comorbidity

Age Category	% in Sample	Weighted & for the U.S. Population
18-44 years	40.72	41.31
45-64 years	63.67	62.47
65 and older	75.70	75.71

Table 6

Percentage of Those in the Population with Diabetes with a Clinical Limitation or Comorbidity Attributed to Diabetes

Age Category	% in Sample	Weighted & for the U.S. Population
18-44 years	31.88	30.93
45-64 years	35.53	34.09
65 and older	26.86	26.96

As mentioned previously, the remaining results will be reported from the general population and then as it applies to the diabetic population. Cross tabulations were used to assess for associations between surrogate markers of education, visits with an eye doctor, visits with a foot doctor, and routine office visits with a care provider, and diabetes. In addition, clinical outcome markers, smoking and emergency department visits, were assessed in the general population and then in the diabetic group.

Table 7 shows more than 50% of those 65 and older had seen an eye doctor in the last 12 months. When the data was examined for older diabetics as shown in Table 8, more than 65% had seen an eye doctor within the last year. Although this was an 8.33% increase, when compared to the general populous, this percentage is far from where it should be for diabetics. The ADA (2012, 2015) and the CDC (2014b) suggest all diabetics should be seen by an eye doctor yearly.

Table 7

Percentage of Population that Have Seen an Eye Doctor in the Last 12 Months

Age Category	% in Sample	Weighted & for the U.S. Population
18-44 years	26.17	27.24
45-64 years	40.71	41.93
65 and older	56.09	58.96

Table 8

Percentage of Diabetics in the Population that Have Seen an Eye Doctor in the Last 12 Months

Age Category	% in Sample	Weighted & for the U.S. Population
18-44 years	43.09	44.09
45-64 years	55.20	56.24
65 and older	65.55	66.69

Table 9 shows less than 16% of any age group reports visiting a foot doctor within the last year. One of the health recommendations and covered diabetic preventative services is one or more visits to a foot doctor each year (ADA, 2015). Table 10 assesses the diabetic population in isolation, less than 30% of older diabetics report seeing a foot specialist within the last year. Although many variables could be at play here, the lack of visits with a foot doctor by diabetics could be explained by a lack of education on the disease.

Table 9

Percentage of Population that Has Seen a Foot Doctor in the Last 12 Months

Age Category	% in Sample	Weighted & for the U.S. Population
18-44 years	3.22	3.26
45-64 years	7.82	7.56
65 and older	16.29	15.93

Table 10

Percentage of those in the Population with Diabetes that Have Seen a Foot Doctor in the Last 12 Months

Age Category	% in Sample	Weighted & for the U.S. Population
18-44 years	12.07	11.73
45-64 years	20.19	19.38
65 and older	30.57	29.91

ADA (2015) recommends a health care provider on a regular basis, which could be visits every two, three, or four months, depending upon comorbid health issues, evaluate diabetics. Tables 11 and 12 shows the number of office visits for the population and then for diabetics. Forty-six percent of the older diabetics had one to four routine office visits within the last year, while 40% of them had five to eight visits. Less than 15% of this older group had eight or more routine office visits. Based on suggested routines, adult diabetics should have three to six routine visits annually (ADA, 2015). It appears that 86% of older diabetics are following suggested surveillance guidelines; 13.4% are being seen more than suggested. The group with more than eight office visits could have many health comorbidities, be older in age, have uncontrolled disease, or some other unknown circumstance.

Table 11

Times Seen for a Routine Office Visit in the Last 12 Months (Weighted Percentage for the Population)

Age Category	1-4 Office Visits	5-8 Office Visits	>8 Office Visits
18-44 years	81.68	13.37	4.75
45-64 years	74.19	19.02	6.80
65 and older	61.33	30.47	8.50

Table 12

Diabetics Seen for a Routine Office Visit in the Last 12 Months (Weighted Percentage for the Population)

Age Category	1-4 Office Visits	5-8 Office Visits	>8 Office Visits
18-44 years	56.67	30.10	13.23
45-64 years	51.87	34.19	13.95
65 and older	46.12	40.47	13.40

Tables 13 and 14 assessed the number of emergency department visits in the last year, in the general population and in the diabetic population. The well-controlled, well-educated diabetic would be expected to have fewer emergency department (ED) visits than those that are poorly controlled or not adequately educated (ADA, 2015). Older diabetics had more emergency department visits than the older person without the disease. Near 30% of older diabetics had one to three ED visits within the past 12 months; less than 2% of older diabetics reported more than three ED visits. Although multiple variables could explain these ED visits, not just diabetes associated issues, at this time, we do not have data to assess if there is an association between number of ED visits and being an older diabetic.

Table 13

Times in an Emergency Department in the Last 12 Months (Weighted Percentage for the Population)

Age Category	1-3 ER Visits	4-6 ER Visits	7 or More ED Visits
18-44 years	19.95	.74	.16
45-64 years	17.50	.66	.15
65 and older	22.69	.80	.14

Table 14

Diabetics that Had Emergency Department in the Last 12 Months (Weighted Percentage for the Population)

Age Category	1-3 ER Visits	4-6 ER Visits	7 or More ED Visits
18-44 years	34.19	2.63	1.11
45-64 years	28.95	1.96	.39
65 and older	29.19	1.50	.32

The next three tables examine smoking. Table 15 shows smoking in the population; Table 16 displays smoking status by age, and lastly smoking is shown by age and diabetes in Table 17.

Table 15

Percentage of Smoking in the Population in 2001-2010

Smoking Status	Weighted Percentage in Adult Population
Daily Smoker	16.78
Smokes Some Days	4.17
Former Smoker	21.73
Never Smoked	57.32

As seen in Table 15, based on NHIS data, 20.95% of U.S. adults, aged 18 and older, are smokers, while 79.05% are currently nonsmokers. Table 15 also shows 57% of the U.S. population has never smoked. Forty-three percent of adults are current or former smokers.

Table 16

Smoking Status by Age in the Population (Weighted Percentage for the Population)

Age	Smokes Daily	Smokes Some Days	Previous Smoker	Never Smoked
18-44 years	18.14	5.76	11.98	64.11
45-64 years	19.39	3.92	26.13	50.57
65 and older	7.95	1.72	37.61	52.71

Table 16 shows age and smoking status. The older adult U.S. population contains more former smokers, when compared with middle aged and younger adults. Yet, less than 10% of those 65 and older continue to smoke. This percentage is in contrast to the middle-aged and younger cohorts who report 23% continue to smoke.

In Table 17, it appears that less than 7.5% of older diabetics are smokers; however, 43.5% of the older diabetic cohort reported a previous smoking history. It appears older diabetics are more likely to have smoked than those of younger ages. The data showed an interesting association; the older diabetic cohort had a higher percentage of previous smoking than all adult groups—those with diabetes and those without. Although current smoking status is much lower in the older diabetic group, there appears to be a negative association with current smoking and age, but a positive association with previous smoking and older age. Perhaps, having diabetes makes a person more aware of their vulnerabilities—so they are more likely to stop smoking or this negative association might be just a cohort related phenomenon.

Table 17

Smoking in the Diabetic Population (Weighted Percentage for the Population)

Age	Smokes Daily	Smokes Some Days	Previous Smoker	Never Smoked	Previous Smoker in Those Not Diabetic
18-44 years	22.52	4.86	15.43	57.19	12.34
45-64 years	16.99	3.45	32.58	46.97	26.50
65 and older	6.31	1.35	43.55	48.80	38.80

It appears that as diabetics age they are less likely to smoke; however, I have to ask if this is true or is it that the older diabetic who smokes is not represented here because they have already succumbed to the disease or its complications.

Summary of the Results

The data accentuate how common diabetes is in the older adult population. Those with the disease report a higher percentage of clinical limitation or co-morbidity than the nondiabetic population; this percentage seems to be present regardless of the age of the patient.

If we assess the diabetic population for education, via surrogate markers—visits with an eye doctor, visits with a foot doctor, and routine health visits, we note those with diabetes did participate more than the nondiabetic populous. However, the difference in the diabetic group was not what was expected clinically. Based on ADA (2015) recommendations, during diabetic education, the patient is instructed on the importance of preventative exams. In those aged 65 and older, Medicare has covered these preventative exams since 2001 (Duncan et al., 2009). Logic would lead this researcher to expect the data would show an impressive difference between how the older diabetic uses these services in comparison with the older nondiabetic population. Such was not the case. Most certainly, lack of education could be an explanation, but other variables could be causative. In an ideal world, the survey would have asked the diabetic patients directly if they had participated in diabetic education, and if so, was it in an individual or group setting. The lack of this direct questioning prompted the use of surrogate markers to assess for diabetic education.

In terms of outcome variables, the data suggests diabetics have more emergency department visits than the nondiabetic population; this association is present in all age groups, not just the older diabetic. This finding would suggest a lack of education; however, this data assessment did not cross tabulate the emergency department visits with the surrogate markers of education to assess for a correlation. And, it must be noted that many other variables, such as other health co-morbidities, could be influencing the results.

The other outcome variable assessed was smoking status. It appears there is a negative correlation with age and being a current smoker. Although being diabetic and being older does seem to correlate with previous smoking behaviors, it may or may not be influencing current tobacco use. The numbers suggest it could be related to an early demise of the older diabetic who smoked or perhaps education was the variable that caused the older diabetic to cease smoking. This association cannot be ascertained as markers of education were not cross tabulated with diabetes and age.

CHAPTER 5

DISCUSSION

The focus of this research study was to describe a cohort of the older diabetic population from a population representative sample of U.S. adults. I assessed older adults from the NHIS databases from 2001 through 2010. This large sample of more than 250,000 subjects was examined for percentage and distribution of diabetes. The population was screened for clinical limitations/comorbidities—those related to diabetes and those related to nondiabetic sources. The sample was also examined for markers of diabetes education. From a correlational standpoint, the diabetic sample was assessed for associations between age and diabetic education markers, age and emergency department visits, and age and smoking status.

The sample consisted of 282,313 adults in the U.S. aged 18 and older. This sample was obtained from NHIS adult household surveys from 2001-2010. From this sample, I found the total distribution of diabetes by age group was 7.63%. Of this distribution within the population, 38.27% of the diabetics were 65 and older. This figure is important. It is important because the baby-boomer cohort is rapidly aging into the 65 and older group, which equates to a larger percentage of older adults and more diabetics entering this older cohort.

When we examined the sample from a different perspective, those within the population diagnosed with diabetes from 2001-2010, we found those 65 and older are 68% more likely to have diabetes than those aged 45 to 64 years. The population was also examined for clinical limitations or comorbidities. As was expected, the older cohort, those 65 and older, reported more limitations than younger groups. When the diabetics were segregated from the total sample and asked the same question, related to clinical limitations/comorbidities, it was again the older group, those over 65, that reported the largest percentage—nearly 76% of diabetics aged 65 and older reported a clinical limitation/comorbidity. In this older group, 26.96% attributed a clinical limitation/comorbidity to diabetes. As can be noted from this descriptive data, diabetes is a commonality in those 65 and older, and future years suggest diabetes will become more common in those 65 and older—is this increase a function of aging per se or other variables, that is unclear.

The sample was then screened for markers of diabetic education. As expected, the older diabetic population did report more eye doctor visits, foot doctor visits, and routine health visits than did the older non-diabetic group. However, the margin of difference between these two groups was much lower than expected. I suspected a large difference in the diabetic group—but that was not the case. The small difference between groups needs further investigation. If diabetic education is thought to prevent downstream complications and improve outcomes, then it is important that all diabetics participate. The data suggests that is not happening.

In terms of outcomes, emergency department visits and smoking status was examined. In the total population, there does seem to be a positive association with age and the number of emergency department visits. However, in the diabetic group, age seems to have a slight trend toward a negative association with emergency department visits. Could this negative association be related to diabetic education efforts—most certainly so, but more data are needed.

In regards to smoking, there appears to be a negative association with age and smoking. However, there appears to be a positive association between age and being a former smoker.

When the diabetic population is assessed in isolation, these same associations are applicable. It is interesting to note the positive association seen in the diabetic group between age and previous smoking is stronger than the association seen in the nondiabetic population. See Table 17 for this association.

In the medical arena, emergency department visits and smoking increases the costs of health care—across all ages and across all diseases (ADA, 2015). If educational intervention can reduce the percentage of these two variables in the diabetic population, a positive effect will be seen economically, in terms of health care dollars, and perhaps improved quality of life.

Practice and Policy Implications

The results of this study support what is commonly seen in the literature. Diabetes is common in the older adult population, yet this population is not exposed, as they should be, to educational knowledge that will help the patient to control their disease and prevent complications (CDC, 2009; Skovlund et al., 2005). This study is a beginning attempt to better evaluate and assess the older diabetics in the United States. The data suggests some older diabetics are receiving diabetic education—as measured by surrogate markers, but by no means near what would be expected, when data suggests that 38% of diabetics are 65 and older. There is great opportunity for improvement here. As consumers, we cannot attribute this lack of preventative participation to cost, as the older population has covered benefits for diabetes as part of their Medicare insurance plans. Is it related to lack of education or perhaps lack of feelings of health efficacy—more data is needed to know how best to intervene.

I think from a health care provider perspective, this preliminary data needs dissemination. The fact there is less than a 10% difference in the nondiabetic and diabetic groups (aged 65 and older) in visits to eye doctors, less than a 15% difference between these groups in foot doctor visits, and near a 10% increase in number of emergency departments visits in the older diabetic group is data that most geriatric health care providers are not aware of. The small differences can equate to large numbers in terms of complications and costs (ADA, 2013). Based on Medicare data in 2012, $245 billion was spent on diabetes (ADA, 2013). These numbers are only expected to continue to rise if we cannot educate more of the older diabetic population; education can mean more than preventative visits; it can be blood sugar control, fewer emergency visits, smoking cessation, and the like.

In many health care arenas, health care providers are reimbursed based on how well they incorporate prevention strategies (CDC, 2012). I can think of few areas where this *pay for performance* philosophy is more important than in the care of the older diabetic. Health care providers of the elderly must act in an urgent fashion to study, educate, and cultivate this diabetic group. Such interventions will ultimately reduce costs while empowering the patient.

In terms of implications for clinical practice, health care providers should initiate a proactive role. Perhaps, there should be some intermittent contact with the older diabetic between the routine visits, to answer questions about their disease, dietary regimen, or areas of management that could be overwhelming them. These interactions could be done by phone or via electronic interactions, such as Skype. For the older diabetic who is frail or homebound, home health care intervention might be a viable solution to ensure diabetic education reaches these individuals. In addition, other venues for education, such as diabetes classes at the local library or senior centers, with an option for transportation might help bridge the gap for those older diabetics who have not been educated or perhaps need more information. And finally, heath care providers must utilize the options that technology has given us—telephonic education options for diabetes or internet based information sessions or classes. These alternative education options may well help us to improve our rates of diabetic education in the senior population.

Recommendations for Future Research

More improvements are necessary in care of the older diabetic in the Unites States. A greater number of them need education; more clinical trials are needed that focus only on this group. And finally, the limited data available from a national standpoint should be used to help influence practice and policy standards. It is obvious from the preliminary data that providers are below par educating the older diabetic. Although few of them remain smokers, many still visit an emergency department on an annual basis. Is there an association between the surrogate markers of education and smoking status? Is there a correlation between the surrogate markers of education and the number of annual emergency department visits? These areas should be further assessed. Are there other markers of diabetic education, such as immunizations or blood sugar monitoring that can be assessed in regards to this population in public domain databases? These would be additional areas or future research.

Limitations

The limitations of this study should be mentioned at this point. Although the sample size is large and represents a 10-year window in time, the data are drawn from a cross-sectional survey; the sample is not longitudinal as it does not follow a group of individuals over time. The participants are selected at random, but those that choose to participate may differ from those that opt out of the study. Self-selection bias, to some degree, limits the study findings. The data are self-report, which questions the validity of the responses. The repeated cross-sectional data does not allow satisfactory assessment of time order among factors.

The data currently cited constitute a secondary data analysis that is mainly descriptive, which could have been subjected to additional analyses. Three correlational questions were attempted to be answered from the data. More sophisticated questions could have been attempted, such as determining associations between age, diabetes, surrogate markers of education, and the outcome variables—smoking and emergency department visits. To determine if there is a relationship between those that appear to have been educated about their diabetes and smoking status and/or emergency department visits would have made the results more powerful. Having a tangible marker of diabetic control, such as hemoglobin A1C, would have also added value to the study results.

Conclusion

The results of this study suggest we have more work to do in terms of education of the older diabetic. More clinical trials are needed. The descriptive and correlation data acquired here suggest stronger efforts are needed to ensure preventative care behaviors are implemented in this population. Is it the responsibility of the health care provider or the patient? It seems the payers are attempting to pave the way, yet there is only partial participation.

As a health care professional who has devoted 32 years to caring for the older adult population, it is obvious to me that we can improve. With dissemination of the limited data that we have, attempting to obtain monies for future research with this older diabetic population, perhaps we can achieve improved education and outcomes for this vulnerable population.

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