COMPARISON OF DIABETES-
RELATED GUIDELINES AND PRACTICE IN NURSING HOMES

BY

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THESIS

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Long-term care of elderly with diabetes in nursing homes has been a national issue. Guidelines focusing on long-term care of elderly with diabetes in nursing homes have been few, and the practice in nursing homes has faced a lot of challenges. This study was to evaluate the similarities and differences between policies and practice of diabetes long-term care of elderly residents in nursing homes.

The study chose two guidelines as standards, and created a survey based on seven articles related to long-term care of elderly with diabetes in nursing homes. After expert panel’s review and modifications, the survey was sent through emails, web message boxes, and phone interviews to nursing homes primarily in Illinois.

The survey included mainly nine categories of diabetes care, which were Staff Available, Staff Training, Resident Food, Medical evaluation, Medication, Other Evaluations on Diabetes Care, Goals, Resident Education, and Special and Emerging Care. The primary result was expect Staff Available, more than 50% of responded nursing homes were aligned with half or more of guidelines on the rest eight categories. But when analyzing specific questions, the study reflected some gaps between the guidelines and practice. Guidelines and practice are both needed to modify and improve to contribute to achieve high quality of diabetes care in nursing homes.
To Father and Mother
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CHAPTER 1

INTRODUCTION

Diabetes is a national issue with the increasing prevalence and the leading cause of death in United States. Among different types of diabetes, type 1 diabetes mellitus (T1DM) and type 2 diabetes mellitus (T2DM) are the most common ones. Type 1 diabetes is a disorder that arises following autoimmune destruction of insulin-producing pancreatic β cells (Atkinson et al., 2011; Bluestone et al., 2010). Mostly, T1DM is diagnosed in children and adolescents. T2DM is a complex heterogeneous metabolic disorder characterized by impaired insulin production and action contributing to increased levels of blood glucose (Inzucchi, 2012; Jin & Patti, 2009). Usually, T2DM is diagnosed in the middle age or later. Both T1DM and T2DM may have the symptoms of polyuria, polydipsia and weight loss; however they most commonly can be seen in T1DM. The situations of T2DM symptoms are more complicated. For example, some adults with T2DM remain obese, which implies the symptom of weight loss is absent in those people (American Diabetes Association, 2014)

Concerning diagnosis of diabetes, four main tests are used: hemoglobin A1c (A1c) test, fasting plasma glucose test, oral glucose tolerance test, and random plasma glucose test. The A1c test indicates the average blood glucose level for the past two to three months. Fasting plasma glucose test is a measure of the fasting plasma glucose level. A blood sample is taken after an overnight fast. The oral glucose tolerance test is a 2-hour test where blood is evaluated at
baseline and 2 hours after drinking a 75g anhydrous glucose dissolved water or other beverages with equivalent amount of glucose. The random plasma glucose test is the one taken at a random time of the day regardless of food intake. Each test usually needs to be repeated on a second day in order to accurately diagnose (American Diabetes Association, 2014).

The treatment of both T1DM and T2DM include medication, diet, exercise, and blood glucose monitoring. For T1DM, inject extrinsic insulin is always required for patients’ lifetime. On contract, T2DM may or may not require insulin. Monitoring blood glucose levels is required at least 4 times each day for patients who are on insulin (Shulman & Daneman, 2010). Otherwise without insulin the frequency of monitoring blood glucose may be more flexible. Furthermore, Continuous Glucose Monitoring (CGM) system is recommended to use to effectively reduce rates of hypoglycemia and to assist doctors and registered dietitians to have a good knowledge of patients’ situations (Gan et al., 2012).

Diabetes in the elderly is different from that in adolescents, young adults, and middle age. The situation of older people with diabetes are much more complex in that elderly people with diabetes always have complications and comorbidity, which has a strong negative impact on the quality of their life. Although most elderly are living independently, those who are most disabled or ill live in nursing homes. Currently, there have been two big challenges of the long-term care for elderly residents with diabetes. For one thing, few randomized control trials focusing on older
people with diabetes have contributed to strong evidence for the best practical long-term care procedures (Kirkamn et al., 2012; Blaum, 2002). For another, guidelines specially aimed at care of elderly people with diabetes and guidelines specially targeted for diabetes care in long-term facilities are few. Under the current condition, the author wanted to compare the actual practice in nursing homes with the published guidelines to identify the degree of their alignment and the quality of diabetes care in nursing homes. Therefore, the purpose of the study was to evaluate the similarities and differences between policies and practice of diabetes long-term care in nursing homes.

The hypothesis is for each category, the percentage aligned with half or more of the guidelines will be greater than 50%. In other words, the percent receiving half or more points will be greater than 50% in categories of Available Staff, Staff Training, Resident Food, Resident Medical Evaluation, Resident Medication, Other evaluations on Diabetes Care, Goals of Diabetes Care, Resident Education, and Special and Emerging Care, separately. To be more specific, each hypothesis is listed below:

Hypothesis One, percent aligned with half or more of the guidelines on Available Staff will be greater than 50%.

Hypothesis Two, percent aligned with half or more of the guidelines on Staff Training will be greater than 50%.

Hypothesis Three, percent aligned with half or more of the guidelines on Resident Food will be
greater than 50%.

Hypothesis Four, percent aligned with half or more of the guidelines on Resident Medical Evaluation will be greater than 50%.

Hypothesis Five, percent aligned with half or more of the guidelines on Resident Medication will be greater than 50%.

Hypothesis Six, percent aligned with half or more of the guidelines on Other Evaluations on Diabetes Care will be greater than 50%.

Hypothesis Seven, percent aligned with half or more of the guidelines on Goals of Diabetes Care will be greater than 50%.

Hypothesis Eight, percent aligned with half or more of the guidelines on Resident Education will be greater than 50%.

Hypothesis Nine, percent aligned with half or more of the guidelines on Special and Emerging Care will be greater than 50%.
CHAPTER 2
LITERATURE REVIEW

Overview of Type 1 Diabetes Mellitus

1. Signs and Symptoms

Type 1 diabetes mellitus (T1DM) is a disorder that arises following the autoimmune destruction of insulin-producing pancreatic β cells (Atkinson et al., 2011; Bluestone et al., 2010). Mostly, T1DM is diagnosed in children and adolescents. The typical symptoms usually presented are polydipsia, polyphagia, polyuria, and weight loss. Other symptoms include extreme fatigue, blurry vision, dizziness, muscle cramps or weakness, flushed hot dry skin, difficulty waking up, rapid deep breathing, a strong fruity breath odor, loss of appetite, belly pain, vomiting, and confusion. Initially, those with T1DM often present with ketoacidosis (Shulamn & Daneman, 2010). Ketoacidosis is a condition where blood ketones are extremely elevated and the pH of the blood falls to below the normal value, 7.41. It occurs because the human body fails to regulate ketone production and the rapid accumulation of keto acids. Since diabetic patients lack effective insulin, cells have to break down fats into ketones to gain enough energy (Nattrass, 2006). The symptoms of ketoacidosis are abnormal pain, mouth dryness, fruity-scented breath, hyperventilation, frequent or excessive urination, nausea, loss of appetite, fatigue, mental confusion, blurred vision, and sleepiness (Rewers et al., 2002).

2. Diagnosis
Four main tests were admitted to diagnose T1DM and monitor blood glucose levels: A1c test, fasting plasma glucose test, oral glucose tolerance test, and random plasma glucose test. The measurement conditions and the threshold values of the four tests are based on American Diabetes Association criteria. Each test usually needs to be repeated on a second day in order to accurately diagnose (American Diabetes Association, 2014).

2.1 Glycated hemoglobin (A1c) Test

This blood test indicates the average blood glucose level for the past two to three months. Glycated hemoglobin tests measure the percentage of blood glucose attached to hemoglobin, which is the oxygen-carrying protein in red blood cells. The higher the blood glucose rises, the more glucose will be attached to hemoglobin. The upper critical value of the normal A1c range is 5.7%. When between 5.7-6.4%, it implies impaired glucose tolerance, or prediabetes. If recorded twice on two separate tests, the A1c level of 6.5% or higher indicates diagnostic diabetes. The advantage of the A1c test in comparison with most other tests is that there is no need to be fasting. The A1c test is considered to be not very accurate in certain people or certain situations such as during pregnant period. It occurs because the maternal vitamin and mineral status may fluctuate and may not be as usual, and indicators may suggest iron deficiency (Hashimoto et al., 2008). So the following introduced test, oral glucose tolerance test, is usually conducted to diagnose diabetes during pregnancy (Bonora & Tuomilehto, 2011). In addition to pregnancy, some people of African, Mediterranean, or Asian descent with a family history of sickle cell anemia or a thalassemia are known to have a probability of these traits interfering with the A1c
results; people with hemoglobin variant also may have inaccurate A1c results (Bonora & Tuomilehto, 2011). The commonly increased A1c occurring in the nondiabetic conditions are iron-deficiency anemia, splenectomy, alcohol toxicity, and lead toxicity (Fischbach & Dunning, 2009). The common decreased A1c occurring in the nondiabetic conditions are hemolytic anemia, chronic blood loss, pregnancy, and chronic renal failure (Fischbach & Dunning, 2009).

2.2 Fasting Plasma Glucose (FPG)

The FPG is a measure of the fasting plasma glucose level. A blood sample is taken after an overnight fast that means no food or liquid for 8-12 hours except for water. The criterion of FPG is: less than 100mg/dL (5.6 mmol/L) is normal, 100 to 125mg/dL is considered as prediabetes, and 126mg/dL or higher on two separate tests is diagnostic of diabetes. When people are in an early stage of T1DM, generally plasma glucose levels have not risen high enough to be recognized at each test, which may delay an accurate diagnosis (Bloomgarden, 2007). However, under some conditions, FPG values are elevated significantly high, but it may not be caused by diabetes. The conditions include acute emotional or physical stress, pituitary adenoma, pancreatitis, and other factors (Fischbach & Dunning, 2009). Myocardial infarction can cause acute physical stress, which leads to increase blood glucose (Fischbach & Dunning, 2009). Pituitary adenoma may increase secretion of growth hormone causing elevated blood glucose levels (Fischbach & Dunning, 2009). Both chronic and acute pancreatitis is likely to result in the abnormal blood glucose levels as well.
2.3 Oral Glucose Tolerance Test (OGTT)

The oral glucose tolerance test is a 2-hour test where blood is evaluated at baseline and 2 hours after drinking a 75g anhydrous glucose dissolved water or other beverages with equivalent amount of glucose. In addition to the FPG, the OGTT is another widely used test. Since the FPG may fail to detect some patients with diabetes who have normal fasting blood glucose levels but do not respond appropriately with insulin to food, an OGTT could be used to identify these people (Nishida et al., 2006). An OGTT should be conducted to determine the glucose tolerance condition when the level of fasting plasma glucose is 110 to 125mg/dl (Nishida et al., 2006). If the duplicated results of the OGTTs are 200mg/dl or more, diabetes can be confirmed without a doubt (American Diabetes Association, 2014). If there is one OGTT above 200 mg/dl and one less than this, other diagnostic procedures should be conducted (American Diabetes Association, 2014).

2.4 Random/Casual Plasma Glucose Test

The random or casual test is one taken at any time of the day regardless of food intake. A blood sample taken at a random time is expressed in milligrams per deciliter or millimoles per liter. Whether you eat or not and whenever you last eat, once the random blood glucose level is 200mg/dL (11.1 mmol/L) or higher, it indicates diabetes, especially with any of the signs or symptoms of diabetes existing such as extreme fatigue, blurry vision, electrolyte disturbance,
ketoacidosis, and hyperglycemia (American Diabetes Association, 2014). But in some conditions, blood glucose levels will increase without indicating diabetes as well. For example, Cushing’s disease with increased glucocorticoids causes higher blood glucose levels (Fischbach & Dunning, 2009). Based on research on the comparison of the accuracy of the random glucose test and oral glucose tolerance test in Marsha van Leeuwen’s lab, it concluded that oral glucose tolerance was more useful and accurate than random plasma glucose test in terms of gestational diabetes mellitus (Leeuwen et al., 2007).

3. Epidemiology of T1DM

Type 1 diabetes mellitus was one of the most common chronic diseases of childhood (Karvonen et al., 2000; Gale, 2002). There were two peaks of onset for T1DM, according to former research, which were at 5-7 years of age and near puberty (Harjutsalo et al., 2008). Other studies also have observed in the very young individuals to get the similar conclusion that there were three peaks of onset for T1DM, the groups of 0 to 4, 5 to 9, and 10 to14 years of age (Bennett & Knowler, 2005). Some studies indicated T1DM affected males and females equally, yet the controversy did exist. (Weets et al., 2001) A modest increase in T1DM cases occurred in males in early age during childhood or adolescence (Krischer et al., 2004). Also, the incidence of T1DM changed when seasonal changing, higher in autumn and winter, and lower in the summer months (Moltchanova et al., 2009). However, the pathogenic mechanism for these observations has been unclear. One possible reason was that the effect of seasons on T1DM was positively related to
the distance from equator (Karvonen et al., 2000). But the conjecture has not been firmly proved so far. Furthermore, recent studies have shown that “T1DM-associated autoimmunity in the months to years before the onset of symptomatic T1DM shows a degree of synchronization, akin to the seasonality, supporting an environmental agent driving the pathogenesis of the disorder” (Atkinson, 2012; Kukko et al., 2005). Different ethnic groups may also have different incidence and prevalence of T1DM. Based on statistical analysis, “non-Hispanic whites have the highest rate of new onset T1DM, which was 24.8 per 100,000 per year among those less than 10 years of age” (Dabelea et al., 2007; Dabelea et al., 2011). Overall, the incidence of T1D has been increasing throughout the world for the recent decades (Gale, 2002). When concerning mortality, the death rate of children under 15 years of age with diabetes, in the U.S., was 1.3 to 3.1/100,000/year during 1890 to 1920, while in Norway it was 2 to 7/100,000/year over the time 1900-1920. The comparison indicated the mortality in Norway was much higher, and in fact Norway was considered as the country with historically high incidence (Gale, 2002).

4. Pathogenesis of T1DM

T1DM results from the combined two factors, genetics and environment. Early familial aggregation and twin studies supported the importance for both genetic and environmental risk factors in T1DM (Tattersall & Pyke, 1972). Research on twins showed that monozygotic twins had historically been considered to have a disease concordance rate of 30% to 50%, while dizygotic twins had a concordance of 6% to 10% (Atkinson, 2012). The genetic influence was
the intrinsic element, which leaded to autoimmune destruction of \( \beta \) cells, which was the only type of cell in the human body producing insulin (Shulman & Daneman, 2010). The environmental factors may “trigger or regulate T1DM through promoting and developing T-cell dependent autoimmunity” (Shulman & Daneman, 2010). The environmental factors included dietary patterns, toxins, bovine serum albumin and \( \beta \)-lactoglobulin in cow’s milk protein, enteroviruses, vitamin D deficiency, drugs, and stress (Gan et al., 2012 Shulman & Daneman, 2010).

Hämäläinen and Knip (2002) reported “85% of new T1DM cases resided in individuals without the known family history for the disease” (Hämäläinen & Knip, 2002). In that case, T1DM etiology was considered extremely complex. The only general explanation was the high variety of gene environment interaction from person to person (Gan et al., 2012). What the majority of scientists agree upon was that the genetic factor “dominated the risk of T1DM initial development more in childhood” (Gan et al., 2012), and the environmental factor “contributed more to the further development of T1DM with advancing age” (Atkinson, 2012).

5. Genetics of T1DM

In the mid1980s, Professor Eisenbarth conducted an oft-cited model, which attempted to integrate each of the three features, genetic, autoantibody, and metabolic markers, for T1DM (Eisenbarth, 1986). The conceptual result of Eisenbarth’s research was that “genetically
susceptible individuals with a fixed number of β cells were exposed to a putative environmental trigger, which induced β cell autoimmunity” (Eisenbarth, 1986; Atkinson, 2012). Therefore, through the model, clinical T1DM would not be present until 80%–90% of the β cells were destroyed, which illustrated onset of autoimmunity did not immediately lead to the onset of diabetes (Atkinson, 2012). In addition, the risk of T1DM was approximately 5% if there was an affected first-degree relative and slightly higher if the affected parent is the father rather than the mother (Shulman & Daneman, 2010). Therefore, children of T1DM mothers had only a 2% risk of developing T1DM, whereas children of T1DM fathers had a 7% risk (Redondo et al., 2001).

Genetic loci have been associated with T1DM by a genome-wide association study and meta-analysis (Barrett et al., 2009). Loci are the plural form of locus. A locus refers to the location on the chromosome where the gene is found. The gene is located within a designed region on the chromosome. With decades of effort, nearly 50 genetic loci in the major histocompatibility region were associated with increased susceptibility to developing the disease, including the alleles DR3/4, DQ 0201/0302, DR 4/4, and DQ 0300/0302 (Shulman & Daneman, 2010; Barrett et al., 2009). According to research, “the first T1DM susceptibility locus identified, the Human Leukocyte Antigen (HLA) complex, provided the greatest contribution (i.e., ~60%) to the overall genetic susceptibility” (Mallone et al., 2005; Redondo et al., 2001). There were three classes of HLA genes. It was class II genes that with the strongest association with T1DM (Redondo et al., 2001). Because the function of class II HLA genes was to encode for molecules,
which engaged in antigen presentation, the influence and effect of the Major Histocompatibility Complex (MHC) allelic variability on the risk of T1DM could be explained by “differences in the presentation of the β cell antigens which might be either by promoting anti self reactivity or by the failure to impart regulated immune responses” (Barrett et al., 2009; Mallone et al., 2005). Moreover, the great majority of T1DM patients carried the HLA-DR3 or -DR4 class II antigens, and it was with about 30% being DR3/DR4 heterozygous (Atkinson, 2012). In Caucasians, “the DR3/DR4 genotype conferred the highest T1DM risk, followed by DR4 and DR3 homozygosity, respectively” (Atkinson, 2012).

6. Autoimmunity, Autoantibodies, and Cellular Immunity

Type 1 diabetes mellitus is an autoimmune disease involving pancreatic β cells, which mainly includes islet cell inflammation and associated β cell damage histologically. The inflammatory physical damage within islets of those with T1DM was typically reflected by “the decreasing or even absent number of insulin-producing β cells along with a pancreatic islet cell infiltrate composed of T-lymphocytes, B-lymphocytes, macrophages, and other cells tightly related to the immune response and function” (Foulis, 2008). The most widely used method to identify autoimmunity was “the presence of autoantibodies to islet and/or β cell antigens” (Foulis, 2008). The advantage of this method was to “detect the early signals of T1DM a long time before it becomes clinically symptomatic” (Yang&Santamaria, 2006).
T1DM-associated autoantibodies were typically present in 70% to 80% of patients newly diagnosed with the disease (Bingley, 2010). But, actually, 0.5% of the general population and 3% to 4% of relatives of patients with T1DM were autoantibody-positive (Knip et al., 2010). It was important to note that a wide variety of factors contribute to the differences between the percentages. It may include the location of geographic population studied, age and gender of the individual tests, and race and ethnicity (Tsirigiani et al., 2009; Bingley, 2010). Autoantibodies were surrogate measures for β cell autoimmunity (Skyler, 2007). Autoantibody titers as well as the absolute number of autoantibodies were both independent predictors of T1DM risk (Skyler, 2007). Specifically, when presenting at higher titers, at a younger age, or with the high-risk HLA genes, autoantibodies showed a more accurate prediction of the risk of T1DM (Atkinson, 2012). Because of the inconsistent accuracy, a report claimed, “around 5 to 15% of adults diagnosed with T2DM might actually have T1DM” (Palmer et al., 2005). That is to say, some of those diagnosed with T2DM were likely to be misdiagnosed. Furthermore, T1DM is a heterogeneous disease. Not all with T1DM possessed the same characteristics, and 70-90% of those with T1DM having these immunological self-reactive properties were identified as Type 1B, which implied the remainder remained unclear concerning pathogenesis (Imagawa et al., 2000). In addition, other potential influential factors existed including the growing problem of obesity, health care provider recognition, as well as an increasingly diverse genetic admixture to reflect a series of additional variable (Knip et al., 2005). Therefore, all those various patterns should be taken into
consideration when one ponders the pathogenesis as well as the clinical presentation of this disease (Atkinson, 2012).

7. Treatment

7.1 Medication-insulin

People with T1DM use extrinsic insulin for their lifetime with the disease. The history of insulin from the discovery to current development has been 92 years, from 1923 to 2015. In 1923, Banting and Best discovered insulin, which was a significant milestone in the history of diabetes (Karamitsos, 2011). Today, a number of types of insulin have been developed and applied.

Insulin is categorized into four sorts: rapid-acting insulin, short-acting insulin, intermediate-acting insulin, and long-acting insulin. In addition to the listed above, two different types of insulin can be combined to obtain intermediate-/rapid-acting analog and intermediate-/short-acting analogs (Gan et al., 2012). Three main characteristics of insulin are onset, peak, and duration. Onset is the time from insulin injection to reaching the bloodstream starting lowering blood sugar. Peak is the time from insulin injection to maximum efficiency of lowering blood glucose. Duration is the continuing work time for lowering blood sugar.

7.1.1 Rapid-acting insulin

In rapid-acting insulin, insulin lispro, insulin aspart, and insulin glulisine are the three main types. Rapid-acting insulin is necessary to solve the problem of mealtime hyperglycemia (Aathira &
Jain, 2014). These short acting medications start to work 15 to 30 minutes after injection, and the peak appears in 30 minutes to 2 hours, with a duration of 3 hours. Insulin lispro, the first man-made insulin entering the market, is used to prevent postprandial hypoglycemia. The advantage of insulin lispro is easy to be absorbed to counteract mealtime hyperglycemia but not to allow prolonged hypoglycemia to happen (Aathira & Jain, 2014). Insulin aspart is another man-made insulin. Immunogenicity and teratogenicity of insulin aspart is similar to regular human insulin in that only one amino acids is modified compared with regular human insulin (Hermansen et al., 2004). But its act in the body is much faster. The side effects are allergic reactions, rashes, and hypoglycemia (Hermansen et al., 2004). Referring to insulin glulisine, it is the newest one put in the list of rapid-acting insulins. It can be used only for people who are more than 4 years of age based on United States Food and Drug Administration (FDA) (Aathira & Jain, 2014).

7.1.2 Short-acting insulin

Short-acting insulins include Humulin R, and Novalin R. They start to work 15 to 30 minutes after injection, and the peak appears in 2 to 5 hours with duration of 5-8 hours (Gan et al., 2012).

7.1.3 Intermediate-acting insulin
Intermediate-acting insulin is NPH insulin (isophane). It starts to work 1 to 2 hours after injection, and the peak appears in 2 to 12 hours with duration of 14 to 18 hours (Hermansen et al., 2004).

7.1.4 Long-acting insulin

Long-acting analogs include Glargine and Detemir, which start to work 2 to 4 hours after injection, and no particular peak appears with duration of 20-24 hours for Glargine and 16-20 hours for Detemir (Gan et al., 2012). Glargine and Detemir were approved by the FDA, and they are applied for children more than 6 years of age.

In addition to the development of injectable insulin, insulin pumps developed a lot in the past five decades. An insulin pump is a small-computerized device. It is used to deliver insulin in two ways. One is in a steady measured and continuous dose, and the other is a bolus dose that is pumped right after mealtime to control the rising blood glucose accompanying food ingestion (American Diabetes Association, 2014). Therefore, it may be applied instead of long-acting analog and rapid-acting analog. Compared with injectable insulin, the advantages of the insulin pump are that it is more convenient, small, accurate, and adjustable (Aathira & Jain, 2014).

7.2 Monitoring

7.2.1 Blood Glucose Monitoring
In childhood and adolescence, T1DM patients are encouraged to monitor blood glucose at least 4 times each day (Shulman & Daneman, 2010). The correct timing includes the time before every meal and the time before sleeping (Bloomgarden, 2007). The record of blood glucose levels helps patients follow the planed pattern and also helps doctors make the insulin dose adjustment if necessary (Shulman & Daneman, 2010). A most common blood glucose test is the self-reported capillary glucose testing, which is recommended every day (Bloomgarden, 2007). A report indicated that the higher the frequency of recording the self-reported capillary glucose test, the lower percentage A1c value. Those testing more than ten times per day had A1c of 6.5%, while people testing 2 or less times per day had A1c values larger than 7.5% (Bloomgarden, 2007).

7.2.2 Continuous Glucose Monitors (CGMs)

The important purpose of CGMs is to avoid hypoglycemia that is considered as the biggest roadblock in the way of achieving glycemic control. Three main constituents, a sensor, wireless transmitter, and a receiver, are the components of the CGM system (Tamborlane et al., 2008). The main function of CGMs is to determine the tendency of blood glucose, and the mechanism of CGM is through glucose oxidase reactions to calculate the concentration of glucose in blood (Tamborlane et al., 2008). This device can be used in both children and adults. The blood glucose tendency analysis helps people with diabetes to effectively reduce rates of hypoglycemia.
Meanwhile, it can assist doctors and registered dietitians to have a good knowledge of patients’ situations (Kaufman et al., 2002).

8. Summary

To sum, T1DM as a disorder with the autoimmune destruction of insulin-producing pancreatic β cells, is diagnosed in children and adolescents. A1c test, fasting plasma glucose test, oral glucose tolerance test, and random plasma glucose test are the primary approaches to diagnose and monitor diabetes. Concerned as the most common chronic diseases of childhood, the factors, age, gender, season, ethnicity, and regions, were believed to affect the onset and prevalence of T1DM. The pathogenesis of T1DM should be studied from two aspects, genetics and environment. Actually, it is very complex because of the high variety of gene environment interaction. Therefore, a plenty of additional research is needed to figure out pathogenesis of T1DM. People with T1DM have to use extrinsic insulin for their lifetime. For commonly used types of insulin include rapid-acting insulin, short-acting insulin, intermediate-acting insulin, and long-acting insulin. In the daily life of childhood and adolescents with T1DM, it is highly recommended to monitor blood glucose at least 4 times each day in order to promote the control of glucose blood levels.

Overview of Type 2 Diabetes Mellitus

1. Definition and Symptoms
Type 2 Diabetes Mellitus (T2DM) is a complex heterogeneous metabolic disorder characterized by impaired insulin production and action, which contributes to the increased levels of blood glucose (Inzucchi, 2012; Jin & Patti, 2009). Although people with T2DM may have some similar symptoms as those with T1DM, which was introduced in the Overview of Type 1 Diabetes, such as polyuria, polydipsia and weight loss, the typical symptoms of T2DM are not exactly the same as the typical symptoms of T1DM. Some symptoms presented in T1DM may not appear in T2DM. For example, some adults with type 2 diabetes remain obese, which is to say the symptom of weight loss is absent in these people (American Diabetes Association, 2014).

Typically T2DM developed slowly and gradually by going through a long asymptomatic period (Lin & Sun, 2010). Then it was usually diagnosed in middle age or later by severe progressive defects in insulin production and action (Inzucchi, 2012). The stage before diabetes diagnosed is called prediabetes, and this stage may also go undetected for many years. Early decrements in insulin secretory capability, mild insulin resistance, and mild hyperglycemia are the main characteristics of prediabetes, and it often does not produce apparent symptoms (Inzucchi, 2012). When hyperglycemia becomes remarkably elevated beyond the upper limit of normal blood glucose levels, diabetes may be diagnosed (American Diabetes Association, 2014). The classic symptoms include blurred vision, having wounds or cuts slow to heal, urinary tract infections, and tingling pain, or impaired sensation in the hands or feet (Inzucchi, 2012; American Diabetes Association, 2014).
In order to detect diabetes in a timely manner, diabetes screening is recommended starting at 45 years of age, in general (American Diabetes Association, 2014). However, if a person has risk factors for developing diabetes, the American Diabetes Association (ADA) suggests he/she should be screened earlier and more frequently. According to the ADA recommendations, screening starts at 45 years of age and then once every three years at least for people not at risk for developing diabetes (American Diabetes Association, 2014). For people with a body mass index (BMI) of 25 kg/m² or more, or with at least one additional risk factor, it is recommended they be screened at any age and more frequently (American Diabetes Association, 2015). The additional risk factors are: having a family history of diabetes, especially first-degree relations; being from high-risk races including black, Native American, Asian, and Pacific Islander as well as Hispanic groups; people who have been previously diagnosed with impaired glucose tolerance (IGT) [2-hour values of the oral glucose tolerance test (OGTT) of 140 mg/dL (7.8 mmol/L) to 199 mg/dL (11.0 mmol/L)] or impaired fasting glucose (IFG) [Fasting plasma glucose (FPG) levels 100 mg/dL (5.6 mmol/L) to 125 mg/d; (6.9mmol/L)] (American Diabetes Association, 2014); having a hemoglobin A1c of 5.7% to 6.4%; people who have a history of gestational diabetes; women who have delivered a baby weighing more than 9 lb. (4.1kg); women who have polycystic ovary syndrome; those whose blood pressure is 140/90 mmHg or higher, or who have diagnosed hypertension; those who have a high density lipoprotein (HDL) cholesterol level less than 35mg per deciliter, or their triglyceride level is more than 250mg per deciliter, or both;
people who have a history of cardiovascular disease; being physically inactive; having acanthosis nigricans with insulin resistance, and other symptoms mentioned in the prior paragraph (Inzucchi 2012; American Diabetes Association, 2014; American Diabetes Association, 2015).

2. Epidemiology

The increasing prevalence of diabetes in the United States is a noticeable issue. Based on data from the 2014 National Diabetes Statistics Report, by 2012 the total number of people with diabetes (type 1 and type 2) was 29.1 million in the United States, which is 9.3% of the population (National Center for Chronic Disease Prevention and Health Promotion & Division of Diabetes Translation, 2014). Among the population of 29.1 million, the percentage of the number of people with T2DM is more than 98% (National Center for Chronic Disease Prevention and Health Promotion & Division of Diabetes Translation, 2014). The number with diabetes in adolescents by 2012 was approximately 200,000 (National Center for Chronic Disease Prevention and Health Promotion & Division of Diabetes Translation, 2014). Among these adolescents, T2DM accounted for 43% of cases (Demmer et al., 2013). Furthermore, the prevalence of undiagnosed T2DM in the population of adolescents was 0.12% (Demmer et al., 2013). On the contrary, children less than 10 years of age were extremely rare in T2DM (American Heart Association, 2013).

Over the 30 years from 1980 through 2011, the number of those diagnosed with T2DM rapidly
increased, from around 5.6 million to around 20.9 million (National Center for Chronic Disease Prevention and Health Promotion & Division of Diabetes Translation, 2013). That is to say, every year the number of new diagnosed patients is substantial. In 2012, the sum of new cases of T2DM was 1.7 million, of which 0.9 million patients were from age 45 to 64 (National Center for Chronic Disease Prevention and Health Promotion & Division of Diabetes Translation, 2014). The group of those 65 years or older is the second largest group (Olokoba et al., 2012). If the growth trend of the new diagnosed cases remains, by the end of 2015 there may be more than one tenth of American adults with diagnosed T2DM (National Center for Chronic Disease Prevention and Health Promotion & Division of Diabetes Translation, 2012).

The prevalence of T2DM does not differ to sex, but ethnicity is one of the strongest factors relative to the prevalence of T2DM. The prevalence, in different ethnicities of people aged 20 or higher, was: “7.6% of non-Hispanic whites, 9.0% of Asian Americans, 13.2% of non-Hispanic blacks, 12.8% of Hispanics, and 15.9% of American Indians/Alaska Natives through 2010 to 2012” (American Heart Association, 2013). Different regions, genetics, family histories, and lifestyles may be the key variables to explain the prevalence of T2DM in different ethnicities. Insulin resistance and insulin deficiency are both influenced by ethnicities, specifically by multi-genetic elements and environmental elements (Jin & Patti, 2009). Regions and lifestyles would be considered as environmental elements, while family history would be considered as the genetic risk (Jin & Patti, 2009). One study examined the correlation between family histories of
obesity and T2DM and the prevalence of T2DM in children (Rosenbaum et al., 2013). The result revealed that the increased possibility of insulin secretory deficiency resulted from the family history of T2DM, and the increased trends of obesity and insulin resistance in children were related to a family history of obesity (Rosenbaum et al., 2013).

In addition, according to Diabetes Report Card in 2012, about 33% of American adults have prediabetes, and among them, approximately 10% of those with prediabetes has never been told that they have prediabetes (National Center for Chronic Disease Prevention and Health Promotion & Division of Diabetes Translation, 2012). Over all about 40% of the U.S. population may be in the hyperglycemic state (National Center for Chronic Disease Prevention and Health Promotion & Division of Diabetes Translation, 2014).

3. Pathogenesis

The main reasons for T2DM, in general, are insulin production defect and insulin resistance. Pancreatic β cells cannot produce enough insulin any more, and the target tissues become less sensitive to insulin. These two maladaptive mechanisms always work together in a patient’s body and they act synergistically leading to diabetes (Watanabe et al., 2007). In order to identify the genetic fact with the two mechanisms, former research was based on family studies and the candidate gene to determine the accurate pathogenic genes (Watanabe et al., 2007). So far, genome-wide association studies (GWAS), and large-scale association studies have discovered
many genes that are believed to account for a certain degree of T2DM susceptibility with the functions of these genes related to insulin action in liver, muscle, or adipose (Sun et al., 2014; Jin & Patti, 2009).

The target tissues of insulin are liver, skeletal muscle, and adipose tissue (Jin & Patti, 2009). When insulin lacking, or insulin sensitivity of tissues decreasing, these tissues are not able to obtain enough glucose from blood efficiently, which leads tissues to have difficulty in working normally (Sun et al., 2014). The liver plays an important role in metabolism. Normally, liver maintains glucose homoeostasis through changing glucose to glycogen for storage during fuel abundance, and breaking down glycogen and synthesizing glucose from non-carbohydrate sources (gluconeogenesis) during fasting (Jin & Patti, 2009). The responsibility of insulin in the liver is to suppress gluconeogenesis and improve glycogen synthesis. Lipid accumulation and excessive counter-regulatory hormone function can promote a low sensitivity to insulin (Jin & Patti, 2009). In that case, the level of blood glucose may gradually increase without returning to normal (Jin & Patti, 2009; Sun et al., 2014; Wilcox, 2005).

Skeletal muscle is considered as the largest insulin-sensitive tissue (Jin & Patti, 2009). Skeletal muscle is sensitized by insulin to promote glucose transport into muscle cells in order to oxidize it, and to promote storage as glycogen (Jin & Patti, 2009). Insulin resistance in skeletal muscle could have a serious influence on the glucose balance in the whole body, because in a healthy
condition, insulin enables glucose to enter cells in the human body, especially muscle and liver
cells (Pinney & Simmons, 2010). When skeletal muscle resists the glucose-entering signal from
insulin, the majority of glucose remains in the blood resulting in a continuing high blood glucose
level. People with a family history of diabetes have a higher risk of lack of reduced
insulin-stimulated blood glucose disposal by skeletal muscle since genetic problems on insulin
resistance may exist through heredity (Pinney & Simmons, 2010). Also, if intramyocellular lipid
has accumulated, muscle insulin resistance occurs because the insulin signal transduction is
diminished (Jin & Patti, 2009). For instance, destruction of GLUT4, a glucose transporter
responsible for the final step of transporting glucose into muscle cells, contributes to severely
impaired insulin sensitivity (Pinney & Simmons, 2010).

In adipose tissue, fatty acids synthesis and lipolysis are constant processes. Insulin suppresses
lipolysis and promotes synthesis in normal, healthy people. One form of fatty acids,
non-esterified fatty acids, can stimulate insulin secretion when excessive (Wilcox, 2005). The
source of non-esterified fatty acids is from dietary lipids. Another source is from excessive
carbohydrate, which can be transformed to non-esterified fatty acids as storage. In the human
body, non-esterified fatty acids can be released through liver into blood circulation. When the
level of non-esterified fatty acids increases, out of the normal range, insulin secretion will be
stimulated (Wilcox, 2005). Therefore, rapid elevation of non-esterified fatty acids in plasma
contributes to increased glucose stimulated insulin secretion (GSIS), which can result in reduction of insulin sensitivity and insulin synthesis/production in tissues (Wilcox, 2005).

The collective effect of the metabolic problems of the three main tissues results in additional insulin impairments and hyperglycemia. Low insulin sensitivity at the β cell level leads to the dysfunction of the β cell. To be more specific, “the glucotoxicity, lipotoxicity, and other symptoms like pro-inflammatory cytokines, and impaired incretin secretion, may cause progressive deterioration of β cell” (Jin & Patti, 2009). Therefore, in a vicious circle, impaired insulin production as well as secretion negatively increases impaired insulin sensitivity by the frequent stimulations of high blood glucose levels, and later it turns prediabetes to diabetes.

4. Diagnosis

At present there are four ways to diagnose T2DM: Glycated Hemoglobin (A1c), Fasting Plasma Glucose (FPG), Oral Glucose Tolerance Test (OGTT), and Random/Casual Plasma Glucose Test (American Diabetes Association, 2014), which is exactly the same four methods to diagnosis T1DM, and is clearly introduced in Overview of Type 1 Diabetes.

5. Treatment

Medical care combined with nutrition therapy is recommended to manage adults with T2MD or adults at high risk for T2DM. A healthful eating pattern, regular physical activity, and
pharmacotherapy are key components of diabetes management (American Diabetes Association, 2014; Evert et al., 2013).

5.1 Medical Nutritional Therapy

Medical Nutrition therapy is an important component of diabetes treatment and management (American Diabetes Association, 2014). Diabetes medical nutrition therapy provides the effective approaches to take care of diabetes across the life span (American Diabetes Association, 2015). Based on both Nutrition Therapy Recommendations for the Management of Adults With Diabetes and the Standards of Medical Care in Diabetes, the key objectives are:

- **Attain individualized glycemic, blood pressure, and lipid goals.** General recommended goals from the ADA for these markers are as follows: A1c <7%; blood pressure <140/80 mmHg; LDL cholesterol <100 mg/dL; triglycerides <150 mg/dL; HDL cholesterol >40 mg/dL for men; HDL cholesterol >50 mg/dL for women (Evert et al., 2013).

- **Achieve and maintain body weight goals** (Evert et al., 2013). As considered, the normal body mass index (BMI) is ranged from 18.50 to 24.99 kg/m². Overweight was defined as BMI of 25 to 29.9 kg/m², and obesity was BMI 30 kg/m² or more.

- **Delay or prevent complications of diabetes** (Evert et al., 2013).

5.1.1 Macronutrient Distribution

Macronutrients are carbohydrate, protein, and fat. Evidence-based research indicates that no ideal calorie distribution from carbohydrate, protein, and fat exists. As for the current average, according to observational studies, “people with diabetes eat a dietary pattern of 45% calories
from carbohydrate, around 36 to 40% calories from fat, and the remaining calories protein” (Evert et al., 2013). However, an optimal macronutrient percent of calories are individualized, and an assessment should be down to analyze current eating patterns, patients’ preferences, and metabolic goals (Evert et al., 2013).

5.1.2 Carbohydrate

Proper carbohydrate intake remains a key strategy in achieving glycemic control. But so far, not enough evidence has been collected to support an ideal amount or an accurate percentage of carbohydrate intake daily, which can be applied for the majority of population (American Diabetes Association, 2015). However, a lower level of carbohydrate intake may be considered as less than 40% of total calories daily, and a higher acceptable level of carbohydrate intake could be more than 50% of total calories, and the average value is about 45% (Evert et al., 2014; Evert et al., 2013). No matter what exactly daily intake percentage is, the concern should be the balance of the carbohydrate counts and the available insulin used, if insulin is being used (American Diabetes Association, 2015). For example, one unit of fast-acting insulin can be used to cover 15 grams of carbohydrate, and 15 gram of carbohydrate is usually considered as 1 carb choice (American Diabetes Association, 2015). As for patients not using insulin, they should set a limit for his/her maximum amount of carbohydrate to eat for each meal (breakfast, lunch, dinner, and snacks), and learn to read food labels to calculate the carbohydrate intakes (Warshaw & Kulkarni, 2011). A lot of carb counting books or websites provide basic food tables and
healthy recipes to help people control total carbohydrate intakes per day. If some patients have health literacy and numeracy concerns, the carbohydrate counting may focus more on portion control or healthful food choices, which may be easier to use (American Diabetes Association 2014). Good sources of carbohydrate are starches, fruits, whole grains, and dairy products. Vegetables are primarily carbohydrate, but have few grams per serving unless they are a kind of starchy vegetable such as potatoes or corn (American Diabetes Association, 2014).

Two concepts, glycemic index (GI) and glycemic load (GL), have been considered in terms of carbohydrate intake (Thomas & Elliott, 2010). The GI ranks carbohydrates based on the extent of raising blood glucose level after eating (Foster-Powell et al., 2002). The measuring method uses specific food containing 25 or 50 grams of carbohydrate (Foster-Powell et al., 2002). Finger-prick blood samples are taken in every 15-30 minutes increments for a total of two hours to form blood glucose curve (Foster-Powell et al., 2002). The area between the curve and the fasting blood glucose level line represents the total rise of blood glucose (Foster-Powell et al., 2002). Dividing the area value of the test food by the area value of consuming the same amount pure glucose (25 or 50 gram) and then multiplying by 100 is GI (Foster-Powell et al., 2002). The GL of food is a number that estimates how much the food will raise a person’s blood glucose level after eating it (Fabricatore et al., 2011). The GL is based on the GI, and is defined as the grams of available carbohydrate in the food times the food's GI and divided by 100 (Fabricatore et al., 2011).
High GI food means this kind of food is easily and rapidly digested and absorbed, which contributes to a rapid increase in blood glucose level. It stimulates the insulin response system, and it can enhance the burden of insulin secretion when the pancreas is compromised (Thomas & Elliott, 2010). On the contrary, low GI foods lead to a gradual rise, or a low rise, in blood glucose. This may reduces the total insulin secretion amount and insulin resistance. Therefore, some suggest that people with diabetes should substitute low-GI foods for higher-GI foods in order to manage to control blood sugar changes (Evert et al., 2014). However, consuming high or low GI foods in the presence of other foods will change the absorption of the GI food, thus making it difficult to use in daily life.

The consumption of fructose by people with diabetes and other people with hypertension or/and obesity has been a controversial since the 1950s. People with diabetes are allowed to consume fructose. The advantages of fructose, compared with glucose, include its utilization of insulin independent, and its slower absorption through the gastrointestinal tract than that of glucose, sucrose, and maltose (Cohen et al., 1977; Moorhouse & Kark, 1957).

5.1.3 Fiber

The fiber intake recommendation for adults with diabetes is not significantly different from the general population (Evert et al., 2013). So far, some research has proved fiber intakes of 50 g/day
or more can improve glycemic control, support weight loss, and lower A1c, but due to the limited sample size and experiment time, no reliable and consistent results are concluded (Evert et al., 2014). Generally the function of dietary fiber intake for people with diabetes is associated with decreased all-cause mortality, because of the reduction of systemic inflammation (Burger et al., 2012). In order to meet the fiber need, adults with diabetes are recommended to intake more than half of all grain as whole grains (U.S. Department of health and Human Services and U.S. Department of Agriculture & American Diabetes Association, 2014).

5.1.4 Fat

Total fat intake for people with diabetes should be individualized. An acceptable fat intake range is 20% - 35% of total calories daily (American Diabetes Association, 2014). However, the recommended distribution of fat is not specifically for people with diabetes (Evert et al., 2014). A Mediterranean-style dietary pattern, which could benefit glycemic control and cardiovascular disease (CVD) risk factors, is recommended as an effective alternative to a lower-fat, high-carbohydrate eating pattern (American Diabetes Association, 2014). Several research through randomized trials proved the benefits of Mediterranean-style dietary pattern on diabetics. For example, Dr. Esposito conducted a randomized trial to serve Mediterranean-style diet or a low-fat diet to 215 overweight people with newly diagnosed T2DM for 4 years (Esposito et al., 2009). The results implied participants with Mediterranean-style diet lost more weight and experienced greater improvements in glycemic control than those with low-fat diet (Esposito et
al., 2009). Dr. Salas-Salvado conducted a study on incidence of type 2 diabetes with the Mediterranean-style diet intervention (Salas-Salvado et al., 2011). The conclusion of the study was “Mediterranean-style diet without calorie restriction was effective to prevent diabetes in participants who had a high cardiovascular risk” (Salas-Salvado et al., 2011). Furthermore, fat quality is much more important than fat quantity (Evert et al, 2014). Fats are categorized as saturated and unsaturated, monounsaturated-fat acids and polyunsaturated-fat acid, or cis-fats and trans-fats. Research studied and examined the relations between different types of dietary fat intake and risk of T2DM in women. The results indicated that total fat intake was not associated with the diabetic risk, and intakes of saturated fatty acids were not significantly related to the diabetic risk, while trans fatty acids were extremely significant to associate with the risk of diabetes (Salmeron et al., 2001). In addition to the incidence of T2DM in women, women with diagnosed T2DM who had a higher intake of cholesterol and saturated fat would lead to the increasing risk of cardiovascular disease (Salmeron et al., 2001). Therefore, no trans-fats intake, low saturated fatty acids intake (less than 10% of calories per day), and low dietary cholesterol (300mg/day) could reduce negative consequences, such as complications of diabetes (Evert et al., 2014). To be more specific, the recommended intake amount of transfats, saturated fat, and cholesterol to people with diabetes is the same as the recommended amount to the general public (Evert et al., 2014). The recommended fat eating pattern can reduce cardiovascular disease risk. People with diabetes should eat items rich in monounsaturated fatty acids and polyunsaturated fatty acids, such as canola, corn, soy, and sunflower oils instead of butter, marbled meat, and
full-fat dairy products in order to follow the guidance (Evert et al., 2014). As for monounsaturated fatty acids, according to clinical trials, a plenty of RCTs, and academic review reports, rich monounsaturated fatty acid eating pattern may promote better glycemic control with decreasing the risk of cardiovascular disease (Evert et al., 2013). In Dr. Maedler’s research, monounsaturated fatty acids prevent the deleterious influence of high glucose levels through regulating β cell proliferation and apoptosis (Maedler et al., 2003). To be more specific, saturated fatty acids can accelerate β cell DNA fragmentation and suppress β cell proliferation; on the contrary, the monounsaturated fatty acids, such as palmitoleic acid, do not affect β cell DNA fragmentation but increase β cell proliferation (Maedler et al., 2003). A randomized, crossover, multicenter study conducted by Dr. Parillo focused on 42 outpatients with type 2 diabetes (Parillo et al., 1992). Participants were provided either a high-monounsaturated fatty acids diet or a high-carbohydrate diet, and both diets were low in saturated fatty acids and the same amounts of fiber (Parillo et al., 1992). The result was “a high-monounsaturated fatty acids diet contributed to lower levels of fasting plasma triglycerides and very-low-density lipoprotein cholesterol concentrations, which indicated the decreased risk of cardiovascular disease” (Parillo et al., 1992). General omega-3 fatty acids intake recommendation, EPA and DHA intake of 0.3-0.5 g/day and ALA intake of 0.8-1.1g/day, is also recommended for people with diabetes (Nishida et al., 2006). Although it may not have direct positive function to glycemic balance from current RCTs results, it does benefits the whole body system health. Food, like fish, rich in long-chain n-3 fatty acids and n-3 linoleic acid are best recommended for people (American Diabetes
Association, 2014). To eat fish, especially fatty fish, at least two times every week is an ideal eating pattern for people with or without diabetes (Evert et al., 2014).

5.1.5 Protein

No ideal amount of protein intake recommendation is diabetes-specific. Individual plans for protein intake is needed for people with diabetes and should consider parents’ preference, eating habits, short-term goal, and long-term goal. Commonly, the protein intake distribution is around 25%-35% of total calorie daily. One consideration is the increased risk for chronic kidney disease, such as diabetic nephropathy, that occurs with diabetes. Kidney disease leads to not only small waste molecules, but also useful substance, such as protein pass through the holes in the filter of millions of tiny blood vessels in kidney system (American Diabetes Association, 2014). Since no apparent symptoms existing in the early stage of diabetic nephropathy, diabetic nephropathy usually is not very easy to be noticed until the time that most function is gone. When entering the late stage of diabetic nephropathy, patients have to follow a low-protein diet to protect the weakness of kidney capacity and functions. But in order to balance the necessary nutrients and the load of kidney, diabetic people with diabetic nephropathy must talk with their doctors or dietitians first before starting a low-protein eating pattern (American Diabetes Association, 2014). In recent decades, in the U. S., about 20-30% of type 1 or type 2 diabetic patients have developed diabetic nephropathy (American Diabetes Association, Nephropathy in Diabetes, 2004). Since the people with diabetes live longer and longer, the number of the cases
of end-stage renal failure in people with T2DM has rapidly increased (Ritz & Stefanski, 1996). From 1988 to 2008, the overall prevalence of diabetic nephropathy in T2DM patients has remained around 35% (Inzucchi, 2012). Patients with T2DM aged more than 65 years have a higher prevalence of diabetic nephropathy, approximately 50% (Inzucchi, 2012).

5.1.6 Calories

Research has not supported an ideal percentage of calories from carbohydrate, protein, and fat for those with diabetes (Evert et al., 2013). Eating patterns, personal preference, culture, religion, health belief, knowledge, weight goal, access to food, other health concerns, and affordability all affect the macronutrient distribution decisions (Salas-Salvado et al., 2011; Evert et al., 2013). Individualized needs assessment should be conducted firstly to focus on those aspects. However, on average, the calorie distribution for those with diabetes is about 45% of total calories from carbohydrate, 36-40% from fat, and the remaining 15-19% from protein (Evert et al., 2013; American Diabetes Association, 2015). Since different research indicated different ranges of carbohydrate allowance, to synthesize most results, the allowable carbohydrate amount is at most around 60% (Evert et al., 2013). “If the person with diabetes sets a strategy to lose weight, a low-fat diet emphasizing less than 30% of total calories from fat with less than 10% of total calories from saturated fat, no trans fat, or cholesterol intake is often recommended” (Evert et al., 2013). Vegetables, fruits, starches, lean protein, and low-fat dairy products are highly recommended to reduce calories for weight loss, within a weight loss and eating plan (Evert et al.,
“If the person is required to be a low carbohydrate diet, according to studies, “a very low carbohydrate diet is defined as 21 to 70g/day of carbohydrate, while a moderately low carbohydrate is considered as 30 to less than 40% of total calories from carbohydrate” (Evert et al., 2013). As for total calories per day, the range is usually from 1500 to 2500 Calories per day (American Diabetes Association, 2015). But no specific recommendation is fit for all people with diabetes. People with diabetes setting total calorie goals should depend on individualized situations following registered dietitians suggestions and recommendations (American Diabetes Association, 2015).

5.1.7 Alcohol

Alcohol consumption guideline for diabetes is that moderate drinking, one drink per day or less for adult women, and two drinks per day or less for adult men (American Diabetes Association, 2014). Based on some epidemiologic data reported, moderate drinking may even have benefits on glycemic control improvement and cardiovascular risk reduction (Evert et al., 2014). However, with three drinks per day or more, the negative influence of alcohol consumption may be a delayed symptom of hypoglycemia (Evert et al., 2014). The symptom is more likely to happen when patients are taking insulin or insulin secretagogues (Evert et al., 2014). A possible way to mitigate the situation is to consume alcohol with food (Evert et al., 2014).

5.1.8 Sodium
Sodium, as a common cooking and food processing seasoning, is over consumed by the majority of people (Mitka, 2013). Currently, the average amount of sodium intake is about 3400 mg/day, which means on average more than 85% of American men and women consume sodium that far exceed the maximum recommended level of intake (Mitka, 2013). The recommendation for the general population is less than 2300 mg/day, and for people who are “51 and older as well as those of any age who are African American or have hypertension, diabetes, or chronic kidney disease” (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010), the reduced intake recommendation is 1500 mg/day (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010). Hypertension is one of complications associated with diabetes. But since there is still lack of evidence for such a low sodium intake benefit in those with diabetes and hypertension, individualize sodium consumption plans (less than 2300 mg/day) should be decided by personal doctors or health management groups to meet patient personal short-term or long-term goals (American Diabetes Association, 2014 & Evert, 2014). In addition to eating a balanced diet as part of medical nutritional therapy, regular physical activity is also important for T2DM to control the level of blood glucose (American Diabetes Association, 2014).

5.2 Physical activities

Physical activity is a significant part of diabetes management, whose feature, compared with other management plans, is that it cannot be easily measured and short-term effects are not
readily seen. But in a long-term regular physical activity program has been proved to benefit by improving blood glucose control, reducing the risk of cardiovascular diseases, and keeping fit with proper weight loss (Gerstel et al., 2013). The physical activity recommendations for diabetes in adults and children are not the same. Adults with diabetes are recommended to engage in “at least 150 min/week of moderate-intensity aerobic physical activity with 50-70% of maximum heart rate” (American Diabetes Association, 2015), and it should “spread over at least 3 days/week with no more than 2 consecutive days without physical activity” (American Diabetes Association, 2015). With 65 years of age or more, patients are also encouraged to follow the recommendation as long as they can (American Diabetes Association, 2015). Walking and jogging are recommended most because of its safety and accessibility (American Diabetes Association, 2015). In addition to the recommendations for adults and children should be educated to participant in 60 minutes or more of physical activity per day (Gerstel et al., 2013). Meanwhile, children need to decrease sedentary activity, such as computer, Ipad, and smart phone use and television watching (Gerstel et al., 2013).

5.3 Medication

Medical care with multifactorial risk reduction strategies beyond glycemic control is required (American Diabetes Association, 2014).

5.3.1 Insulin

Insulin is a hormone produced by the β cells in the pancreas. In diabetes, where endogenous
insulin is not produced or not produced in sufficient quantities or sensitivity is low to normal insulin amounts, exogenous or insulin by injection is needed. Usually there are four main types of insulin, rapid-acting insulin, regular insulin (short-acting insulin), intermediate-acting insulin, and long-acting insulin (American Diabetes Association, 2013). The types of insulin used for treating T2DM are exactly the same as the types of insulin used for T1DM. Since in Overview of Type 1 Diabetes, it has introduced this section, and there is no repeat here.

5.3.2 Oral Medications

Several choices of oral medications could be made depending on individual situations. The common groups of oral medications are Sulfonylureas, Biguanides (metformin and phenformin), Meglitinides, Thiazolidinediones, Dipeptidyl-Peptidase IV inhibitors (DPP), and Alpha-Glucosidase Inhibitors.

Sulfonylureas mainly improve the insulin secretion of β cells (American Diabetes Association, 2013). Therefore, the drugs primarily lead to lower blood glucose concentrations (Groop, 1992). Sulfonylureas are generally well tolerated but carry a risk of hypoglycemia (Olokoba et al., 2012). These drugs are generally required to be taken one or two times per day. Biguanides are the most commonly used medications in overweight and obese patients (Olokoba et al., 2012). As a type of oral glucose-lowering agent, it treats non-insulin-dependent diabetes (Bailey, 1992). The main biguanides include metformin and phenformin (Bailey, 1992). They suppress hepatic
glucose production, increase insulin sensitivity, enhance glucose uptake by phosphorylating GLUT-enhance factor, increase fatty acid oxidation, and decrease the absorption of glucose from the gastrointestinal tract (Olokoba et al., 2012). Compared to phenformin, metformin does not have the risk of the association with lactic acidosis. Therefore, it is used more widely and in some cases works with sulfonylureas (Bailey, 1992). Meglitinides, with sulfonylureas together, act on the ATP-dependent K-channel by binding to a subunit in the pancreatic β cells thereby stimulating the release of insulin from the β cells (Olokoba et al., 2012; Pfeiffer, 2007). They usually are taken before every meal (American Diabetes Association, 2013). Thiazolidinediones are a kind of insulin sensitizer, selective ligands transcription factor peroxisomes proliferator-activated gamma (Olokoba et al., 2012). They help insulin work well in skeletal muscle, fat, and liver (American Diabetes Association, 2013). One typical situation is that patients are treated with thiazolidinediones when lifestyle intervention and metform therapy all have failed (Goldstein & Muller-Wieland, 2008). Dipeptidyl-Peptidase IV inhibitors (DPP) inhibit dipeptidyl peptidase-4 (DPP-4) and increase active levels of these hormones and, in doing so, improve islet function and glycemic control in T2DM (Olokoba et al., 2012).

Alpha-Glucosidase Inhibitors have not been widely used due to high rates of side effects, such as diarrhea and flatulence (Olokoba et al., 2012). However, they are likely to be safe and effective, especially for postprandial hyperglycemia (Olokoba et al., 2012). They are required to be taken after the first bite of a meal (Olokoba et al., 2012).
5.3.3 Dietary Supplements

Dietary supplements are defined as everything from vitamins, minerals, to herbs (American Diabetes Association, 2012). The primary types include botanicals, vitamins, minerals, fatty acids, and others (American Diabetes Association, 2012). Since these are all natural, they appear to be safe in general, and the effect may be mild, smooth, and not apparent (Yeh et al., 2003). A meta-analysis of randomized clinical trials was conducted to determine the effect of chromium, one of the common dietary supplements on insulin and glucose responses in both healthy participants and people with T2DM (Althuis et al., 2002). The results were that healthy subjects indicated no effect of chromium on glucose or insulin responses, and the effects with diabetics were inconclusive (Althuis et al., 2002).

Although the function of dietary supplements is mild, some severe side effects as well as drug interactions could happen. For example, some dietary supplements may have interactions with prescription drugs; some may interact with each other; or excessive intakes can cause other side effects (American Diabetes Association, 2015). Therefore, compared to taking dietary supplements, it is more often recommended to set individualized meal planning including optimization of food choices and food portions to meet the RDAs of all vitamins and minerals (American Diabetes Association, 2015). If having dietary supplements is what patients wish to do, then patients should talk to his/her private doctor first who knows his/her diabetes and other health situations well, which is a more scientific way to protect body (American Diabetes...
6. Summary

Type 2 Diabetes Mellitus is a complex heterogeneous metabolic disorder characterized by impaired insulin production and action, which contributes to the increased levels of blood glucose (Inzucchi, 2012; Jin & Patti, 2009). It is usually diagnosed in middle age or later by severe progressive defects in insulin production and action (Inzucchi, 2012). In the United States, the total number of people with diabetes (type 1 and type 2) was 29.1 million, which was a noticeable issue (National Center for Chronic Disease Prevention and Health Promotion & Division of Diabetes Translation, 2014). Ethnicity is one of the strongest factors relative to the prevalence of T2DM. Different regions, genetics, family histories, and lifestyles are the key aspects of ethnicities to have impacts on the prevalence of T2DM. For pathogenesis of T2DM, pancreatic β cells producing not enough insulin, and the target tissues less sensitive to insulin, are the primary causes contributing to T2DM. In a vicious circle, impaired insulin production as well as secretion negatively increases impaired insulin sensitivity by the frequent stimulations of high blood glucose levels, and later it turns prediabetes to diabetes. Lastly when concerning the treatment of T2DM, it consists of medication, medical nutritional therapy, and physical activity.

Overview of Elderly with Diabetes

1. Differences between younger and older adults with diabetes
The age definition of older adults with diabetes mellitus is aged 65 years or more. In the U.S., in this age group there are around 10.9 million people with diabetes, including both diagnosed and undiagnosed which was showed from National Diabetes Statistics Report in 2014. Diabetes in the older adult is more complex compared with diabetes in adolescents, young adults, and the middle-aged group.

The situations of elderly people with diabetes are complicated. One consideration is when diabetes starts. Some elderly individuals developed diabetes in their younger years, while others have only been diagnosed recently (American Diabetes Association, 2015). Other considerations include complications and comorbidity. Some elderly individuals have a substantial number of complications at varying stages of severity or significant comorbidities because of the length of time having diabetes, no matter whether diagnosed or undiagnosed. Some elderly individuals may have few complications and comorbidities (Blaum, 2002). Also, there is an issue of years while having diabetes but being undiagnosed. Some elderly individuals are in an undiagnosed situation for many years, which indicates they may have diabetes in a younger age but without treatment and management. On the contrary, some elderly individuals have diabetes diagnosed early in the period of hyperglycemia (American Diabetes Association, 2015). Therefore, they are well educated about diabetes and learn to how to manage by themselves. Precisely because those multiple possibilities of situations exist, the consequences of diabetes in elderly people are difficult to accurately assess, which leads to higher mortality and body function loss (Kirkamn et
Actually, compared with few complications, the millions of elderly people with diabetes have significant complications (Blaum, 2002). The top diabetes-related issues are hypertension, microvascular and cardiovascular diseases, end-stage renal disease, and eye and foot diseases (American Diabetes Association, 2015; Kirkamn et al., 2012). The common serious symptoms include depression, cognitive impairment, functional disability, and persistent pain (American Geriatrics Society Expert Panel, 2013). Premature death, as a result, happens (American Diabetes Association, 2015). Compared with elderly people with diabetes, younger diabetic patients have fewer and less severe complications. Therefore, greater attention to elderly people’s clinical and functional heterogeneity should be paid both in research and clinical care.

2. Care in Assisted Living and Nursing Homes

2.1 The Challenge of Care for Diabetes in Elderly

2.1.1 Few Studies Focusing on Older People with Diabetes

Randomized clinical trials (RCTs) in diabetes lay the foundation for our current understanding of diabetes treatments (Kirkamn et al., 2012). However, most of RCTs mainly chose middle-aged diabetic patients as their participants. Only a limited number of RCTs significantly focused on elderly people with diabetes (Kirkamn et al., 2012; Blaum, 2002). Since issues and conditions as mentioned above may be very different, physicians, dietitians, and patients themselves should
not infer interventions and treating methods from those trials in younger objects (Blaum, 2002). Furthermore, if focusing on geriatric syndromes, such as depression, cognitive impairment, and persistent pain, even if substantial studies in general populations of elderly people have approved effective interventions to improve those symptoms, still few research studies have focused on the geriatric syndromes in elderly people with diabetes to determine best practice treatment (American Geriatrics Society Panel, 2003). In addition, although the elderly group have been included in some research programs, such as Diabetes Prevention Program, and the Action to Control Cardiovascular Risk in Diabetes trail, people who are aged 75 years or more generally are excluded from RCTs (Knowler et al., 2002; Gerstain et al., 2008). Therefore, little has been reported so far in diabetes in people aged 75 years or more (Blaum, 2002).

2.1.2 Few Guidelines Published especially for Elderly People with Diabetes

The care of elder adults with diabetes is very complicated depending on patients’ functional status, cognitive situation, economical condition, and life expectation (American Diabetes Association, 2015). However, at present, few guidelines are particularly targeted for elderly diabetic patients’ intervention and treatment, which leads clinicians and physicians to be in a dilemma. For instance, for some elderly adults with diabetes, especially those with certain disability or impairment, “there is a small but definite risk of adverse effects of treatments, such as adverse drug effects, orthostatic hypotension and falls, adverse effects of aspirin or statins, and hypoglycemia” (Blaum, 2002).
As far as the author’s concerned, two published guidelines precisely targeted towards the needs of elderly with diabetes are *Guidelines for Improving the Care of the Older Person with Diabetes Mellitus*, 2003 written by California Healthcare Foundation/American Geriatrics Society Panel, and *Guidelines for Improving the Care of Older Adults with Diabetes Mellitus: 2013 Update*, 2013, written by American Geriatrics Society Expert Panel. Two published guidelines concerned the long-term care of diabetes management on the elderly: *Diabetes Management in Long-Term Care Facilities: A practical Guide 6th Edition* authored by Minnesota State Diabetes Educators, and *Diabetes Management in Long-Term Settings* authored by Dr. Haas and Dr. Burke.

2.2 The Key Aspects in Current Guidelines for Elderly Adults with Diabetes

The guidelines for clinicians, nurses, patients, and their families to care for the elderly with diabetes in order to achieve specific goals are listed in the following from the official guidelines called *Guidelines for Improving the Care of Older Adults with Diabetes Mellitus: 2013 Update*.

2.2.1 Aspirin

*If an older adult has DM and known cardiovascular disease, daily aspirin therapy 81 to 325 mg/day is recommended, unless contraindicated or the patient is taking other anticoagulant therapy* (American Geriatrics Society Expert Panel, 2013).

2.2.2 Smoking
Older adults with DM who smoke should be assessed for readiness to quit and should be offered counseling and pharmacologic interventions to assist with smoking cessation (American Geriatrics Society Expert Panel, 2013).

2.2.3 Hypertension

If an older adult has DM and requires medical therapy for hypertension, then the target blood pressure should be less than 140/90 mmHg if it is tolerated. There is potential harm in lowering systolic blood pressure to less than 120 mmHg in older adults with type 2 DM (American Geriatrics Society Expert Panel, 2013).

Older adults with DM and hypertension should be offered a therapeutic intervention to lower blood pressure within 3 months if systolic blood pressure is 140 to 160 mmHg or diastolic blood pressure is 90 to 100 mmHg or within 1 month if blood pressure is greater than 160/100 mmHg (American Geriatrics Society Expert Panel, 2013).

Older adults with DM who are taking an ACE inhibitor or ARB should have renal function and serum potassium levels monitored after approximately 1 to 2 weeks of initiation of therapy, with each dosage increase, and at least yearly (American Geriatrics Society Expert Panel, 2013).
Older adults with DM who are prescribed a thiazide or loop diuretic should have electrolytes checked after approximately 1 to 2 weeks of initiation of therapy, with each dosage increase, and at least yearly (American Geriatrics Society Expert Panel, 2013).

2.2.4 Glycemic Control

Target goal for glycosylated hemoglobin (A1c) in older adults generally should be 7.5% to 8%. A1c between 7% and 7.5% may be appropriate if it can be safely achieved in healthy older adults with few comorbidities and good functional status. Higher A1c targets (8–9%) are appropriate for older adults with multiple comorbidities, poor health, and limited life expectancy. There is potential harm in lowering A1c to less than 6.5% in older adults with T2DM (American Geriatrics Society Expert Panel, 2013).

Older adults with DM and whose individual targets are not being met should have their A1c levels measured at least every 6 months and more frequently, as needed or indicated. For older adults with stable A1c over several years, measurement every 12 months may be appropriate (American Geriatrics Society Expert Panel, 2013).

For older adults with DM, a schedule for self-monitoring of blood glucose should be considered, depending on functional and cognitive abilities. The schedule should be based on the goals of

The management plan for older adults with DM with severe or frequent hypoglycemia should be evaluated; the patient should be offered referral to a DM educator, endocrinologist, or diabetologist, and the individual and any caregivers should have more frequent contacts with the healthcare team while therapy is being readjusted (American Geriatrics Society Expert Panel 2013).

If an older adult is prescribed an oral antidiabetic agent, metformin, unless contraindicated, is the preferred first-line agent in combination with lifestyle therapy (American Geriatrics Society Expert Panel 2013).

Use estimated glomerular filtration rate rather than serum creatinine levels to guide metformin use. Specifically, do not use metformin in patients with an estimated glomerular filtration rate of less than 30 mL/min per 1.73 m². For patients with an estimated glomerular filtration rate between 30 to 60 mL/min per 1.73 m², check renal function more frequently and use lower dosages (American Geriatrics Society Expert Panel 2013).

2.2.5 Lipids
For older adults with DM and dyslipidemia, efforts should be made to correct the lipid abnormalities if feasible after overall health status is considered (American Geriatrics Society Expert Panel 2013).

Pharmacologic therapy with a statin is recommended in addition to medical nutrition therapy and increased physical activity unless contraindicated or not tolerated (American Geriatrics Society Expert Panel 2013).

Older adults with DM who are newly prescribed a statin should have alanine aminotransferase level measured before treatment with the new medication begins and as clinically indicated thereafter (American Geriatrics Society Expert Panel 2013).

2.2.6 Eye Care and Food Care

Older adults with new-onset DM should have an initial screening dilated-eye examination with funduscopy performed by an eye care specialist (American Geriatrics Society Expert Panel 2013).

Older adults with DM and who are at high risk of eye disease (symptoms of eye disease present; evidence of retinopathy, glaucoma, or cataracts on an initial dilated-eye examination or subsequent examinations during the prior 2 years; A1c $\geq$ 8.0%; type 1 DM; or blood pressure
≥140/90 mmHg) on the prior examination should have a screening dilated-eye examination performed by an eye care specialist with funduscopy training at least annually. Persons at lower risk or after one or more normal eye examinations may have a dilated-eye examination at least every 2 years (American Geriatrics Society Expert Panel 2013).

Older adults with DM should have a careful foot examination at least annually to check skin integrity and to determine whether there is loss of sensation or decreased perfusion and more frequently if there is evidence of any of these findings (American Geriatrics Society Expert Panel 2013).

2.2.7 Nephropathy Screening

A test for the presence of albuminuria should be performed in patients at diagnosis of type 2 DM. After the initial screening and in the absence of previously demonstrated macro- or microalbuminuria, a test for the presence of microalbuminuria should be performed annually (American Geriatrics Society Expert Panel 2013).

2.2.8 Diabetes Self-Management Education and Support

Persons with DM and, if appropriate, family members and caregivers should receive diabetes self-management education and support (DSME/S) with reassessment and reinforcement periodically as needed (American Geriatrics Society Expert Panel 2013).
The monitoring technique of older adults with DM who self-monitor blood glucose levels should be routinely reviewed (American Geriatrics Society Expert Panel 2013).

Older adults with DM and normal cognition and functional status should perform at least 150 minutes per week of moderate-intensity aerobic physical activity. Unless there are contraindications, older adults with DM should be advised to perform aerobic and resistance exercises to the best of their ability under the direction of their healthcare provider (American Geriatrics Society Expert Panel 2013).

Older adults with DM should be evaluated regularly for diet and nutritional status and, if appropriate, should be offered referral for culturally appropriate medical nutrition therapy (MNT) and counseled on the content of their diet (e.g., intake of high-cholesterol foods and appropriate medical nutrition therapy and counseled on the content of their diet and on the potential benefits of weight reduction (American Geriatrics Society Expert Panel 2013).

Older adults with DM who are prescribed a new medication and any caregiver should receive education about the purpose of the drug, how to take it, and the common side effects and important adverse reactions, with reassessment and reinforcement as needed (American Geriatrics Society Expert Panel 2013).
Older adults with DM and any caregiver should receive education about risk factors for foot ulcers and amputation. Physical ability to provide proper foot care should be evaluated, with reassessment and reinforcement periodically as needed (American Geriatrics Society Expert Panel 2013).

2.2.9 Depression

Older adults with DM are at greater risk of major depression and should be screened for depression during the initial evaluation period (first 3 months) and if there is any unexplained decline in clinical status (American Geriatrics Society Expert Panel 2013).

Older adults with DM who present with new-onset or a recurrence of depression should be treated or referred within 2 weeks of presentation, or sooner if they are a danger to themselves, unless there is documentation that the patient has improved (American Geriatrics Society Expert Panel 2013).

Older adults who have received therapy for depression should be evaluated for improvement in target symptoms within 6 weeks of the initiation of therapy (American Geriatrics Society Expert Panel 2013).
2.2.10 Polypharmacy

*Older adults with DM should be advised to maintain an updated medication list for review by the clinician* (American Geriatrics Society Expert Panel 2013).

*The medication list of an older adult with DM who presents with depression, falls, cognitive impairment, or urinary incontinence should be reviewed* (American Geriatrics Society Expert Panel 2013).

2.2.11 Cognitive Impairment

*Clinicians should assess older adults with DM for cognitive impairment using a standardized screening instrument during the initial evaluation period and with any significant decline in clinical status. Increased difficulty with self-care should be considered a change in clinical status* (American Geriatrics Society Expert Panel 2013).

*If there is evidence of cognitive impairment in an older adult with DM and delirium has been excluded as a cause, then an initial evaluation designed to identify reversible conditions that may cause or exacerbate cognitive impairment should be performed with the first 3 months after diagnosis and with any significant change in clinical status* (American Geriatrics Society Expert Panel 2013).
2.2.12 Urinary Incontinence


*If there is evidence of urinary incontinence in the evaluation of an older adult with DM, then an evaluation designed to identify treatment causes of urinary incontinence should be pursued* (American Geriatrics Society Expert Panel 2013).

2.2.13 Injurious Falls

*Older adults with DM should be asked about falls every 12 months or more frequently if needed. If an older adult presents with evidence of falls, the clinician should document a basic falls evaluation, including an assessment of injuries and examination of potentially reversible causes of the falls* (American Geriatrics Society Expert Panel 2013).

2.2.14 Pain

*Older adults with DM should be assessed during the initial evaluation period for evidence of persistent pain* (American Geriatrics Society Expert Panel, 2013).

2.3 Guidelines for Elderly People in Diabetes are Different from General Guidelines

First of all, the guidelines should consider a patient’s comorbidities, functional status, and life
expectancy to set individualized goals (American Geriatrics Society Expert Panel 2013). The screening and detection to examine and monitor geriatric syndromes is important in the primary care for elderly diabetic patients (American Geriatrics Society Expert Panel 2013). Meanwhile, the screening frequency for complications should be individualized (Kirkamn et al., 2012). Also, some rapidly developing complications that can contribute to impaired functional status, such as visual issues, need additional attention (American Geriatrics Society Expert Panel 2013). In the guidelines for elderly adults, special care in prescribing and monitoring pharmacological therapy is required, because specific medicine for treating a specific disease may have negative effects on other syndromes (Kirkamn et al., 2012). Since many elderly people are on many medications, cost should be considered (American Diabetes Association 2015). Furthermore, older adults, who cannot meet the criteria of glycemic goals for the general population, should have relaxed individualized criteria, such as loosening the upper limit (Kirkamn et al., 2012). To sum, for elderly with diabetes, the treatment and management should be all individualized based on the available comprehensive information of elderly patients.

4. Summary

Older adults with diabetes are defined as patients aged 65 years or more. In the U.S., in this age group there are around 10.9 million people with diabetes. The situations of elderly people with diabetes are complicated. The onset time of diabetes, the duration of the undiagnosed condition, the duration of diagnosis, and the degree of diabetic complications all result in the level of
development and severity of diabetes. For diabetes long-term care of elderly, there are several challenges. Firstly, few studies focusing on the elderly with diabetes established little evidence on management and treatment. Secondly, few guidelines mainly aimed at the elderly with diabetes. Thirdly, there were a lot of differences between general guidelines and elderly guidelines, to which long-term care facilities should pay attention.
CHAPTER 3

METHODOLOGY

Search and Key Terms

The University of Illinois online library system was used to search. The key terms were “diabetes care” and “nursing home”. In addition, the American Diabetes Association Website (http://www.diabetes.org/) and Geriatrics Care Website (http://geriatricscareonline.org/) were also used to search for credible resources.

Reference Decision

After searching, 221 and 166 articles were found in Ebsco and PubMed through the University of Illinois online library system, respectfully. Among them, seven academic articles were determined as references. Then the seven articles were used to develop survey questions. The names of articles were listed as follow:

- *Diabetes Management in Skilled Nursing Facilities: A Role for Diabetes Educators* authored by E. D. Sullivan and J. Weyranch.

- *Diabetes Care in Nursing Homes: What Should We Expect?* authored by I. B. Hirsch.


- *Diabetes in the Nursing Home* authored by B. A. White, R. A. Jablonski, and S. Falkenstern.
• *Diabetes Management in the Nursing Home Setting: Clinical Tips* authored by J. Schultz.


• *Diabetes Management in the Nursing Home: A Systematic Review of the Literature* authored by T. J. Garcia and S. A. Brown.

In addition, two guidelines were selected as the standardized guidelines. The policies, requirements, and recommendations in the two guidelines would be considered as the standard answers to questions in the survey. The two guidelines were *Guidelines for Improving the Care of Older Adults with Diabetes Mellitus: 2013 Update* by American Geriatrics Society Guidelines, 2013; and *Diabetes Management in Long-term Care Facilities: A Practical Guide* 6th Edition by Minnesota State Diabetes Educators, 2011.

Based on these seven articles, initially 42 questions were created by the author in early January 2014. The questions mainly focused on staff, resident’s living, resident’s medications, medical conditions, the goal of diabetes care, and special and emerging care.

*Modification #1*

Four professors who had abundant experience on survey development helped the author review the content of each question and the format of the whole survey. Based on the professors’ advice, questions were classified by nine aspects which included Staff Available, Staff Training,
Resident Food, Resident Medical Evaluation, Resident Medications, Other Evaluations on Diabetes Care, Goals of Diabetes Care, Resident Education, and Special and Emerging Care.

IRB #1 and Modification #2

1. IRB #1 Application and Certification

The first Institutional Review Board (IRB) application for research involving human subjects was sent to the IRB office on February 12th, 2014. After one month, on March 12th, 2014, IRB#1 entitled “Diabetes Care in Long Term Care - Expert Panel Review of Survey Questions” was approved with the Protocol Number 14603 (see Appendix A). In that case it was ready to invite expert panels to provide suggestions and edits on the survey.

2. Expert Panel Information and Questionnaire Modification

Seventeen experts were invited through emails. The author attached three documents including an informational letter, two questionnaire drafts with one Word format and one PDF format. After six weeks, from March 21st to May 5th in 2014, eleven experts gave the responses. Among them, one of experts did not work on this area. The rest ten experts included four nurses, five dietitians, and one nursing home administrator. The five dietitians consisted of a clinical education specialist, director of nutrition office of elder affairs, a registered dietitian, a consulting dietitian, and a food and nutrition services manager. All of the ten people on the expert panel left comments and offered suggestions on the survey.
The author organized all ideas from the expert panel to an Excel table. Each question was arranged into each column, and each row indicated comments from each expert panel. The purpose of making such a table was to let the author clearly generate key suggestions for questions. After changing, most questions became yes or no or multiple choice. Only some open questions remained as short-answer questions.

*The Cover Letter Creation*

The function of the cover letter (see Appendix C) was to introduce comprehensive information of the survey in a short space. Therefore, the cover letter concisely consisted of invitation, introduction of the current issue on diabetes long-term care, the purpose of the study, the participant’s rights, the confidential policy, the survey’s requirements, and the author’s contact information.

*Final Survey Edition*

With adding the cover letter in the very beginning, the final edition of survey (see Appendix C) contained a total of 89 questions distributed in twelve categories. In addition to the nine categories mentioned before, three more categories were About You, Payment Structure, and Nursing Home Scale and Location. The survey had two formats. One was electronic format in
Qualtrics, which could create a link:

https://illinoisaces.co1.qualtrics.com/SE/?SID=SV_28Y1ErBdvGAjQQB

When clicking the link, the cover letter would automatically appear and provide directions to participants to operate one by one step. The other format was the Word format that was prepared to print out if necessary.

Three Methods to Send Survey

A list of all nursing homes in Illinois was obtained from one of the author’s committee members. The list included nursing home names, directors’ names, mailing addresses, and phone numbers. Based on nursing home names and mailing addresses, partially nursing homes’ home pages and email addresses were found. Overall there were 1176 nursing homes, 198 had email addresses, 277 had message-leaving boxes on their webs, and the rest 701 only provided phone numbers. Therefore, three methods were decided to conduct the survey. They were 1) to send out the Qualtrics link by emails, 2) to leave the Qualtrics link through message-leaving boxes, and 3) to orally invite by phone calls.

Email Contents, Message-Box Contents, and Phone Call Script Completion

Based on the three methods decided, the brief introduction information in the email was pasted into the message-leaving box by the author. Also the phone call script was created. The function of the script was to establish the general conversation content which ensured all the key points
would be mentioned in each phone call. In addition, a spreadsheet for phone interview was
developed to record the result of each phone call. The spreadsheet included nursing home names,
addresses, phone numbers, date called, the calling results (not there, not interested, interested
with accomplished by email link/paper copy/phone now/call another time), and other comments.

IRB #2

The second IRB application was for getting approval to formally send out the survey. All
documents included the electronic survey edition both in Word format and Qualtrics format, the
script of calling nursing homes, the list of nursing homes with email addresses, the list of nursing
homes with telephone numbers, the IRB exemption form, and the additional participants
information table. The second IRB Protocol Number was 15394, which was approved on
December 3rd in 2014 (see Appendix B).

The emails were sent out immediately after the approval. Every email contained a letter (email
content) with the survey link, and an attachment, the IRB #2 certification. The author sent all
e-mails by using the author’s University of Illinois email address. The subject line was research
survey on diabetes practice in long-term care and nursing homes from University of Illinois
master candidate. In four days, from February 4th to February 8th 2015, the email was sent to the
198 nursing homes. However, the issue was that after more than one month, on March 12th, 2015,
only 9 participants opened the survey and 2 participants completed the survey.
The emails were sent out first after approval. Every email contained a letter (email content) with the survey link, and an attachment, the IRB 2 approval. The author sent all emails out through Illinois.edu email address, and cc’d the author’s advisor. The subject line was research survey on diabetes practice in long-term care and nursing homes from University of Illinois master candidate. The author spent four days, from February 4\textsuperscript{th} to February 8\textsuperscript{th} 2015, completing sending out all emails to 198 nursing homes. However, after more than one month, on March 12\textsuperscript{th} only 2 questionnaires finished.

\textit{Survey Adjustment}

Facing the challenge of the low response rate and the high dropout rate, several changes were decided: firstly, to send reminder emails to nursing homes who had already got initial emails; secondly, to hire an native speaker student to conduct the phone interview part; thirdly, to add an incentive that participants would have a chance to win one of ten $30 gift cards or the American Diabetes Association book entitled \textit{Diabetes Management in Long-term Settings: A Clinician’s Guide to Optimal Care for the Elderly}; fourthly, to reach a wider audience through requesting an invitation to participate be placed on the website or communicated to groups' members through an eBlast or email for the Healthy Aging Dietetics Practice Group of the Academy of Nutrition and Dietetics, and through the Continuing Education Institute of Illinois, and through the Illinois Health Care Association.
IRB #2 Amendment

Because of the changes made, IRB #2 was needed to update. All updated documents sent to the IRB Office were IRB #2 Research Amendment, IRB additional investigators information, email for organization, reminder email content for re-contacting, and the edited cover letter with adding an illustration of the incentive. On April 16\textsuperscript{th}, 2015, the IRB office approved all the modifications.

Survey Response

By May 7\textsuperscript{th} all reminder to the former 198 nursing homes had been sent out. By May 9\textsuperscript{th} all three organizations had helped the author send out the survey link. By May 15\textsuperscript{th} all messages had been left to 277 nursing homes through the message-leaving boxes online. By June 18\textsuperscript{th} total 701 phone contacts had been completed. By June 20\textsuperscript{th}, the total number of responses was 219.

Data Analyzing Methods

There were three main perspectives to analyze data, which were to analyze the answer distribution of each question, to calculate each respondent’s score of each category to test hypotheses, and to complete the Chi-Square test to identify significant relationships between categories.

1. Answer Distribution
For multiple-choice questions, the percent of each choice was calculated. For short-answer questions, the similar responses were grouped as one answer. Then the percent of each answer was calculated.

2. Score Calculation

Firstly, the standard answers were found in the guidelines. For questions whose answers could not be accurately found in the guidelines, they would not be counted in the total scores. For each question with the standard answer, if a respondent choose the standard answer, he/she would get 1 point, otherwise he/she would get 0 points. The points would be added together to get the subtotal of each category for each respondent. Finally, the percent of subtotals of each category would be calculated.

3. Chi-Square Test

To compare every two categories by Chi-Square in SPSS, the P values would be obtained to indicate significant relationships. For those two categories with a significant relationship, Chi-Square would be used again to find out the questions that had significant relationships in the two categories. The study defined P value less than .05 was significant, and P value less than .001 was highly significant.
CHAPTER 4

RESULTS

A total of 219 subjects opened the survey. They at least read the first page of the survey cover letter. Among them, 180 subjects answered at least one question in the survey. In the About You part, the first part in the survey, Question 1 asked “Do you primarily work with”. Ninety-four out of a hundred and eighty subjects chose “not associated with a nursing home”, therefore the survey ended after they clicked the NEXT button. The rest of the 86 subjects indicated they primarily worked with nursing homes. Among the 86 subjects, 27 subjects chose “work with two or more nursing homes”; 55 subjects chose “work with one nursing home”; and the rest 4 subjects completed the former edition of the survey which did not have the About You part at that time. Because the 4 subjects were directly invited through email by the author, the author was sure the 4 subjects primarily work with nursing homes. Therefore, all the results discussed below were all based on the 86 subjects.

Results of Table 1

Table 1 includes responses of all yes/no/not sure/varies multiple-choice questions completed by the 86 subjects. Because subjects had the right to skip questions that they did not want to answer, the number of responses to each question would be equal to or less than 86. In the response rate column, response rates of Q4, Q8, Q34, Q44, Q58, Q60, Q70, Q71, and Q74 were not available, because those questions were selectively shown to subjects depending on the answers to the
former questions. For Q44, Q58, Q60, Q62, Q64, and Q74, they did not have the choice “Varies too much among several nursing homes to say”. Questions in Table 1 were grouped into nine categories, the same as the categories in the survey.

Concerning Category 1 Available Staff at nursing homes, few had a diabetes care coordinator (n=4, 5.0%). Excluding those having a coordinator, one fifth had a staff person overseeing diabetes care (n=16, 27.1%), about half had access to an endocrinologist or a nurse practitioner (n=39, 50.6%), and most had a Registered Dietitian (RD) (n=69, 88.5%). Among nursing homes with an RD, more than half developed individualized meal plans for residents with diabetes by RD (n=35, 51.5%).

Looking at Category 2 Staff Training at nursing homes, less than half conducted staff orientations including diabetes care (n=30, 43.5%), staff training including diabetes care (n=33, 47.8%), and inservices including diabetes care (n=30, 42.3%).

As for Category 3 Resident Food at nursing homes, more than half nursing homes required or offered 3 snacks every day (n=35, 53.0%). More than half allowed residents with diabetes free to exercise personal choice in food selection (n=37, 53.6%). More than half offered a consistent carbohydrate diet for residents with diabetes (n=43, 62.3%). The minority of nursing homes made changes if residents with diabetes went to bed right after dinner (n=12, 17.4%). Most
nursing homes monitored food intake for residents with diabetes (n=57, 82.6%), while about one fifth monitored carbohydrate intake (n=14, 20.3%). More than one fourth had flexible meal plans to let residents with diabetes have 5 meals per day (n=18, 26.9%). Nearly one third served alcoholic beverages (n=22, 32.8%), and for those serving alcoholic beverages, about one sixth offered alcoholic beverages available to all residents with diabetes (n=8, 13.6%).

Considering Category 4 Resident Medical Evaluation at nursing homes, most measured hemoglobin A1c (n=51, 78.5%), and also most evaluated residents for medical conditions affecting blood glucose goals (n=52, 78.8%).

Category 5 is related to resident medication at nursing homes. Few nursing homes set a limit on the number of insulin injections that a resident can receive each day (n= 3, 4.8%). The majority used sliding scale insulin in their facility (n=60, 90.9%), more than half allowed residents with diabetes older than 80 years of age to receive metformin (n=34, 51.5%), more than 60% ordered labs for residents receiving metformin (n=21, 61.8%), and none of the nursing homes had a separate admission medical checklist for residents with diabetes upon admission (n=0, 0.0%).

Concerning Category 6 Evaluation of Other Medical Conditions at nursing homes, few nursing homes used algorithms to manage residents with diabetes (n=3, 4.7%). Less than one fourth had a quality improvement tool for evaluate compliance with the diabetes-related policies in place
(n=15, 23.1%). Most had glucose parameters indicating when nurses should alert the attending
physician of serious changes (n=56, 86.2%). For Q55 “do your policies on diabetes care require a
dietary restriction”, nearly half of respondents chose “Yes” (n=3, 42.9%), but the total response
number was only 7. This response rate was very low, which was 8.1%, compared with the
response rates of the rest of questions in Table 1 which ranged from 72.1 to 91.9%. The next
question asking about weight goals indicated that 40% of nursing homes set weight goals for
residents with diabetes (n=26, 40.0%). Among those having weight goals, the majority set the
weight goals individualized (n=24, 92.3%). In addition to questions about weight goal, two thirds
of nursing homes would change weight schedules, if necessary, for residents with diabetes (n=41,
65.1%). More than half had their residents with diabetes engaged in exercise (n=34, 54.0%), and
30 out of 34 respondents chose “Yes, exercise is monitored” (n=30, 88.2%). Most of nursing
homes required the resident’s dental condition evaluation upon admission (n=52, 78.8%). Almost
no nursing homes estimated the amount of carbohydrate eaten prior to giving any before-meal
insulin (n=2, 3.0).

In Category 7 Goals of Diabetes Care at nursing homes, about two thirds documented goals for
residents with diabetes (n=49, 75.4%), 91.8% of those goals set individualized (n=45, 91.8%),
and 93.2% of individualized goals were discussed with residents and their families (n=41,
93.2%).
Referring to Category 8 Resident Education at nursing homes, most educated residents with diabetes (n=54, 84.4%), and more than half had their standardized education materials (n=23, 42.6%).

As for the last category, Category 9 Special and Emerging Care at nursing homes, there were three multiple-choice questions on special care plans. The responses indicated that more than half of nursing homes had plans for residents with diabetes who are unable to eat (n=34, 54.8%), who have problems on hydration (n=33, 50.8%), and who are suspected or diagnosed as dehydration (n=43, 66.2%).

The response rates of all questions in Table 1 were ranged from 8.1% to 91.9%. The only one lowered than 72.0% was Q55 “do your policies on diabetes care require a dietary restriction”, the response rate of which was 8.1%. 22 questions were in the domain from 70%-79.9%; 10 questions were in the domain from 80.0-89.9%; one question was higher than 89.9%, which was 91.9%.

*Results of Table 2*

Table 2 shows the answers to questions that can be directly compared to policies in the guidelines. For each question, the number and the percentage of responses aligning with the guidelines, the number and the percentage of responses not aligning with the guidelines, and the
total number of responses were calculated in this table. Still, questions were listed based on the nine categories.

In Category 1 Available Staff, the question with the greatest alignment with the guidelines was Q6 “Do you have a registered dietitian” (88.5% agreed). In addition, another three questions reached half or more agreement with the guidelines: does your facility have access to an endocrinologist or nurse practitioner for consultation (50.7% agreed), does your Registered Dietitian develop individualized meal plans (51.5% agreed), and how soon is the meal plan completed (87.5% agreed). Q4 “Is there a staff person who oversees diabetes care”, was with 27.1% of alignment with the guidelines (27.1% agreed). Poor alignments with the guidelines were reflected in those questions where 20% or fewer agreed, and in Category 1 it is Q1 “Does your facility have a diabetes care coordinator” (5.1% agreed).

In Category 2 Staff Training, there were two questions where less than half agreed with the guidelines. Q12 “Do you include diabetes care in the ongoing staff orientation” was 43.5%, and Q14 “Do you include diabetes care in the ongoing staff training” was 47.8%.

Concerning Category 3 Resident Food, the question with the greatest alignment with the guidelines was Q27 “Is food intake monitored” (82.6%). 50% or more but less than 80% agreed with the guidelines were four questions: what extent do the diet reflect personal preferences
(67.7% agreed), do you offer a consistent carbohydrate diet for residents with diabetes (62.3% agreed), what changes made for meals or snacks if resident go bed right after dinner (50.0% agreed), and what changes are made if a resident’s intake is poor (63.2% agreed). Poor alignment with the guidelines was Q25 “After dinner, are changes made to meals or snacks if going to bed after dinner” (17.4% agreed).

As for Category 4 Resident Medical Evaluation, four questions were with more than half but less than 80% agreed with the guidelines: is hemoglobin A1c measured (78.5% agreed), how often is A1C measured (54.9% agreed), what do you consider is a “normal” A1c value (77.6% agreed), and are you evaluate resident for medical conditions affecting blood glucose goals (78.8% agreed). Only one question, how often is blood glucose level usually checked, was only 27.7% of alignment with the guidelines.

Looking at Category 5 Resident Medication, Q43 “Do residents older than 80 receive metformin” had 51.5% of agreement with the guidelines, while Q48 “Is there a separate admission medical checklist for those with diabetes upon admission” was completely not aligned with the guidelines (0.0% agreed).

A total of nine comparable questions were in Category 6 Evaluation of Other Medical Conditions. Two questions had more than 80% of alignment with the guidelines: do you have glucose
parameters indicating when nurses should alert the attending physician of serious changes (86.2% agreed), and are weight goals individualized (92.3% agreed). Four questions were half or more agreed with the guidelines: do residents with diabetes engaged in exercise (54.0% agreed), is the resident’s dental condition evaluated upon admission (78.8% agreed), how often is weighted (65.6% agreed), and does residents with diabetes weight schedule change (65.1% agreed).

Questions less than 50% of agreement were do you have a quality improvement tool for evaluate compliance with the diabetes-related policies in place (23.1% agreed), and do you have weight goals for residents with diabetes (40.0% agreed). In addition, Q65 had nine answers that all aligned with the guidelines. Therefore, each choice was analyzed individually. The choice with the greatest alignment with the guidelines was “screen for skin ulcers” (89.6% agreed). Other half or more agreed with the guidelines were “mental status” (76.1% agreed), “frequency of failing” (74.6% agreed), “blood pressure” (82.1% agreed), and “eye exams” (55.2% agreed).

“Albuminuria testing” was 35.8% agreed, and “meter calibration policies” was 14.9% agreed.

In Category 7 Goals of Diabetes Care, there were two questions with more than 90% of alignment with the guidelines: are goals for residents with diabetes individualized (91.8% agreed), and are goals discussed with residents and their families (93.2% agreed). One question with 75.4% of agreement with the guideline was that Q69 “are goals for residents with diabetes documented”. As for Q67 and Q68 with multiple answers aligned with the guidelines, the choice “keep blood glucose in a target range” in Q67 (74.2% agreed) and the choice “enhance quality of
life” in Q68 (40.6% agreed) had the greatest agreements in each question individually.

There were a total two questions were in Category 8 Resident Education. There was 84.4% of answers to Q73 “do you educate residents with diabetes about their diabetes” aligning with the guidelines. The alignment rate of Q74 “do you have standardized education materials” was 42.6%.

Category 9 Special and Emerging Care included two questions with half or more agreeing with the guidelines. Q76 “do you have a plan for residents with diabetes who are unable to eat” was 54.8% agreed, and Q80 “If dehydration is suspected, diagnosed, or a known problem, is there a general plan or guideline” was 66.2%.

Results of Table 3

Table 3 displays the subtotal scores for the guideline categories. When the response aligned with the guidelines, it would be scored as 1 point, and if not aligned, would get 0 points. Each question in Table 2 was worth 1 point, except Q65, and Q67. They were worth 8 points and 10 points individually. The “Blank” column meant that some respondents among the 86 respondents did not answer any question in the category. The “Blank” column was not included in the total response number of each category.
The number and the percentage of receiving full points in each category are shown in the fourth column. Therefore, the category where nursing home respondents had the greatest alignment with the guidelines (receiving full points) was Resident Education (n=23, 35.9%), and the following were Special and Emerging Care (n=22, 33.8%) and Staff Training (n=22, 30.1%). The percentage of receiving full points of Available Staff was 7.3 (n=6, 7.3%). The percentage of receiving full points of Resident Medical Evaluation was 7.6 (n=5, 7.6%). The percentage of receiving full points of Goals of Diabetes Care was 1.5 (n=1, 1.5%). No respondents got full points in Resident Food, Resident Medication, and Evaluation of Other Medical Conditions (all n=0, 0.0%).

The number and the percentage of respondents receiving half or more of the total points in each category were displayed in the fifth column, which meant for those respondents, the majority of answers aligned with the guidelines. The category with the highest percentage in this condition was Evaluation of Other Medical Conditions (n=49, 73.1%); on the contrary, the category with the lowest percentage was Staff Training (n=19, 26.0%).

Compared with categories where nursing home respondents had less than half or even 0.0% of alignment with the guidelines, the high percentages included 56.1% from Available Staff (n=46), and 48.5% from Resident Medication (n=32). By contrast, the categories with the low percentages were Resident Education (n=10, 15.6%) and Special and Emerging Care (n=10, 16.0%).
Results of Table 4

Table 4 shows the Chi-Square results among subtotal scores, or individual comparable questions. The table includes variable names, Chi-Square values, Degree of Freedom, and P value.

By comparing 9 category subtotals with each other, among 36 pairs, there were 10 pairs with P value less than .05. They were Available staff subtotal and Resident medical evaluation subtotal (P= .018), Staff training subtotal and Goals of diabetes care subtotal (P= .018), Resident food subtotal and Resident medical evaluation subtotal (P= .002), Resident food subtotal and Other evaluations on diabetes care subtotal (P= .016), Resident medical evaluation subtotal and Resident medication (P= .001), Resident medical evaluation subtotal and Other evaluations on diabetes care subtotal (P= .001), Resident medical evaluation subtotal and Goals of diabetes care subtotal (P=.010), Resident medical evaluation subtotal and Resident education subtotal (P= .001), Other evaluation on diabetes care subtotal and Goals of diabetes care subtotal (P= .002), and Other evaluation on diabetes care subtotal and Resident education subtotal (P= .012).

In each significant pair, significant relationships among individual comparable questions were listed in Table 4.
values of Q5 “does your facility have access to an endocrinologist or nurse practitioner for consultation” and Q36 “is A1c measured?” (P = .001), Q5 “does your facility have access to an endocrinologist or nurse practitioner for consultation” and Q37 “how often is A1c measured” (P = .011), as well as Q5 “does your facility have access to an endocrinologist or nurse practitioner for consultation” and Q39 “do you evaluate the resident for medical conditions that might influence usual blood glucose goals” (P = .000) were less than .05, which were significant.

Under Staff training subtotal and Goals on diabetes care subtotal, Q12 “Do you include diabetes care in your ongoing staff orientation” and Q69 “is food intake monitored” as two variables, generated P value less than .05 (P = .048); Q14 “do you include diabetes care in your ongoing staff training” and Q69 “are goal for residents with diabetes documented” also generated P value less than .05 (P = .025). Under Resident food subtotal and Resident medical evaluation subtotal, two sub-pairs of Q27 “is food intake monitored” and Q36 “is A1c measured” (P = .000), and Q27 “is food intake monitored” and Q39 “do you evaluate the resident for medical conditions that might influence usual blood glucose goals” (P = .014) showed the significances by P value less than .05. For Resident food subtotal and Other evaluations of diabetes care subtotal, two sub-pairs, Q25 “after dinner, are changes made to meals or snacks of a resident goes to bed right after dinner” and Q57 “do you have weight goals for residents with diabetes” (P = .021), as well as Q31 “what types of changes do you recommend if a resident’s intake is poor” and Q62 “is the resident’s dental condition evaluated upon admission” (P = .010) were significant. Concerning Resident medical evaluation subtotal and Resident medical subtotal, the questions of Q36 “is
hemoglobin A1c measured” and Q43 “do residents older than 80 receive metformin” were with P value less than .05 (P= .001); Q39 “do you evaluate the resident for medical conditions that might influence usual blood glucose goals” and Q43 “do residents older than 80 receive metformin” were with P value less than .05 (P= .011). Under the pair of Resident medical evaluation subtotal and Other evaluation on diabetes care subtotal, one significant relationship was between Q43 “do residents older than 80 receive metformin” and Q52 “do you have glucose parameters indicating when nurses should alert the attending physician of serious changes” (P= .001). As for Resident medical evaluation subtotal and Goals of diabetes care subtotal, there were three sub-pairs proved significant, which were Q36 “is hemoglobin A1c measured” and Q69 “are goals for residents with diabetes documented” (P= .031), Q39 “do you evaluate resident for medical conditions affecting blood glucose goals” and Q69 “are goals for residents with diabetes documented” (P= .002), as well as Q39 “do you evaluate resident for medical conditions affecting blood glucose goals” and Q71 “are goals discussed with residents and their families” (P= .018). Under the pair of Resident medical evaluation subtotal and Resident education subtotal, the P value of Q36 “is hemoglobin A1c measured” and Q73 “do you educate residents about their diabetes” was significant (P= .000). Under Other evaluations on diabetes care subtotal and Goals of diabetes care subtotal, Q51 “do you have a quality improvement tool to evaluate compliance with the diabetes-related policies in place” and Q69 “are goals for residents with diabetes documented” as two variables showed significance (P= .013). Besides, Q52 “do you have glucose parameters indicating when nurses should alert the attending
physician of serious changes” and Q69 “are goals for residents with diabetes documented” as the other sub-pair with P value less than .05 (P= .021). Lastly, Q52 “do you have glucose parameters indicating when nurses should alert the attending physician of serious changes” and Q73 “do you educate residents with diabetes about their diabetes” consist of a significant sub-pair under Other evaluation on diabetes care subtotal and Resident education subtotal (P= .001).

Results of Table 5

Table 5 displayed the classified responses to each short–answer question. For each question, answers were sorted and generated into key words, then calculating the total numbers of similar answers.

According to responses, in 22 out of 32 nursing homes, dietitians had the responsibility of completing the meal plans for residents with diabetes. The meal plans were commonly revised as needed. To monitor food intake, 41 out of 48 nursing homes used an intake sheet to calculate, and food intake was documented by aids. In order to monitor carbohydrate intake, 5 out of 12 nursing homes served consistent carbohydrate diets with doing food records. Concerning how many times can a resident receive the insulin injections, one response was 5 per day, and the other answered “doctor determines”. The A1c, liver function, and renal function were ordered most often in nursing homes for residents receiving metformin. Doctor’s orders mainly
determined the timing of medications based on 21 out of 57 of responses. Answers from respondents indicated that in 27 of 55 nursing homes, there were 90% or more probability that the schedule could be adhered to within a 1-hour range. For the question that how to use algorithms to manage residents with diabetes, the only answer was reporting to Registered Dietitian, Doctor of Medicine, or nurses. The glucose parameters indicating when nurses should alert physicians of serious changes was below 60 or more than 400 based on the majority of respondents. Only one answer, 15/15 rules was provided to the question, the policies on diabetes care require a dietary restriction. To monitor exercise, 11 out of 27 respondents answered through restorative programs. According to 50 responses, 30 expressed they discussed the care goals with residents and residents’ families through care plan meetings as needed. For residents with diabetes unable to eat, 9 out of 31 considered tube feedings. The most widely applied hydration plan was general encouragement of fluid intake put forward by 21 out of 55 respondents. Among 55 responses, 37 respondents considered the general plan for dehydration was to encourage fluids intake at the same time informing doctors or nurse practitioners. The last question was how many Medicare/Medicaid beds are in your nursing homes. A total of 16 nursing homes had 50-99 Medicare/Medicaid beds and 11 nursing homes had 100 or more Medicare/Medicaid beds. Another way to describe the number of Medicare/Medicaid beds was 10 respondents indicated that 75-100% of their beds were Medicare/Medicaid beds.

Results of Table 6
Table 6 includes two table-completion questions. The first one is Q13 “please write down the staff orientation modality”. Five aspects to describe staff orientations included object, form, topic, duration, and frequency. According to responses, the objects usually were all nursing staff, new staff, Certified nursing assistant, Licensed Dietitian, and Registered nurses. The form was lecture. Topics included signs and symptoms of diabetes, oral health, blood sugar monitoring, carb counting, medication, and eye and foot care. The duration was about 15-60min, and in most nursing homes orientations were conducted annually or upon hire.

The second one is Q15 “please write down the staff training modality”. Five aspects to describe staff training included object, form, topic, duration, and frequency. From responses, the objects usually were all nursing staff, all new staff, Certified nursing staff, dietitian staff, and nurses. The form was lecture, review, and online training courses. Topics included monitoring intake, signs and symptoms of diabetes, blood sugar monitoring, carb counting, medication, meal plan, insulin, and eye and foot care. The duration was about 15 to 120 minutes and in most nursing homes trainings were conducted annually or twice per year.
CHAPTER 5

DISCUSSION

This study was mainly conducted in Illinois. The subjects were nursing home staff including administrators, doctors, dietitians, and nurses. This study identified 12 aspects of diabetes care in nursing homes, which were About You, Available Staff, Staff Training, Resident Food, Resident Medical Evaluation, Resident Medication, Other Evaluations on Diabetes Care, Goals of Diabetes Care, Resident Education, Special and Emerging Care, Payment Structure, and Nursing Home Scale and Location. Among these aspects, About You, Payment Structure, and Nursing Home Scale and Location were only used for brief demographic information. The rest of the aspects were discussed as follows:

*Nursing Home Staff Availability and Training*

Based on responses collected and data analysis, it showed: in all responding nursing homes, more than half of the nursing homes had access to endocrinologists or nurse practitioners; most nursing homes had registered dietitians (RDs), and RDs had the primary responsibility of developing meal plans for their residents with diabetes upon admission; the majority of nursing homes completed the meal plan within the required 21 days upon admission; however, the minority of nursing homes had diabetes care coordinators or specific staff overseeing diabetes care; less than half of the nursing homes had ongoing orientations and trainings including topics about diabetes care, and less than half conducted diabetes inservices for their staff as well.
Through comparing Chi-Square P values with .05, the level of nursing home staff and training subtotals had significant relationships with resident medical evaluation subtotal, and goals of diabetes care subtotal, separately. Those with endocrinologists or nurse practitioners did especially better in blood glucose monitor and control scores. In addition, nursing homes conducting better ongoing orientations, trainings, and inservices had better scores on goals setting and documentation.

Quality of diabetes care in nursing homes includes every aspect of treatment and management that is offered to residents with diabetes. Without a doubt, medical evaluation and goal setting are two very important elements of the quality of diabetes care. Therefore, this study indicated that the level of staff would affect the levels of medical evaluation and goals setting, which would further impact the quality of diabetes care. This is similar to the opinions from other academic papers, which was “poor quality care has been associated with inadequate staff and poor knowledge and skills mix” (Spilsbury et al., 2011), and Dr. Hyer’s research also pointed out there was a relationship between nursing staff and nursing home quality (Hyer et al., 2011).

Furthermore, two table-completion questions in Table 6 focusing on staff orientation and training reported that certified nursing assistants (CNAs), licensed practice nurses (LPNs), and other nursing staff were mentioned most frequently to be required to attend ongoing orientations and
trainings in all responded nursing homes. Thus, it may indicate that nursing staff were the primary target that highly needs education and trainings to improve their knowledge, skills, and comprehensive capacities for better quality of diabetes care. Other research more clearly showed the variety of education levels of nurses to emphasize the training necessity to this target group, which reported, “about 20% of CNAs have not graduated from high school, and more than 30% have attended some colleges” (Aaron, 2014). Moreover, in the study, some respondents talked about RDs that usually played a role in teaching rather than learning. It reflected that different types of staff with different background demanded different levels of orientation and trainings and it was not proper to train all staff at the same level. For nursing homes, the author considered, to individually evaluate the background of nursing staff and then to decide educational materials may be a good way to effectively educate.

But, since “quality in nursing home settings is complex” (Spilsbury et al., 2011), more aspects should be included in quality, such as food service, medication, education, and special care. Based on Chi-Square test, this study found that the level of nursing home staff availability and training did not have significant relationships with resident food service, medication, education, and special care separately. However, all these aspects are also necessary parts determining the quality of care, if staff level did not have direct significant influences on these aspects, the relationship between nursing home staff and quality of care was not completely consistent and strong. The same conclusion was also made by other papers, which suggested, “currently major
methodological and theoretical weaknesses limit interpretation of the staff impact on quality of care in nursing homes” (Backhaus et al., 2014).

When compared with the guidelines, for questions on staff available, only 43.9% of respondents were aligned with half or more of the guidelines. Therefore, Hypothesis One was rejected. For question on staff training, 56.1% of respondents were aligned with half or more of the guidelines, so Hypothesis Two was accepted.

*Resident Food*

When examining responses on resident food, it showed: more than half nursing homes offered 3 snacks per day and provided diverse diets to meet residents’ personal preferences; also more than half nursing homes offered a consistent carbohydrate diet and made changes if a resident’s intake was poor; the majority of nursing homes monitored food intake; by contrast, only about one fifth of nursing homes monitored carbohydrate and gave changes to meals or snacks if residents with diabetes went to bed right after dinner.

Firstly, as mentioned before, it showed that more than 80% of nursing homes required their nurses to monitor residents’ food intake, which implied the majority of responded nursing homes followed guidelines in this regard, and food monitoring was considered as a very important part of diabetes care. Other articles also put forward the same point as well. For example, one paper
said “accurate measuring resident’s dietary consumption can aid in the dietetic are provided to residents with diabetes” (Palmer et al., 2015). Another paper pointed out “an estimate of food intake is required in patients at risk of malnutrition, especially in elderly patients” (Berrut et al., 2015). Indeed, elderly residents with diabetes are the group who are at the highest risk of malnutrition in nursing homes. Therefore, nursing homes should conduct food monitoring for residents with diabetes, especially for elderly with diabetes. When looking at the answers to the question, how to monitor food intake, the majority of responses were CNAs recorded the percentage of each item remaining in a meal by filling in a daily meal flowsheet, and the approach was percentage/portion estimation by visual observation. It implied the meal portion record was the most common method in nursing homes currently, which was consistent with the view in the other paper authored by Michelle Palmer. The paper described the current situation and reasons, which was “visual estimation of intake is used more often in the clinical setting as it may reduce the time and workload burden” (Palmer et al., 2015). Based on a study on validation of meal portion estimation conducted in France, it concluded, “valid estimates of food consumption can be obtained with meal-portion method” (Berrut et al., 2015). In recent decades, although many studies suggested food weight was more accurate, the fact, based on this study, was nursing homes all used portion estimation. The reason may be “weighing food can be complex, particularly when the items remaining on a plate need to be weighed separately following consumption” (Pouyet et al., 2015).
Through Chi-square analysis, resident food subtotal had a significant relationship with medical evaluation subtotal and other evaluations on diabetes care subtotal. The study may imply that the level of residents’ meal and snack intake affected both blood glucose levels and weight changes. For one thing, more than half of the responses indicated that if a resident’s intake was poor, nursing homes would offer more healthy snacks to promote appetite, give more snack choices, and encourage consumption to support the insulin dosage and reduce the risk of hypoglycemia. A paper on diabetes in the elderly in nursing homes also put forwards: “variable appetite and nutritional intake was one of the factors that increased the risk of hypoglycemia in the elderly” (Migdal et al., 2011). Thus to make sure enough food intake in order to support the insulin dosage and nutritional requirement is necessary for blood glucose levels control. For another, poor intake of residents with diabetes can lead to deficient nutritional status and unhealthy weight loss. The same influence was proved in Dr. Castellanos’s paper in which it reported, “dietitians use the food intake information for the initial and ongoing risk assessment of residents’ nutritional status” (Castellanos & Andrews, 2002). But, as for the significant relationships resulting from Chi-Square test between the specific questions such as food intake monitoring score with A1c measurement score, and food intake monitoring score with medical condition evaluation score, it was not apparent why they had such significances. The suggestion may be that nursing homes that emphasized strict food intake monitoring also considered blood glucose levels as their core responsibility, and A1c measurement and medical condition evaluation were two of the key measures to examine and ensure blood glucose levels. Therefore, nursing homes
doing better in food intake monitoring did better in A1c and medical condition examinations. To clearly clarify the significance, further research is needed.

Concerning the next hypothesis, for questions on resident food, 64.3% of respondents were aligned with half or more of the guidelines. Therefore, Hypothesis Three was accepted.

*Resident Medical Evaluation and Medication*

In the survey, questions related to medical evaluation and medication generally showed: about 75% of nursing homes measured A1c for residents with diabetes; the majority of nursing homes evaluated medical conditions affecting blood glucose goals; almost all nursing homes used sliding scale insulin; and residents older than 80 in more than half of the nursing homes received metformin for treating diabetes. In addition, in the study less than one third of nursing homes measured blood glucose levels multiple times each day.

By examining the result that 90.9% of nursing homes used sliding scale insulin (SSI), another article was found to show the similar percentage. It concluded that “rates of SSI use were high among patients upon admission staying in nursing homes (54%)”, and “33% of residents who had not started on SSI later switched to SSI” (Pandya et al., 2008). Thus the total percent of SSI using would be 87% in nursing homes based on Dr. Pandya’s data. However, guidelines and other articles did not recommend the wide and high frequent usage of SSI, because it was a
concern as it may increase the risk of periods of hypoglycemia (Migdal et al., 2011). The data from other research supported “SSI usage with no improvement in glucose control, longer hospital stays, higher risk of hypoglycemia” (Pandya et al., 2008). Therefore, it has been a big issue of SSI usage in nursing homes.

As for the usage of metformin for older residents, according to Guideline for Improving the Care of Older Adults with Diabetes Mellitus: 2013 Update, metformin was “the preferred first-line oral antidiabetic agent in combination with lifestyle therapy” for the elderly with diabetes (American Geriatrics Society Expert Panel, 2013). On the other hand, the contraindications of metformin application included “impaired hepatic function, congestive heart failure, renal failure, pulmonary disease with chronic hypoxia, and metabolic acidosis” (Migdal et al., 2011). In the study, responses showed that 51.5% of nursing homes allowed residents older than 80 to receive metformin, which revealed the application of metformin was just slightly the majority, and since nursing homes had many other choices of medication when concerning contraindications, it was not necessary for choosing metformin. In addition, residents may have been treated for many years with a different medication and with good glycemic control. In that case, it was unnecessary to be compulsive about switching to metformin.

In addition, it was less than one third (27.7%) of nursing homes that measured blood glucose levels multiple times per day. There was another study conducting a survey to examine the
situation of blood glucose checks in nursing homes in 2008. The result was “30.8% of facilities had a policy in place for blood glucose monitoring” (Feldman et al., 2009), which suggested a disappointing situation. Based on the standardize criteria, in the first week of admission, residents treated with insulin should measure their capillary blood glucose levels four times per day with before each meal and at bedtime; later twice per day is acceptable (Nettles & Reger, 2011). As for residents without insulin injections, upon admission it is twice per day and later twice per week (Nettles & Reger, 2011). Thereby it is clear that blood glucose should be examined for every resident with diabetes. In addition, in the survey conducted in 2008, “only 7.1% of facilities tested hemoglobin A1c for their residents with diabetes” (Feldman et al., 2009). On the contrary, our finding was 78.5% of nursing homes measured A1c, and among those nursing homes, 54.9% of them checked A1c for residents with diabetes every 3 months to 6 months, which may imply an improvement in the blood glucose A1c management in nursing homes from 2009 to 2015. The reasons may include the encouragement of A1c test as a universal application and the development of the advanced technology for the A1c measurement. Based on the author’s findings, the statements of A1c test changes in each year Standards of Medical Care in Diabetes written by ADA from 2008 to 2012. Before 2009, the use of A1c for diabetes diagnosis had not been recommended “due to lack of global standardization and uncertainty about diagnostic thresholds” (American Diabetes Association, 2009), and in 2009’s and 2010’s Standards of Medical Care in Diabetes, A1c was just considered to be likely recommended as a preferred diagnostic test (American Diabetes Association, 2009; American Diabetes Association,
2010). Until in *Standards of Medical Care in Diabetes*-2011 A1c was just listed in the diabetes diagnosis test table but in the bottom line. After 2012, *Standards of Medical Care in Diabetes* listed A1c in the top line in the table of criteria for the diagnosis of diabetes, which indicated A1c became the most ideal and critical test to diagnose diabetes, and nowadays it has been commonly used to control blood glucose levels (Aaron, 2014). Therefore, it was obvious that the increasing attention of A1c test contributed to the ascending application of A1c test. Furthermore, the developing of the advanced technology of A1c drove its application as well. Formerly, A1c had to be ordered and tested by specialists in hospitals, and it needed to wait certain time for the results. But within the last decade, A1c technology has been improved with point of care (POC) devices, which has allowed “immediate availability of A1c measurement, greatly facilitating diabetes care in both specialist and general practices” (Bode et al., 2007). Moreover, currently several A1c testing kits have been available for home use by patients’ themselves. Therefore, it became very convenient for both facility diabetes management and self-management.

When concerning Hypothesis Four, 63.7% of respondents were aligned with half or more of the guidelines on the medical evaluation area. For Hypothesis Five, 51.5% of respondents were aligned with half or more of the guidelines on the medication area. Therefore, Hypothesis Four and Five were accepted.

*Other Evaluations on Diabetes Care*
The study showed: in all nursing homes residents were weighed; about two thirds of nursing homes set and modified weight schedules for residents with diabetes, and the schedule and weight goals were individualized; in half of nursing homes, residents with diabetes were engaged in exercise and most were monitored; more than half nursing homes evaluated residents’ dental conditions upon admission; and mental status, frequency of failing, skin ulcers, blood pressure, and eye exams were the most common screening items during the period of living in nursing homes; only one fifth of nursing homes had a quality improvement tool to evaluate compliance with the diabetes-related policies in place.

In nursing homes, it is necessary to set weight schedules for residents with diabetes, particularly elderly residents with diabetes, in that those residents are likely to lose weight unintentionally and unnoticed (Morley, 2008). Moreover, weight loss of elderly residents is “associated with increasing mortality and an increasing propensity to have a hip fracture” (Morley, 2007). In this study, it implied none of nursing homes weighed residents less than once per six months, and only two nursing homes weighed their residents once every six months and once every three months separately, which may be interpreted that almost all nursing homes had paid significant attention to routine weight measurement. According to responses, the most common weight schedule was daily or weekly upon admission for 4 to 5 weeks then monthly after that, which was aligned with “looking for weight changes monthly or more frequently if there are major changes in the resident’s condition” in the guidelines (Nettles & Reger, 2011). Another article
also pointed out the same point of view that “a standardized weight protocol should be used to assess resident’s body weight monthly by wearing bed clothes and using the same type of scale, at the same time of day each month” (Simmons et al., 2009). Since our study did not focus on consistency of weight measurement, additional research may be needed to identify the current situation of consistency in nursing homes.

Exercise is one of elements contributing to resident’s blood glucose levels and weight control, and it is generally recommended to be three times per week with a total of more than 150 minutes (Nettles & Reger, 2011). In addition, there are no specific monitoring requirements or recommendations introduced in the guidelines. In fact, because the majority of residents with diabetes in nursing homes are elderly, they are likely to have certain diabetic complications including retinopathy, foot ulcers, peripheral neuropathy, and coronary disease, which leads to be concerned about the frequency and types of physical activity they can tolerate (Migdal et al., 2011). Therefore, the situation in nursing homes would be complex and variable. In the current study, residents with diabetes were engaged in exercise in 54.0% of nursing homes, and 88.2% of those nursing homes monitored exercise. The primary assessment of exercise was restorative programs with restorative aide recording. When looking at other articles related to exercise in nursing home residents with diabetes, there was no specific study investigating quantitative percentages, but they claimed generally that the majority of residents in nursing homes were documented to be inactive (MacRae et al., 1996; Resnick, 2008). Compared with these articles,
our study may interpret that recently more nursing homes had encouraged residents to participant in exercise with restorative programs; meanwhile, monitoring and documenting have been most often conducted by restorative aides. According to other papers, restorative programs in nursing homes indicated programs focused on helping residents return or maintain to their highest practicable physical functional level (Resnick et al., 2008). It should be an individualized, effective program to assure a resident will not deteriorate or diminish (Shanthi Jacob Johnson et al., 2005). However, how the monitoring is done and where the documentation is, and what goals there are for individuals is unknown.

A quality improvement tool is an assessment that embraces “the latest strategies and treatment algorithms” to evaluate nursing home management (Feldman et al., 2009). The implementation of a quality improvement tool can promote the nursing home’s quality of care and enhance the quality of life for residents. In the current study, 23.1% of nursing homes had a quality improvement tool to assess compliance with diabetes-related policies in place. In another study completed in 2008, data showed just 7.8% of nursing homes had their quality improvement tools (Feldman et al., 2009). Comparing the two results with each other, it may be implied that from 2008 to 2015, an increasing number of nursing homes had the quality improvement tool. But more studies are necessarily needed to confirm it, in that the study investigated 65 nursing homes mainly in Illinois while the one in 2008 accessed 13 nursing homes in 6 states, including Illinois. Exploring the reasons that it remained such a low proportion of having a quality improvement
tool may be: no specific and clear requirements or recommendations on quality improvement tools were in the guidelines; the leadership teams of nursing homes had low motivation for developing quality improvement tools for their own nursing homes; and the workload cost could be high when following the steps in Guide to Implementing Quality Improvement Principles published by Centers for Medicare & Medicaid Services (CMS). Therefore, in author’s point of view, additional studies are needed to understand nursing homes’ difficulties in developing and implementing quality improvement tools in practice rather than just setting up policies without implementation strategies.

When checking Hypothesis Six, 73.1% of respondents were half or more aligned with the policies and recommendations on other evaluations on diabetes care in the guidelines. As a result, Hypothesis Six was accepted.

Goal and Plan Setting and Resident Education

In the current study, 75.4% of nursing homes set and documented goals for residents with diabetes, and in those nursing homes, 83.7% set individualized goals by discussing with residents and their families. In general, the ultimate goal for long-term diabetes care was enhancing quality of residents’ life, while the primary goal for short-term diabetes care was keeping blood glucose within a target range. For education, 84.4% of nursing homes educated residents about their diabetes, and among them 42.6% of nursing homes had standardized education materials.
Currently, the number of guidelines for treating diabetes has been many, but the number of guidelines focusing on diabetes in elderly, especially in vulnerable elderly is few (Benetos et al., 2013). Actually in nursing homes, the majority of residents with diabetes are frail and need assistance, and a large percent of residents with diabetes have complications (Feldman et al., 2009; Migdal et al., 2011). Therefore, individualized goal and plan setting are highly recommended in nursing homes (American Geriatrics Society Expert Panel, 2013). In this study, 63.1% of nursing homes followed the recommendation ($75.4\% \times 83.7\% = 63.1\%$), and the approach to reach residents and their families’ thoughts on goals and plans was setting care plan meetings upon admission and/or quarterly. In addition, to enhance the quality of resident’s life was chosen as the ultimate and comprehensive goal by most respondents, which was completely aligned with the point of view from other articles. For instance, Dr. Benetos put forwards “the focus of care plan for residents suffering from multiple health problems should be made with the holistic objectives of enhancing quality of life” (Benetos et al., 2013).

The results of the Chi-Square tests showed that the diabetes care goal subtotal had significant relationships with staff training subtotal, resident medical evaluation subtotal, and other evaluations on diabetes care subtotal individually, which indicated the goal setting dependent on a resident’s status including blood glucose levels, weight, physical activity, dental condition, mental status, blood pressure, skin ulcers, frequency of falling, and diabetic complications. The
staff training and goal settings had the significant relationship, which may be explained by better knowledge and skilled staff contributing to better satisfying the needs of residents and their families through setting full-scale goals (Spilsbury et al., 2011; Hyer et al., 2011). Furthermore, the training of staff helps understand “the specificities of caring for frail elderly residents with diabetes, and how to keep the individual care plan up to date for consultation by doctors and nurses” (Benetos et al., 2013).

Resident education is an approach to help residents better understand diabetes and to encourage self-management. Based on the guidelines, it clarifies that “diabetes self-management education should start upon admission or as soon as feasible, especially in those new to insulin therapy or in whom the diabetes regimen has been substantially altered” (Nettles & Reger, 2011; American Geriatrics Society Expert Panel, 2013). The basic guidance for diabetes self-management education is the National Standards for Diabetes Self-Management Education and Support. Since the majority of nursing home residents are the elderly, “diabetes self-management education needs to be provided at the appropriate literacy level” (American Geriatrics Society Expert Panel, 2011). In this study, more than four fifths of nursing homes educated their residents with diabetes, and less than half of those nursing homes decided their standardized education materials which mainly included carbohydrate counting, dietetics nutrition care, and information from the American Diabetes Association website. A small portion of nursing homes developed education materials by their RDs and approved by facilities. The above results revealed that the percentage
of those educating residents was high. But when concerning educating elderly with diabetes, the mental status and the efficiency of education may need to be evaluated in nursing homes. For those with mental diseases, such as Alzheimer’s disease, the education may not be necessarily conducted. Furthermore, according to the list of education content areas, education materials may embrace “diabetes disease process, treatment options, nutritional management and physical activity into life style, medication safety, blood glucose monitoring, self-management decision making, preventing, detecting, and treating acute and chronic complications, and personal strategies development of psychosocial issues and behavior change” (Funnell et al., 2008).

Comparing the responses with the standards, education materials of nursing homes were not covering all those aspects in fact, but only highlighted blood glucose control and nutrition care. The author considered that the decision of what contents included might be made individually. It may depend on not only literacy level and mental status mentioned above, but also types of diabetes, diabetic complications, former diabetes education levels, and other factors. Therefore, to cover all topics or partial topics in education depends on the needs and demands of each resident with diabetes.

When examining Hypothesis Seven, 63.1% of respondents were aligned with half or more of the guidelines on goals of diabetes care. As for Hypothesis Eight, 84.3% of respondents were aligned with half or more of the guidelines on resident education. Therefore, Hypothesis Seven and Eight were accepted.
Resident Special and Emerging Care

Concerning special care, about half of nursing homes had a plan for residents with diabetes who were unable to eat, and two thirds of nursing homes had a plan on dehydration.

About 35-85% of elderly residents with diabetes in nursing homes are likely to be malnourished (Burger, 2010). It is mainly caused by insufficient food intake. Based on one of the guidelines, it suggested “if unable or unwilling to eat, carbohydrate containing liquids should be substituted within the following 3 to 4 hours and 15 grams of carbohydrate every hour” (Nettles & Reger, 2011). But the responses in this study were: 54.8% of nursing homes had eating plans, and the plans mentioned most included tube feedings, decisions made by doctors or RDs, and assisting residents in eating if residents cannot feed themselves. There are apparent differences between the policies and the practice, in that the guideline directed the acute situation while respondents reflected the chronic and not emerging conditions. The author considered both guidelines and respondents were reasonable and solutions can be multiple because of the various cases. Two papers pointed out that inadequate food intake of elderly residents resulted from food preferences changing, depressed mood, disability, and eating functions worsening or altered which included olfactory nerves and taste buds changing, chewing and swallowing slowing, and teeth loss (Abbasi & Rudman, 1994; Burger, 2010). Therefore, if a resident with disability has a good appetite, a nurse assistant feeding the resident will be a feasible and considerate solution, which
ensures both nutrients intake and quality of dining experience. In addition, the answer of tube feeding was suggested most times. But, actually, tube feedings may be better to be used as a last solution, because tube feedings can lead to “a loss of functioning and serious medical and psychological problems” (Leff et al., 1994). In that case, if elderly residents with diabetes can be retrained to chew and swallow well and get enough nutrition by oral eating, tube feeding would not be necessary.

When considering dehydration in nursing homes, the fact sheet showed that about 31% of residents were dehydrated (Mentes, 2006). The reasons for dehydration are inadequate fluid intake and excessive loss of total body water (Thomas et al., 2008). Residents with diabetes have could have high blood glucose levels resulting in dehydration by increased urination. To face the challenge, 66.2% of nursing homes claimed they had rehydration plans. Encouraging fluids intake, informing doctors and nurse practitioners, and intravenous rehydration were the most common solutions in those nursing homes. The responses were highly aligned with suggestions in other papers (Mentes, 2006; Thomas et al., 2008; Nettles & Reger, 2011). For instance, Dr. Thomas concluded two primary methods of rehydration were oral rehydration and subcutaneous infusion (Thomas et al., 2008). The response to how to approach fluids intake was to improve access to oral rehydration, and intravenous rehydration was one of approaches to subcutaneous infusion. Furthermore, some answers specifically illustrated that they provided beverages according to resident’s preference, which agreed with suggestions which were “to provide
preferred beverages during group activities” (Mentes, 2006) and “a mixture of sugar-free Kool-aid, diet pop, or broth, not just water alone” (Nettles & Reger, 2011).

When concerning Hypothesis Nine of Special and Emerging Care, 84.6% of respondents agreed with half or more of the guidelines. Therefore, Hypothesis Nine was accepted.
CHAPTER 6

CONCLUSIONS

Diabetes is a national issue with the increasing prevalence and a leading cause of death in the United States. In recent decades a great number of elderly patients with diabetes, about 10 million, choose to live at nursing homes to receive the long-term care (Harris-Kojetin et al., 2013; Center for Chronic Disease Prevention, 2014). In order to improve the quality of care in nursing homes, guidelines were published aimed to direct the practice. The purpose of the study was to evaluate the similarities and differences between policies and practice of diabetes long-term care in nursing homes.

The results of hypothesis testing showed Hypothesis One of Available Staff was rejected, while all of Hypothesis Two of Staff Training, Hypothesis Three of Resident food, Hypothesis Four of Resident Medical Evaluation, Hypothesis Five of Medication, Hypothesis Six of Other evaluations on diabetes care, Hypothesis Seven of Goals of Diabetes Care, Hypothesis Eight of Resident Education, and Hypothesis Nine of Special and Emerging Care were accepted. The results showed in each aspect of diabetes care in nursing homes, except Available Staff, more than half respondents were aligned with half or more of the guidelines.

When concerning Staff Availability, in contrast to the guidelines, the majority of responding nursing homes lacked a coordinator or a specific person to take charge of diabetes care. In the
study, it indicated the availability and training levels of nursing home staff had an impact on quality of diabetes care in nursing homes, but it was not completely consistent and strong. For Resident Food Category, most of the nursing homes did well in food monitoring through portion estimation. Furthermore, the study revealed food intake levels related to both blood glucose levels and weight changes. When assessing Medical Evaluation and Medication, it was not aligned with the recommendations that almost all nursing homes used SSI to control blood glucose. In addition, compared with former studies, more nursing homes regularly measured A1c for residents with diabetes, which implied an improvement in the blood glucose management. For Other Evaluations on Diabetes Care, responded nursing homes were aligned with the guidelines: residents in nursing homes were weighted routinely and engaged in exercise with monitoring. But the recommendation of developing quality improvement tools was not adopted by the majority of nursing homes because of no clear directions, complicate developing steps, and unavailable staff. For Goals Category, the ultimate long-term goal was to enhance the quality of residents’ life in the majority of nursing homes. Individual goals with plans were set through care plan meetings with residents’ families, which was aligned with the guidelines. The study also showed goals setting had impacts on staff training, resident medical evaluation, and other evaluations on diabetes care separately, and vice versa. As for Resident Education, the results indicated education materials prepared by nursing homes were only highlighting blood glucose control and nutrition care, which was not individualized and considerate. When concerning Special and Emerging Care, consistent with the guidelines, more than half of nursing homes had
plans for residents with diabetes who were unable to eat and who were in dehydration. But the specific solutions were different between the policies and the practice, in that guidelines emphasized acute situations and respondents considered chronic conditions.

Overall the study reflected some gaps between policies and practice. For one thing, nursing homes lacked staff equipped with professional knowledge, proficient skill, and abundant experience, and staff education was inadequate for the target group, nursing staff in responded nursing homes, which led to be difficult to well implement policies and recommendations. For another, few RCTs established evidence-based practice; guidelines focusing on long-term care of elderly with diabetes in nursing homes were few; and some policies or recommendations were not comprehensive and specific enough. This lack of evidence may make application to practice limited.
CHAPTER 7

FUTURE DIRECTIONS

The study has three main limitations. Firstly, subjects of this survey were primarily from nursing homes in Illinois of which the number was 52. Another 25 subjects were from 18 different states, California, Delaware, Florida, Indiana, Iowa, Kentucky, Massachusetts, Michigan, Missouri, Montana, New Jersey, North Carolina, Ohio, Oregon, Pennsylvania, Virginia, and Wisconsin, and no more than four subjects were from the same state. The remaining 9 did not answer this question. Therefore, all interpretations of the study may be biased by regions. Situations reflected in the study were most close to the current situations in Illinois rather than other states. Therefore, in order to further conduct the nation-wide evaluation, additional research could reach broader participants from different states, and contacting national health care related organizations would be an effective and time-saving approach.

Secondly, the survey open rate and answer rate were low. The author directly contacted 1176 nursing homes in Illinois and indirectly contacted doctors, dietitians, and nurses over the country through three nutrition and health care related organizations. However, only 219 participants opened the survey link reaching the cover letter view, and 180 participants answered at least one question. Furthermore, only 86 out of 180 participants were actually working at nursing homes. Therefore, the survey open rate was no more than 18.6%, the answer rate was 82.2%, and the effective respondents working at nursing homes were 47.8%. As far as the author was concerned,
email-sending failures, no answers of phone interviews, and asking for volunteers without enough benefits were the biggest challenges when inviting. Given the information from mail delivery subsystem, more than fifty emails were declined. Half of the phone interviews were not answered. Additionally, the survey may cost variable time ranged from one minute to thirty minutes depending on the answer to each question and how long was the respondent’s response to each short-answer question. In that case, respondents may feel impatient during the latter half of the survey. In the future research, to well balance the length of survey and the contents in the survey would be a key point to increase the response rate. Besides, the appropriate incentives would be needed as well.

Thirdly, some Chi-Square test results were hard to find sufficient evidence for explanation. In other words, it was not apparent why a relationship among certain variables showed significance. Those are: changes to meals or snacks if going bed right after dinner score with dental condition evaluation upon admission score, whether A1c measurement score with receiving metformin after 80 years of age score, resident evaluation when medical conditions may influence usual blood glucose score with receiving metformin after 80 years of age score, whether A1c measurement score with educating residents score, and setting glucose parameters indicating when alerting physician of serious change with educating residents. Although the significant relationships existed, little former research was aligned with them. Therefore, additional studies in the future are needed to help clarify these areas.
Fourthly, based on the results from this study, the author considered two aspects were especially worth further thinking and exploring. One was about exercise in nursing home. In the study, we only learned the engagement percentage and the monitoring percentage, but we do not know what types of exercise are included in restorative programs, what other types of exercise are conducted, what the understanding of “exercise” for nursing home staff is, how the monitoring is done, where the documentation is, and what goal for individuals are. Thus additional research is called for to continue answering these questions. The other was about the degree of alignment with the guidelines. In this study the author used “50%” as the critical line to divided nursing homes into two groups, alignment and misalignment. But actually “50%” only means half, which is not enough to reach the degree of “well done” or “satisfying”. The 50% even up to 80% should be considered that it still needs certain improvement, and less than 50% means there exists a big problem which is far from the alignment. Therefore, how to set a critical value to judge the performance of nursing homes is a challenge.
### Table 1 Responses of yes/no multiple-choice questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Not sure</th>
<th>Various</th>
<th>Number responding</th>
<th>Response rate %</th>
<th>Yes rate %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category 1: Available Staff</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q1 Does your facility have a diabetes care coordinator?</td>
<td>4</td>
<td>60</td>
<td>8</td>
<td>7</td>
<td>79</td>
<td>91.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Q4 Is there a staff person who oversees diabetes care?</td>
<td>16</td>
<td>38</td>
<td>3</td>
<td>2</td>
<td>59</td>
<td>-*</td>
<td>27.1</td>
</tr>
<tr>
<td>Q5 Does your facility have access to an endocrinologist or nurse practitioner for consultation?</td>
<td>39</td>
<td>20</td>
<td>10</td>
<td>8</td>
<td>77</td>
<td>89.6</td>
<td>50.6</td>
</tr>
<tr>
<td>Q6 Do you have a Registered Dietitian?</td>
<td>69</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>78</td>
<td>81.3</td>
<td>88.5</td>
</tr>
<tr>
<td>Q8 Does your Registered Dietitian develop individualized meal plans?</td>
<td>35</td>
<td>24</td>
<td>5</td>
<td>4</td>
<td>68</td>
<td>-</td>
<td>51.5</td>
</tr>
<tr>
<td><strong>Category 2: Staff Training</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q12 Do you include diabetes care in the ongoing staff orientation?</td>
<td>30</td>
<td>21</td>
<td>12</td>
<td>6</td>
<td>69</td>
<td>80.2</td>
<td>43.5</td>
</tr>
<tr>
<td>Q14 Do you include diabetes care in the ongoing staff training?</td>
<td>33</td>
<td>22</td>
<td>10</td>
<td>4</td>
<td>69</td>
<td>80.2</td>
<td>47.8</td>
</tr>
<tr>
<td>Q16 Has nursing staff received diabetes inservices in past 2 years?</td>
<td>30</td>
<td>13</td>
<td>23</td>
<td>5</td>
<td>71</td>
<td>82.6</td>
<td>42.3</td>
</tr>
<tr>
<td><strong>Category 3: Resident Food</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q17 Do you require or offer 3 snacks per day?</td>
<td>35</td>
<td>20</td>
<td>6</td>
<td>5</td>
<td>66</td>
<td>76.7</td>
<td>53.0</td>
</tr>
<tr>
<td>Q23 Are residents with diabetes free to exercise personal choice in food selection?</td>
<td>37</td>
<td>25</td>
<td>0</td>
<td>7</td>
<td>69</td>
<td>80.2</td>
<td>53.6</td>
</tr>
<tr>
<td>Q24 Do you offer a consistent carbohydrate diet for residents with diabetes?</td>
<td>43</td>
<td>12</td>
<td>14</td>
<td>0</td>
<td>69</td>
<td>80.2</td>
<td>62.3</td>
</tr>
<tr>
<td>Q25 After dinner, are changes made to meals or snacks if going to bed right after dinner?</td>
<td>12</td>
<td>37</td>
<td>20</td>
<td>0</td>
<td>69</td>
<td>80.2</td>
<td>17.4</td>
</tr>
<tr>
<td>Q27 Is food intake monitored?</td>
<td>57</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>69</td>
<td>80.2</td>
<td>82.6</td>
</tr>
<tr>
<td>Q29 Is carbohydrate intake monitored?</td>
<td>14</td>
<td>45</td>
<td>9</td>
<td>1</td>
<td>69</td>
<td>80.2</td>
<td>20.3</td>
</tr>
<tr>
<td>Q32 Are there flexible meal plans where residents can have 5 meals per day?</td>
<td>18</td>
<td>43</td>
<td>3</td>
<td>3</td>
<td>67</td>
<td>77.9</td>
<td>26.9</td>
</tr>
<tr>
<td>Q33 Are alcoholic beverages served?</td>
<td>22</td>
<td>38</td>
<td>4</td>
<td>3</td>
<td>67</td>
<td>77.9</td>
<td>32.8</td>
</tr>
<tr>
<td>Q34 Are alcoholic beverages available to all residents?</td>
<td>8</td>
<td>41</td>
<td>10</td>
<td>0</td>
<td>59</td>
<td>-</td>
<td>13.6</td>
</tr>
<tr>
<td>Category 4: Resident Medical Evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q36 Is hemoglobin A1c measured?</td>
<td>51</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>65</td>
<td>75.6</td>
<td>78.5</td>
</tr>
<tr>
<td>Q39 Are you evaluate resident for medical conditions affecting blood glucose goals?</td>
<td>52</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>66</td>
<td>76.7</td>
<td>78.8</td>
</tr>
<tr>
<td>Category 5: Resident Medication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q40</td>
<td>Is there a limit on number of insulin injections a resident can receive each day?</td>
<td>3</td>
<td>38</td>
<td>19</td>
<td>2</td>
<td>62</td>
<td>72.1</td>
</tr>
<tr>
<td>Q42</td>
<td>Does your facility use sliding scale insulin?</td>
<td>60</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>66</td>
<td>76.7</td>
</tr>
<tr>
<td>Q43</td>
<td>Do residents older than 80 receive metformin?</td>
<td>34</td>
<td>4</td>
<td>24</td>
<td>4</td>
<td>66</td>
<td>76.7</td>
</tr>
<tr>
<td>Q44</td>
<td>Any labs ordered for residents receiving Metformin?</td>
<td>21</td>
<td>5</td>
<td>8</td>
<td>-</td>
<td>34</td>
<td>-</td>
</tr>
<tr>
<td>Q48</td>
<td>Is there a separate admission medical checklist for those with diabetes upon admission?</td>
<td>0</td>
<td>52</td>
<td>12</td>
<td>2</td>
<td>66</td>
<td>76.7</td>
</tr>
</tbody>
</table>

Category 6: Other Evaluations on Diabetes Care

<p>| Q49 | Do you use algorithms to manage residents with diabetes? | 3 | 40 | 18 | 3 | 64 | 74.4 | 4.7 |
| Q51 | Do you have a quality improvement tool to evaluate compliance with the diabetes-related policies in place? | 15 | 29 | 18 | 3 | 65 | 75.6 | 23.1 |
| Q52 | Do you have glucose parameters indicating when nurses should alert the attending physician of serious changes? | 56 | 2 | 5 | 2 | 65 | 75.6 | 86.2 |
| Q55 | Do your policies on diabetes care require a dietary restriction? | 3 | 4 | 0 | 0 | 7 | 8.1 | 42.9 |</p>
<table>
<thead>
<tr>
<th>Q57</th>
<th>Do you have weight goals for residents with diabetes?</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>27</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q58</th>
<th>Are weight goals individualized?</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q59</th>
<th>Do residents with diabetes engaged in exercise?</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q60</th>
<th>Is exercise monitored?</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q62</th>
<th>Is the resident’s dental condition evaluated upon admission?</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q64</th>
<th>Does residents with diabetes weight schedule change?</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q66</th>
<th>Is the amount of carbohydrate eaten estimated prior to giving any before-meal insulin?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>43</td>
</tr>
</tbody>
</table>

**Category 7: Goals of Diabetes Care**

<table>
<thead>
<tr>
<th>Q69</th>
<th>Are goals and plans for residents with diabetes documented?</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>6</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Q70</th>
<th>Are goals for residents with diabetes individualized?</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q71</th>
<th>Are goals discussed with residents and their families?</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>1</td>
</tr>
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</table>

**Category 8: Resident Education**

<table>
<thead>
<tr>
<th>Q73</th>
<th>Do you educate residents with diabetes about their diabetes?</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 1 (cont.)

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>NA</th>
<th>Total</th>
<th>No Response</th>
<th>Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q74 Do you have standardized education materials?</td>
<td>23</td>
<td>26</td>
<td>5</td>
<td>-</td>
<td>54</td>
<td>42.6</td>
</tr>
<tr>
<td>Category 9: Special and Emerging Care</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q76 Do you have a plan for residents with diabetes who are unable to eat?</td>
<td>34</td>
<td>9</td>
<td>16</td>
<td>3</td>
<td>62</td>
<td>72.1</td>
</tr>
<tr>
<td>Q78 Is there a hydration plan for residents with diabetes?</td>
<td>33</td>
<td>12</td>
<td>13</td>
<td>7</td>
<td>65</td>
<td>75.6</td>
</tr>
<tr>
<td>Q80 If dehydration is suspected, diagnosed, or a known problem, is there a general plan or guideline?</td>
<td>43</td>
<td>5</td>
<td>10</td>
<td>7</td>
<td>65</td>
<td>75.6</td>
</tr>
</tbody>
</table>

* The “-” meant no response rate available, because those questions were selectively shown based on the answers to the former questions.
Table 2 Responses in keeping with the guidelines

<table>
<thead>
<tr>
<th>Questions</th>
<th>Agree with guidelines n (n)%</th>
<th>Not agree with guidelines n (n)%</th>
<th>Responses n</th>
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<td><strong>Category 1: Available Staff</strong></td>
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<tr>
<td>Q1 Do your facility have a diabetes care coordinator?</td>
<td>4 (5.1)</td>
<td>75 (94.9)</td>
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<tr>
<td>Q4 Is there a staff person who oversees diabetes care?</td>
<td>16 (27.1)</td>
<td>43 (72.9)</td>
<td>59</td>
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<tr>
<td>Q5 Does your facility have access to an endocrinologist or nurse practitioner for consultation?</td>
<td>39 (50.7)</td>
<td>38 (49.4)</td>
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<tr>
<td>Q6 Do you have a Registered Dietitian?</td>
<td>69 (88.5)</td>
<td>9 (11.5)</td>
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<td>Q8 Does your Registered Dietitian develop individualized meal plans?</td>
<td>35 (51.5)</td>
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<td>Q10 How soon is the meal plan completed?</td>
<td>28 (87.5)</td>
<td>4 (12.5)</td>
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<td><strong>Category 2: Staff Training</strong></td>
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<td>Q12 Do you include diabetes care in the ongoing staff orientation?</td>
<td>30 (43.5)</td>
<td>39 (56.5)</td>
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<tr>
<td>Q14 Do you include diabetes care in the ongoing staff training?</td>
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<td>36 (52.2)</td>
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<td><strong>Category 3: Resident Food</strong></td>
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<tr>
<td>Q22 What extent do the diet reflect personal preferences?</td>
<td>46 (67.7)</td>
<td>22 (32.4)</td>
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<td>Q24 Do you offer a consistent carbohydrate diet for residents with diabetes?</td>
<td>43 (62.3)</td>
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<tr>
<td>Q25 After dinner, are changes made to meals or snacks if going to bed right after dinner?</td>
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<td>57 (82.6)</td>
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<td>Q26 What changes made for meals or snacks if resident go bed right after dinner?</td>
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<td>4 (50.0)</td>
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<td>Q27 Is food intake monitored?</td>
<td>57 (82.6)</td>
<td>12 (17.4)</td>
<td>69</td>
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<td>Q31 What changes are made if a resident’s intake is poor?</td>
<td>36 (63.2)</td>
<td>21 (36.8)</td>
<td>57</td>
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<td><strong>Category 4: Resident Medical Evaluation</strong></td>
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<td>Q35 How often is blood glucose level usually checked?</td>
<td>18 (27.7)</td>
<td>47 (72.3)</td>
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<td>Q36 Is hemoglobin A1c measured?</td>
<td>51 (78.5)</td>
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<td>Q37 How often is A1c measured?</td>
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<td>23 (45.1)</td>
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<td>Q38 What do you consider is a “normal” A1c value?</td>
<td>45 (77.6)</td>
<td>13 (22.4)</td>
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<tr>
<td>Q39 Do you evaluate resident for medical conditions affecting blood glucose goals?</td>
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<td>Category 5: Resident Medication</td>
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<td>Q43 Do residents older than 80 receive metformin?</td>
<td>34 (51.5)</td>
<td>32 (48.5)</td>
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<td>Q48 Is there a separate admission medical checklist for those with diabetes upon admission?</td>
<td>0 (0.0)</td>
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<tr>
<td>Category 6: Other Evaluations on Diabetes Care</td>
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<tr>
<td>Q51 Do you have a quality improvement tool to evaluate compliance with the diabetes-related policies in place?</td>
<td>15 (23.1)</td>
<td>50 (76.9)</td>
<td>65</td>
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<td>Q52 Do you have glucose parameters indicating when nurses should alert the attending physician of serious changes?</td>
<td>56 (86.2)</td>
<td>9 (13.9)</td>
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<td>Q57 Do you have weight goals for residents with diabetes?</td>
<td>26 (40.0)</td>
<td>39 (60.0)</td>
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<td>Q58 Are weight goals individualized?</td>
<td>24 (92.3)</td>
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<td>Q59 Do residents with diabetes engaged in exercise?</td>
<td>34 (54.0)</td>
<td>29 (46.0)</td>
<td>63</td>
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<tr>
<td>Q62 Is the resident’s dental condition evaluated upon admission?</td>
<td>52 (78.8)</td>
<td>14 (21.2)</td>
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<td>Q63 How often is weighted?</td>
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<td>Q64 Does residents with diabetes weight schedule change?</td>
<td>41 (65.1)</td>
<td>22 (34.9)</td>
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<td>Q65 Residents screened for mental status</td>
<td>51 (76.1)</td>
<td>16 (23.9)</td>
<td>67</td>
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<tr>
<td>Q65 Residents screened for frequency of failing</td>
<td>50 (74.6)</td>
<td>17 (25.4)</td>
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<tr>
<td>Q65 Residents screened for skin ulcers</td>
<td>60 (89.6)</td>
<td>7 (10.4)</td>
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<tr>
<td>Question</td>
<td>Number</td>
<td>Percentage</td>
<td>Place</td>
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<tr>
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<td>Q65 Residents screened for blood pressure</td>
<td>55 (82.1)</td>
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<td>67</td>
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<td>Q65 Residents screened for albuminuria testing</td>
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<td>43 (64.2)</td>
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<td>Q65 Residents screened for lipid level</td>
<td>32 (47.8)</td>
<td>35 (52.2)</td>
<td>67</td>
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<td>Q65 Residents screened for meter calibration policies</td>
<td>10 (14.9)</td>
<td>57 (85.1)</td>
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<tr>
<td>Q65 Residents screened for eye exams</td>
<td>37 (55.2)</td>
<td>30 (44.8)</td>
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**Category 7: Goals of Diabetes Care**

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<tr>
<td>Q67 Short-term goals _1</td>
<td>16 (25.8)</td>
<td>46 (74.2)</td>
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<tr>
<td>Q67 Short-term goals _2</td>
<td>45 (72.6)</td>
<td>17 (27.4)</td>
<td>62</td>
</tr>
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<td>Q67 Short-term goals _3</td>
<td>36 (58.1)</td>
<td>26 (41.9)</td>
<td>62</td>
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<td>Q67 Short-term goals _4</td>
<td>30 (48.4)</td>
<td>32 (51.6)</td>
<td>62</td>
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<tr>
<td>Q67 Short-term goals _5</td>
<td>29 (46.8)</td>
<td>33 (53.2)</td>
<td>62</td>
</tr>
<tr>
<td>Q67 Short-term goals _6</td>
<td>33 (53.2)</td>
<td>29 (46.8)</td>
<td>62</td>
</tr>
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<td>Q67 Short-term goals _7</td>
<td>46 (74.2)</td>
<td>16 (25.8)</td>
<td>62</td>
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<td>Q67 Short-term goals _8</td>
<td>17 (27.4)</td>
<td>45 (72.6)</td>
<td>62</td>
</tr>
<tr>
<td>Q67 Short-term goals _9</td>
<td>32 (51.6)</td>
<td>30 (48.4)</td>
<td>62</td>
</tr>
<tr>
<td>Q67 Short-term goals _10</td>
<td>8 (12.9)</td>
<td>54 (87.1)</td>
<td>62</td>
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<tr>
<td>Q68 Long-term goals _1</td>
<td>2 (3.1)</td>
<td>62 (96.9)</td>
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<tr>
<td>Q68 Long-term goals _2</td>
<td>9 (14.1)</td>
<td>55 (85.9)</td>
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<td>Q68 Long-term goals _3</td>
<td>7 (10.9)</td>
<td>57 (89.1)</td>
<td>64</td>
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<td>Q68 Long-term goals _4</td>
<td>8 (12.5)</td>
<td>56 (87.5)</td>
<td>64</td>
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<tr>
<td>Q68 Long-term goals _5</td>
<td>10 (15.6)</td>
<td>54 (84.4)</td>
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</tr>
<tr>
<td>Q68 Long-term goals _6</td>
<td>6 (9.4)</td>
<td>58 (90.6)</td>
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<tr>
<td>Q68 Long-term goals _7</td>
<td>16 (25.0)</td>
<td>48 (75.0)</td>
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<td>Q68 Long-term goals _8</td>
<td>3 (4.7)</td>
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<td>Q68 Long-term goals _9</td>
<td>26 (40.6)</td>
<td>38 (59.4)</td>
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<td>Q68 Long-term goals _10</td>
<td>10 (15.6)</td>
<td>54 (84.4)</td>
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<tr>
<td>Q69 Are goals for residents with diabetes documented?</td>
<td>49 (75.4)</td>
<td>16 (24.6)</td>
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<td>Q70 Are goals or residents with diabetes individualized?</td>
<td>45 (91.8)</td>
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<tr>
<td>Q71 Are goals discussed with residents and their families?</td>
<td>41 (93.2)</td>
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**Category 8: Resident Education**

<table>
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<th>Question</th>
<th>Number</th>
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<td>Q73 Do you educate residents with diabetes about their diabetes?</td>
<td>54 (84.4)</td>
<td>10 (15.6)</td>
<td>64</td>
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</table>
Table 2 (cont.)

<p>| Q74 Do you have standardized education materials? | 23 (42.6) | 31 (57.4) | 54 |
| Category 9: Special and Emerging Care | |
| Q76 Do you have a plan for residents with diabetes who are unable to eat? | 34 (54.8) | 28 (45.2) | 62 |
| Q80 If dehydration is suspected, diagnosed, or a known problem, is there a general plan or guideline? | 43 (66.2) | 22 (33.9) | 65 |</p>
<table>
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<tr>
<th>Category</th>
<th>Full points (maximum)</th>
<th>Responses n</th>
<th>Receiving full points n (n)%</th>
<th>Receiving ≥ half, &lt; all n (n)%</th>
<th>Receiving &lt; half; &gt; 0 n (n)%</th>
<th>Receiving 0 n (n)%</th>
<th>Blank n</th>
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<td>6 (7.3)</td>
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<td>35 (42.7)</td>
<td>11 (13.4)</td>
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<tr>
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<td>2</td>
<td>73</td>
<td>22 (30.1)</td>
<td>19 (26.0)</td>
<td>-</td>
<td>*</td>
<td>32 (43.8) 13</td>
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<tr>
<td>Resident Food</td>
<td>6</td>
<td>70</td>
<td>0 (0.0)</td>
<td>45 (64.3)</td>
<td>21 (30.0)</td>
<td>4 (5.7)</td>
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<tr>
<td>Resident Medical Evaluation</td>
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<td>66</td>
<td>5 (7.6)</td>
<td>37 (56.1)</td>
<td>22 (33.3)</td>
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<td>66</td>
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<td>34 (51.5)</td>
<td>-</td>
<td>32 (48.5)</td>
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<tr>
<td>Other Evaluations on Diabetes Care</td>
<td>16</td>
<td>67</td>
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<td>49 (73.1)</td>
<td>18 (26.9)</td>
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<tr>
<td>Goals of Diabetes Care</td>
<td>14</td>
<td>65</td>
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<td>64</td>
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<td>10 (15.6)</td>
<td>22</td>
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<tr>
<td>Special and Emerging Care</td>
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<td>33 (50.8)</td>
<td>-</td>
<td>10 (15.4)</td>
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</table>

# The "Blank" meant respondents did not give any responses in the categories.
* The "-" meant the possibility of receiving <half and >0 was not existing.
<table>
<thead>
<tr>
<th>Variable 1</th>
<th>Variables 2</th>
<th>Chi-square</th>
<th>df</th>
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<td>Q5 Does your facility have access to an endocrinologist or nurse practitioner for consultation?</td>
<td>Q36 Is A1c measured?</td>
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<td>.001*</td>
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<tr>
<td>Q5 Does your facility have access to an endocrinologist or nurse practitioner for consultation?</td>
<td>Q37 How often is A1c measured?</td>
<td>6.402</td>
<td>1</td>
<td>.011*</td>
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<tr>
<td>Q5 Does your facility have access to an endocrinologist or nurse practitioner for consultation?</td>
<td>Q39 Do you evaluate the resident for medical conditions that might influence usual blood glucose goals?</td>
<td>14.590</td>
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<td><strong>The goal on diabetes care subtotal</strong></td>
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<td>Q69 Are goal for residents with diabetes documented?</td>
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<td>Q69 Are goal for residents with diabetes documented?</td>
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<td>Q25 After dinner, are changes made to meals or snacks of a resident goes to bed right after dinner?</td>
<td>Q57 Do you have weight goals for residents with diabetes?</td>
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<td>Q31 What types of changes do you recommend if a resident’s intake is poor?</td>
<td>Q62 Is the resident’s dental condition evaluated upon admission?</td>
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<td>Resident food subtotal</td>
<td>Resident medical evaluation subtotal</td>
<td>10.616</td>
<td>1</td>
<td>.001&lt;sup&gt;*&lt;/sup&gt;</td>
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<td>Q36 Is hemoglobin A1c measured?</td>
<td>Q43 Do residents older than 80 receive metformin?</td>
<td>10.340</td>
<td>1</td>
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<tr>
<td>Q39 Do you evaluate the resident for medical conditions that might influence usual blood glucose goals?</td>
<td>Q43 Do residents older than 80 receive metformin?</td>
<td>6.440</td>
<td>1</td>
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<td>Other evaluations on diabetes care subtotal</td>
<td>11.590</td>
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<tr>
<td>Q43 Do residents older than 80 receive metformin?</td>
<td>Q52 Do you have glucose parameters indicating when nurses should alert the attending physician of serious changes?</td>
<td>11.457</td>
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<td>Goals of diabetes care subtotal</td>
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<td>Q36 Is hemoglobin A1c measured?</td>
<td>Q69 Are goals for residents with diabetes documented?</td>
<td>5.973</td>
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<td>Q39 Do you evaluate resident for medical conditions affecting blood glucose goals?</td>
<td>Q69 Are goals for residents with diabetes documented?</td>
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<td>Q39 Do you evaluate resident for medical conditions affecting blood glucose goals?</td>
<td>Q71 Are goals discussed with residents and their families?</td>
<td>12.914</td>
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<td>Resident medical evaluation subtotal</td>
<td>Resident education subtotal</td>
<td>18.750</td>
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<td>.000&lt;sup&gt;** b&lt;/sup&gt;</td>
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<tr>
<td>Q36 Is hemoglobin A1c measured?</td>
<td>Q73 Do you educate residents about their diabetes?</td>
<td>18.750</td>
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<td>.000&lt;sup&gt;** b&lt;/sup&gt;</td>
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<tr>
<td>Resident medical evaluation subtotal</td>
<td>Special and emerging care subtotal</td>
<td>.031</td>
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<td>1.000&lt;sup&gt;b&lt;/sup&gt;</td>
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Table 4 (cont.)

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<tr>
<th>Resident medication subtotal</th>
<th>Other Evaluations on Diabetes Care subtotal</th>
<th>2.412</th>
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<td>Goal subtotal</td>
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<td>Q51 Do you have a quality improvement tool to evaluate compliance with the diabetes-related policies in place?</td>
<td>Q69 Are goals for residents with diabetes documented?</td>
<td>6.128</td>
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<td>.013*</td>
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<td>Q52 Do you have glucose parameters indicating when nurses should alert the attending physician of serious changes?</td>
<td>Q69 Are goals for residents with diabetes documented?</td>
<td>6.658</td>
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<td>Q52 Do you have glucose parameters indicating when nurses should alert the attending physician of serious changes?</td>
<td>Q73 Do you educate residents with diabetes about their diabetes?</td>
<td>17.043</td>
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<td>Special and emerging care subtotal</td>
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<td>Resident education subtotal</td>
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<td>Special and emerging care subtotal</td>
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<td>Resident education subtotal</td>
<td>Special and emerging care subtotal</td>
<td>.814</td>
<td>1</td>
<td>.328 b</td>
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</table>

* meant P value < .05, which was significant.
** meant P value < .001, which was highly significant.
a. with the P values, each of the minimum expected count was larger than 1.00.
b. the percentages of cells having expected count less than 5 was more than 20%, therefore, used Fisher’s Exact P value instead.
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<tr>
<th>Short-answer questions</th>
<th>Answer generalization</th>
<th>n_1</th>
<th>n_2</th>
<th>n_3</th>
<th>n_4</th>
<th>n_5</th>
<th>n_6</th>
<th>n_7</th>
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<td>Q9 Who completes the meal plans?</td>
<td>Dietitian</td>
<td>22</td>
<td>7</td>
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<td>Q11 How often is the meal plan revised?</td>
<td>As needed</td>
<td>12</td>
<td>5</td>
<td>5</td>
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<tr>
<td>Q28 How to monitor food intake?</td>
<td>Food intake sheet used; %</td>
<td>41</td>
<td>4</td>
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<td>Q30 How to monitor carbohydrate intake?</td>
<td>Consistent carbohydrate</td>
<td>5</td>
<td>3</td>
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<td>diets and food records</td>
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<td>Question</td>
<td>Frequency</td>
<td>Response 1</td>
<td>Frequency</td>
<td>Response 2</td>
<td>Frequency</td>
<td>Response 3</td>
<td>Frequency</td>
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<td>Q41 How many can a resident receive the insulin injections?</td>
<td>5 per day</td>
<td>1</td>
<td>Doctor determines</td>
<td>1</td>
<td>Varies</td>
<td>1</td>
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<td>Q45 What is ordered specially because of metformin?</td>
<td>A1c</td>
<td>7</td>
<td>Liver function</td>
<td>7</td>
<td>Renal function</td>
<td>7</td>
<td>CBC</td>
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<td>Q46 How is the timing of medications for those with diabetes determined?</td>
<td>Doctor's orders</td>
<td>21</td>
<td>With meals</td>
<td>14</td>
<td>Standard medication pass</td>
<td>5</td>
<td>Depending on glucose levels</td>
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<tr>
<td>Q47 How likely is it that the schedule is adhered to within a 1-hour-range?</td>
<td>90% or more</td>
<td>27</td>
<td>More than 50%, less than 90%</td>
<td>19</td>
<td>Not likely and difficult</td>
<td>2</td>
<td>Varies or unsure</td>
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<tr>
<td>Q50 How to use algorithms to manage residents with diabetes?</td>
<td>Reporting to RD, MD, or nurses</td>
<td>3</td>
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<td>Q53 What is your glucose parameter and how are they set?</td>
<td>Below 50</td>
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<td>Below 60</td>
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<td>More than 200</td>
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<td>Q53 What is your glucose parameter and how are they set? (Continue)</td>
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<td>More than 350</td>
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<td>More than 400</td>
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<td>More than 450</td>
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<td>More than 500</td>
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<td>Varies or set by MD</td>
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<td>Q56 Your polices on diabetes care require a dietary restriction?</td>
<td>15/15 rules</td>
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<td>Q61 How is exercise monitored?</td>
<td>Through restorative programs</td>
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<td>Through physical therapy</td>
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<td></td>
<td>Others</td>
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<td>Q72 How is the discussion with a resident and his/her family accomplished?</td>
<td>Care plan meetings as needed</td>
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<td>Initial care plan meeting upon admission</td>
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<td>Quarterly care plan meetings</td>
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<td>Twice per year care plan meetings</td>
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<td></td>
<td>Through phone</td>
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<td></td>
<td>Others</td>
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<td>Question (cont.)</td>
<td>Response</td>
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<tr>
<td><strong>Q77</strong> The plan for those residents with diabetes unable to eat?</td>
<td>Tube feedings 9, Inform Doctor of Medicine and Registered Dietitian 6, Individuated 5, If cannot feed themselves, they are assisted by staff 4, Others 7</td>
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<td><strong>Q79</strong> What is the hydration plan?</td>
<td>General encouragement 14, Hydration Passes 6, Minimums mentioned 3, Others 5</td>
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<td><strong>Q81</strong> What is the general plan or guidelines of dehydration?</td>
<td>Encourage fluids intake 21, Inform doctor or nurse practitioner 16, IV hydration 12, Input and output (I&amp;O) 2, Others 4</td>
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<td><strong>Q83</strong> What is the percentage of those covered by insurance?</td>
<td>25% 1, 50 50, Others 1</td>
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<tr>
<td><strong>Q84</strong> How many medicare/medicaid beds are in your nursing homes?</td>
<td>100 beds or more 11, 50-99 beds 16, Less than 50 beds 10, 75-100% of their beds 4, 50-75% of their beds 1, Less than 50% of their beds 0, None 3</td>
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Table 5 (cont.)

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<tr>
<th>Q84 How many medicare/medicaid beds are in your nursing homes? (Continue)</th>
<th>Varies</th>
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<th>Others</th>
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<table>
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<th>Respondent number</th>
<th>Who attends</th>
<th>Form and topic</th>
<th>Duration</th>
<th>How often</th>
</tr>
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<tr>
<td>1</td>
<td>All nursing staff</td>
<td>What to monitor for blood sugar reactions, provide good foot care during bathing, monitor skin care, monitor what resident is eating and educate the family about the diet</td>
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<td>2</td>
<td>All staff</td>
<td>-</td>
<td>-</td>
<td>Annually</td>
</tr>
<tr>
<td>3</td>
<td>Dietary staff</td>
<td>-</td>
<td>-</td>
<td>Twice per year</td>
</tr>
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<td>4</td>
<td>Nursing staff</td>
<td>-</td>
<td>-</td>
<td>Annually</td>
</tr>
<tr>
<td>5</td>
<td>Dietary staff</td>
<td>CCHO diet</td>
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<td>Annually</td>
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<tr>
<td>6</td>
<td>All employees</td>
<td>Preventive oral health &amp; its effect on total health, scientific lecture and demonstration</td>
<td>-</td>
<td>Annually</td>
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<tr>
<td>7</td>
<td>Certified nursing assistant, Licensed Dietitian</td>
<td>Signs and symptoms of diabetes, medication</td>
<td>60 min</td>
<td>Annually</td>
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<tr>
<td>8</td>
<td>Nurses</td>
<td>Insulin pen certification by return demonstration after lecture</td>
<td>-</td>
<td>Upon hire</td>
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<td>9</td>
<td>Nursing staff</td>
<td>Crab counting, types of insulin, the timing of accuchek, arrival of food tray, and administration of insulin</td>
<td>-</td>
<td>Annually</td>
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<td>10</td>
<td>Registered nurses, certified nursing assistant</td>
<td>-</td>
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<td>Annually</td>
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<tr>
<td>11</td>
<td>-</td>
<td>Lecture, all nurses blood sugar, neuropathy, all aspects of diabetes</td>
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<td>Description</td>
<td>Duration</td>
<td>Frequency</td>
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<tr>
<td>12</td>
<td>Lecture with return demonstration</td>
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<td>13</td>
<td><strong>Registered nurses, certified nursing assistant, licensed practice nurse</strong></td>
<td>30min</td>
<td>Annually</td>
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<td>14</td>
<td><strong>Meetings</strong></td>
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<tr>
<td>15</td>
<td><strong>New nurses</strong></td>
<td>60 min</td>
<td>Twice per year</td>
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<tr>
<td>16</td>
<td><strong>Nursing staff</strong></td>
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<tr>
<td>17</td>
<td><strong>Registered nurse</strong></td>
<td></td>
<td>On hire and as needed</td>
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<tr>
<td>18</td>
<td><strong>Registered nurse</strong></td>
<td>60 min</td>
<td>Upon hire</td>
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<tr>
<td>19</td>
<td><strong>Nurse</strong></td>
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</tr>
<tr>
<td>20</td>
<td><strong>Nursing staff and nursing administrative staff</strong></td>
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<td>Twice per month</td>
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<tr>
<td>21</td>
<td><strong>Training, accucheck, lab values and staff response to fluctuating blood sugar levels including immediate treatment and notifications</strong></td>
<td>Less than 15min</td>
<td>During new hire</td>
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<td>22</td>
<td><strong>Meeting</strong></td>
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<td>23</td>
<td><strong>Inservice on skin care</strong></td>
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<td>24</td>
<td><strong>All new employees</strong></td>
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<td>Who attends</td>
<td>Form and topic</td>
<td>Duration</td>
<td>How often</td>
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<tr>
<td>1</td>
<td>All new nursing staff</td>
<td>Training, monitoring intake, foot care, signs and symptoms of hypoglycemia, importance of proper diet, skin care</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>All employee</td>
<td>Computer generated training which is completed online</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>All staff</td>
<td>4 online training courses</td>
<td>-</td>
<td>Per quarterly</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Annually</td>
</tr>
<tr>
<td>5</td>
<td>Certified nursing assistant</td>
<td>Monitor for symptoms of high and low blood sugar</td>
<td>30min</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Nurses</td>
<td>Appropriate use of glucometers, handling of low blood sugars including use of intravenous (IV) dextrose</td>
<td>30min</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Nursing staff and food service employees</td>
<td>-</td>
<td>30-60 min</td>
<td>Annually</td>
</tr>
<tr>
<td>8</td>
<td>All nursing staff</td>
<td>Information on insulin, medication, meal planning</td>
<td>-</td>
<td>Every 6 months</td>
</tr>
<tr>
<td>9</td>
<td>-</td>
<td>Foot and wound care, diet control and insulin</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>-</td>
<td>Glucometers competency, signs/symptoms</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Dietary and nursing staff</td>
<td>Consistent carbohydrate diet, related to nutrition</td>
<td>30min</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>Certified nursing assistant, nurses</td>
<td>Identifying early signs of dietetic ulcers</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>Dietary staff</td>
<td>Review the importance of following the prescribed diet, menu items, and serving sizes accurately</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>All level of nursing staff, all food and nutrition staff, all activity and social service aids</td>
<td>Diabetes in general touching on diet, hypoglycemic incidents, foot and eye care</td>
<td>15-30 min</td>
<td>Annually</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>15</td>
<td>All level of nursing staff</td>
<td>-</td>
<td>-</td>
<td>Annually</td>
</tr>
<tr>
<td>16</td>
<td>All employees</td>
<td>Lecture, show, and tell</td>
<td>60-90 min</td>
<td>Annually</td>
</tr>
<tr>
<td>17</td>
<td>-</td>
<td>Lecture and self-directed coursework, diabetes education</td>
<td>30 min</td>
<td>Annually</td>
</tr>
<tr>
<td>18</td>
<td>New employees</td>
<td>Complete blood count monitoring, prepare insulin, administration of insulin and what to do if the client is hypo/hyperglycemic.</td>
<td>120 min</td>
<td>-</td>
</tr>
<tr>
<td>19</td>
<td>All dietary and nursing staff</td>
<td>Types of diabetes, treatment of diabetes, signs/symptoms of hyper and hypoglycemia, skin care, foot care, proper diets and snacks and monitoring intake</td>
<td>60 min</td>
<td>Twice per year</td>
</tr>
<tr>
<td>20</td>
<td>Nurses and certificated nursing staff</td>
<td>-</td>
<td>60 min</td>
<td>-</td>
</tr>
<tr>
<td>21</td>
<td>Registered nurse, licensed practice nurse, Certificated nursing assistant</td>
<td>Long-term nutritional and correctional insulin, crab choice and how they can be substituted</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>22</td>
<td>-</td>
<td>Role play</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>23</td>
<td>Assistants that deliver the meals</td>
<td>Diabetic education</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* "-" meant no answers given by respondents
REFERENCES


in the Elderly and in Nursing Home Residents. *Journal of the American Medical Directors Association, 12*, 627-632.


diagnosed in early adulthood is not specific for the immune-mediated form nor is it HLA-DQ restricted: Possible relation to increased body mass index. *Diabetologia, 44*, 40–47.


APPENDIX A

IRB #1

March 12, 2014

Karen Chapman-Novakofski
Food Science & Human Nutrition
343 Bevier Hall
905 S Goodwin Ave
M/C 182

RE: Diabetes Care in Long Term Care- Expert Panel Review of Survey Questions
IRB Protocol Number: 14603

EXPIRATION DATE: 03/11/2017

Dear Dr. Chapman-Novakofski:

Thank you for submitting the completed IRB application form for your project entitled Diabetes Care in Long Term Care- Expert Panel Review of Survey Questions. Your project was assigned Institutional Review Board (IRB) Protocol Number 14603 and reviewed. It has been determined that the research activities described in this application meet the criteria for exemption at 45CFR46.101(b)(2). This determination of exemption only applies to the research study as submitted. Please note that additional modifications to your project need to be submitted to the IRB for review and exemption determination or approval before the modifications are initiated.

We appreciate your conscientious adherence to the requirements of human subjects research. If you have any questions about the IRB process, or if you need assistance at any time, please feel free to contact me or the IRB Office, or visit our website at http://www.irb.illinois.edu.

Sincerely,

Rebecca Van Tine, MS
Assistant Human Subjects Research Specialist, Institutional Review Board

c: Weixiao Huang
APPENDIX B

IRB#2

Office of the Vice Chancellor for Research
Office for the Protection of Research Subjects
528 East Green Street
Suite 203
Champaign, IL 61820

12/03/2014

Karen Chapman-Novakofski
343 Bevier Hall
905 S Goodwin Ave
M/C 182

RE: Diabetes Care in Long-term Care: Survey sent out to nursing homes in Illinois
IRB Protocol Number: 15394

EXPIRATION DATE: December 02, 2017

Dear Dr. Chapman-Novakofski:

Thank you for submitting the completed IRB application form for your project entitled Diabetes Care in Long-term Care: Survey sent out to nursing homes in Illinois. Your project was assigned Institutional Review Board (IRB) Protocol Number 15394 and reviewed. It has been determined that the research activities described in this application meet the criteria for exemption at 45CFR46.101(b)(2).

This determination of exemption only applies to the research study as submitted. Please note that additional modifications to your project need to be submitted to the IRB for review and exemption determination or approval before the modifications are initiated.

We appreciate your conscientious adherence to the requirements of human subjects research. If you have any questions about the IRB process, or if you need assistance at any time, please feel free to contact me at the OPRS office, or visit our website at http://www.irb.illinois.edu.

Sincerely,

Rose St. Clair, BA
Assistant Human Subjects Research Specialist, Office for the Protection of Research Subjects

cc: Sandra Burke
Weixiao Huang
Dear Participant:

We would like to invite you to participate in a research study on diabetes care by completing a 30-minute survey. This study is being conducted by Dr. Karen Chapman-Novakofski and Weixiao Huang (graduate student) from Department of Food Science and Human Nutrition at the University of Illinois.

Upon completing the survey, or any part of it past the question about whether you work with a nursing home, you can be entered to win one of ten $30 gift cards or the American Diabetes Association book entitled Diabetes Management in Long-Term Setting: A Clinician's Guide to Optimal Care for the Elderly.

As you know, diabetes long-term care is a national issue. Some professional organizations and universities have developed guidelines to help in this regard. However, some aspects of these guidelines may not be possible in every nursing home because of the operational complexity, high cost and labor intensity, or other factors.

This research project aims to evaluate the similarity and differences between theory and practice. We chose three guidelines and ten academic articles as the typical representatives of theory. Our survey reflects this theory, and your responses will contribute to the practice aspects. Therefore, we are asking you to complete the survey, which will help us determine how practical the guidelines have been, on which aspects nursing homes may need help, and where the guidelines might be modified.

Certainly, your participation is voluntary, and you may choose not to answer some or all of the questions. All answers on the survey are kept confidential, and no name or other personal identifiers are asked for, unless you wish to be entered into the drawing. In this case, your responses will be separated from your contact information. Survey results will be presented as summary information only, and no individual answers will be shared. We hope to receive responses from the nursing homes in Illinois as well as dietitians, nursing staff, and nursing home administrators throughout the country that may be reached through professional organizations.

The survey takes about 30 minutes to fill out. For most questions, you just need check the choices that match your thoughts. Some questions need short explanatory answers. There are no right or wrong answers.
APPENDIX C (cont.)

Your responses will contribute to the understanding of diabetes care practices in nursing homes, and hopefully to better align guidelines with practice. In this way, we hope this project will contribute to better policy, practice, future research, and more benefits to diabetic patients.

We are looking forward to your survey answers within four weeks. If you have any questions or concerns, please email us: Dr. Karen Chapman-Novakofski, kmc@illinois.edu, or Weixiao Huang at whuang43@illinois.edu; or phone us at 217-244-2852. If you have any questions about your rights as a participant in this study or any concerns or complaints, please contact the University of Illinois Institutional Review Board at 217-333-2670 or via email at irb@illinois.edu.

In order to support anonymity, your submitting of this survey implies consent. We are not asking for a signature that may identify you in particular.

PLEASE READ CAREFULLY BEFORE PROCEEDING. By clicking the next button, you indicate you have read the instructions and agree to participate in this survey.

If you prefer a paper copy of this survey instead, please enter your mailing address below. We will send a paper copy to you (if not, please leave it blank).

Thank you. Your effort in completing the survey is greatly appreciated.

Weixiao Huang
Graduate student

Karen Chapman-Novakofski, PhD, RD
Professor
APPENDIX C (cont.)

Diabetes Care in Nursing Homes

Please check your response box or write your comments in the available spaces. Questions are arranged by topic.

About You

1. Do you primarily work with:

   One nursing home □

   Two or more nursing homes □

   Not associated with a nursing home □ [end survey and thank them]

2. What is your primary responsibility? (Check all that apply.)

   Administration □

   Nursing □

   Medical □

   Nutrition/dietetics □

   Other __________ □

3. What state do you work in? (have drop down of all states)

4. How many years have you been working with nursing homes?

   1-5 □   6-10 □   >10 □
APPENDIX C (cont.)

Available Staff

If you work with more than one nursing home, please select the answer that reflects the majority of the homes you work with, or select - varies too much to say as an answer.

1. a. Does your facility have a diabetes care coordinator?

Yes □ No □ Not sure □ Varies too much among several nursing homes to say □

b. If yes, what are the qualifications of the diabetes care coordinator? And what percentage of their time is devoted to diabetes? (Check all that apply.)

Registered Dietitian □ The percentage of time ______________________

Bachelor of Science in Nursing □ The percentage of time _____________

Associate Degree in Nursing □ The percentage of time _______________

Licensed Practical Nurse □ The percentage of time __________________

Nursing Assistant □ The percentage of time _________________________

Diploma nurse □ The percentage of time ___________________________

Social worker □ The percentage of time ____________________________

Others ________ □ The percentage of time _________________________
APPENDIX C (cont.)

c. If no, that is to say your facility does not have a diabetes care coordinator, is there a staff person who oversees diabetes care within the facility?

Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

d. If yes, the percentage of time _____________________

2. Does your facility have access to an endocrinologist or nurse practitioner for consultation?

Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

3. a. Do you have a Registered Dietitian?

Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

b. If yes, they are (Check all that apply.)

Full time □  Part time □  Consulting □

c. Does he/she develop individualized meal plans for residents of your center?

Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

d. If yes, who completes these? _______________________________

and how soon after admission are they completed? __________________

and how often are they revised? ________________________________
APPENDIX C (cont.)

Staff Training

If you work with more than one nursing home, please select the answer that reflects the majority of the homes you work with, or select-varies too much to say as an answer.

1. Do you include any aspect of diabetes care in your ongoing staff orientation or training? check the boxes below.

   a. Staff orientation

   Or Varies too much among several nursing homes to say □

<table>
<thead>
<tr>
<th>Number</th>
<th>*Orientation modality</th>
<th>**Classification of employees</th>
<th>Topics</th>
<th>Duration per topic</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Example)</td>
<td>Lecture</td>
<td>Registered nurses</td>
<td>Diabetes eye and foot health</td>
<td>60 min</td>
<td>Once per month</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
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<td>10</td>
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<td></td>
</tr>
</tbody>
</table>
APPENDIX C (cont.)

*Orientation modality could be lecture, web-based self-directed modules, role-playing, reading or handouts, etc.
**Classification of employees could be registered nurses, licensed practical nurses, nursing assistants, etc.

b. Staff training

Or Varies too much among several nursing homes to say □

<table>
<thead>
<tr>
<th>Number</th>
<th>*Training modality</th>
<th>**Classification of employees</th>
<th>Topics</th>
<th>Duration per topic</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Role-playing</td>
<td>Nursing assistants</td>
<td>Diabetes eye and foot health</td>
<td>30 min</td>
<td>Once per month</td>
</tr>
<tr>
<td>2</td>
<td></td>
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</tr>
</tbody>
</table>

*Training modality could be lecture, web-based self-directed modules, role-playing, reading or handouts, etc.
**Classification of employees could be registered nurses, licensed practical nurses, nursing assistants, etc.
APPENDIX C (cont.)

2. Has nursing staff received in-services in the past 2 years on diabetes?

   Yes □   No □   Not sure □   Varies too much among several nursing homes to say □

Resident Food

1. a. Do you require or offer 3 snacks per day for residents?

   Yes □   No □   Not sure □   Varies too much among several nursing homes to say □

c. If yes, all residents □   all residents with diabetes □

   all residents on insulin □   type 1 diabetes □   type 2 diabetes □.

d. If yes, what type of snacks do you serve? (Check all that apply, ✔ in the squares.)

   Less than 5 grams of carbohydrate:

<table>
<thead>
<tr>
<th></th>
<th>1/4 of a whole avocado (~4g)</th>
<th>2</th>
<th>5 baby carrots</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1 hard-boiled egg</td>
<td>4</td>
<td>1 cup of light popcorn</td>
</tr>
<tr>
<td>5</td>
<td>1/4 cup of fresh blueberries</td>
<td>6</td>
<td>2 saltine crackers</td>
</tr>
<tr>
<td>7</td>
<td>1 frozen sugar-free popsicle</td>
<td>8</td>
<td>1/2 cup sugar-free gelation</td>
</tr>
<tr>
<td>9</td>
<td>1 piece of string cheese stick</td>
<td>10</td>
<td>8 green olives</td>
</tr>
<tr>
<td>11</td>
<td>2 tablespoons pumpkin or sesame seeds</td>
<td>12</td>
<td>15 almonds</td>
</tr>
<tr>
<td>13</td>
<td>3 celery sticks + 1 tablespoon of peanut butter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### APPENDIX C (cont.)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>5 cherry tomatoes + 1 tablespoon ranch dressing</td>
</tr>
<tr>
<td>15</td>
<td>1 cup cucumber slices + 1 tablespoon ranch dressing</td>
</tr>
<tr>
<td>16</td>
<td>1 cup of salad greens + 1/2 cup of diced cucumber + drizzle of vinegar and oil</td>
</tr>
<tr>
<td>17</td>
<td>Others:____________________________________________________________________________</td>
</tr>
</tbody>
</table>

About 10-20 grams of carbohydrate:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 small apple or orange</td>
</tr>
<tr>
<td>2</td>
<td>1/2 turkey sandwich</td>
</tr>
<tr>
<td>3</td>
<td>1/2 cup tuna salad + 4 saltines</td>
</tr>
<tr>
<td>4</td>
<td>3 cups light popcorn</td>
</tr>
<tr>
<td>5</td>
<td>1/4 cup dried fruit and nut mix</td>
</tr>
<tr>
<td>6</td>
<td>1 cup chicken noodle soup, tomato soup, or vegetable soup</td>
</tr>
<tr>
<td>7</td>
<td>1/3 cup hummus + 1 cup raw fresh cut veggies</td>
</tr>
<tr>
<td>8</td>
<td>1/4 cup cottage cheese + 1/2 cup canned or fresh fruit</td>
</tr>
<tr>
<td>9</td>
<td>1 cheese quesadilla + 1/4 cup salsa</td>
</tr>
<tr>
<td>10</td>
<td>2 rice cakes + 1 tablespoon peanut butter</td>
</tr>
<tr>
<td>11</td>
<td>5 whole wheat crackers + 1 piece of string cheese</td>
</tr>
<tr>
<td>12</td>
<td>Others:______________________________________________________________________________</td>
</tr>
</tbody>
</table>

2. What types of diets are available for the clinician to order for those with diabetes? (Check all that apply.)

- Texture changes □
- Calorie levels □
- Carbohydrate levels □
- Low fat □
- Low sodium □
- No added sugar □
- Regular □
- Others □__________________________
- Varies too much among several nursing homes to say □
APPENDIX C (cont.)

3. To what extent do the diets of those with diabetes reflect personal preferences?

- Not at all □
- Some □
- A lot □
- All preferences □
- Not sure □

Varies too much among several nursing homes to say □

4. Are residents free to exercise personal choice in food selection? For instance, do they complete a “restaurant-type” order for meals?

- Yes □
- No □
- Not sure □

Varies too much among several nursing homes to say □

5. Do you offer a consistent carbohydrate diet for diabetes?

- Yes □
- No □
- Not sure □

6. a. After dinner, are changes made to meals or snacks if a resident goes to bed right after dinner?

- Yes □
- No □
- Not sure □
- Varies too much among several nursing homes to say □

b. If yes, how?__________________________________________________________
                                                                                   
7. a. Is food intake monitored?

- Yes □
- No □
- Not sure □
- Varies too much among several nursing homes to say □

b. If yes, how?__________________________________________________________
                                                                                   
8. a. Is carbohydrate intake monitored?
Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

b. If yes, how? ____________________________________________
__________________________________________________________

9. What types of changes do you recommend if a resident’s intake is poor?
Recommend:_________________________________________________
___________________________________________________________

Or Varies too much among several nursing homes to say □

10. Are there “flexible meal plans” or “room service plans” where residents can have 5 meals per day?

Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

11. a. Are alcoholic beverages served at your facility?

Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

b. Are they available to all residents?

Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

c. If no, who is restricted? ________________________________

Resident Medical Evaluation
APPENDIX C (cont.)

If you work with more than one nursing home, please select the answer that reflects the majority of the homes you work with, or select-varies too much to say as an answer.

1. How often are blood glucose levels usually checked when residents have a diagnosis of diabetes?

   Multiple times/day □   Once/day □   Once/week □   Once/month □

   □

   Once/6 months □   Varies with resident □, explain:________________

2. a. Is hemoglobin A1c measured?

   Yes □   No □   Not sure □   Varies too much among several nursing homes to say □

   b. If yes, how often?

   Monthly □   3 months □   6 months □   yearly □   others □, __

   c. What do you consider as a “normal” value? ______________________

3. Do you evaluate the resident or patient for medical conditions that might influence usual blood glucose goals?

   Yes □   No □   Not sure □   Varies too much among several nursing homes to say □

Resident Medication
APPENDIX C (cont.)

If you work with more than one nursing home, please select the answer that reflects the majority of the homes you work with, or select-varies too much to say as an answer.

1. a. Is there a limit on the number of insulin injections a resident can receive each day?

   Yes □   No □   Not sure □   Varies too much among several nursing homes to say □

   b. If yes, how many can they receive? _____________________________

2. Do you or does your facility use sliding scale insulin?

   Yes □   No □   Not sure □   Varies too much among several nursing homes to say □

3. a. Do residents older than 80 receive metformin?

   Yes □   No □   Not sure □   Varies too much among several nursing homes to say □

   b. Are there any lab tests ordered with this?

   Yes □   No □   Not sure □

   c. If yes, what is ordered in particular because metformin is prescribed?

   _____________________________________________________________

4. a. How is the timing of medications for those with diabetes determined?

   _____________________________________________________________

   _____________________________________________________________

   b. How likely is it that the schedule is adhered to within a 1 hour range?

   _____________________________________________________________

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APPENDIX C (cont.)

5. Is there a separate admission medical checklist for those with diabetes upon admission?

Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

Other Evaluations on Diabetes Care

If you work with more than one nursing home, please select the answer that reflects the majority of the homes you work with, or select-varies too much to say as an answer.

1. a. Do you use algorithms to manage residents with diabetes?

Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

b. If yes, what is it? __________________________________________

2. Do you have a quality improvement tool to evaluate compliance with the diabetes-related policies in place?

Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

3. a. Do you have glucose parameters indicating when nurses should alert the attending physician of serious changes?

Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

b. If yes, what are they and how are they set? __________________
APPENDIX C (cont.)

4. How often does hypoglycemia appear in residents with diabetes?
   
   <5% of those with diabetes/year □  <10% of those with diabetes/year □
   
   <25% of those with diabetes/year □  <50% of those with diabetes/year □
   
   >50% of those with diabetes/year □  Varies too much among several
   nursing homes to say □

5. a. Do your policies on diabetes care require a dietary restriction?
   
   Yes □  No □  Not sure □  Varies too much among several
   nursing homes to say □
   
   b. If yes, briefly explain ________________________________
      ________________________________

6. a. Do you have weight goals for patients with diabetes?
   
   Yes □  No □  Not sure □  Varies too much among several
   nursing homes to say □
   
   b. If yes, are they individualized?
   
   Yes □  No □  Not sure □

7. a. Do residents with diabetes engage in exercise?
   
   Yes □  No □  Not sure □  Varies too much among several
   nursing homes to say □
   
   b. If yes, are they monitored?
   
   Yes □  No □  Not sure □
APPENDIX C (cont.)

c. If yes, how? ____________________________________________

8. Is the resident’s dental condition evaluated upon admission?

Yes □  No □  Not sure □

9. a. How often are residents weighed?

   Once/day □  Once/week □  Once/month □  Once/3 months □

   Once/6 month □  Once/year □  others □ ________________

b. Does this schedule change?

   Yes □  No □  Not sure □

c. If yes, when? ____________________________________________

10. Are residents with diabetes screened for the following? (Check all that apply.)

   Mental status □  Frequency of falling □  Skin ulcers □

   Blood pressure testing □  Albuminuria testing □  Lipids level □

   Meter calibration policies □  Eye exams □  Others □ __________

11. a. Is the amount of carbohydrate eaten estimated prior to giving any before-meal insulin?

   Yes □  No □  Not sure □  Varies too much among several nursing homes to say □

b. If yes, by whom? ____________________________________________
APPENDIX C (cont.)

Goals of Diabetes Care

1. What is the focus of diabetes care for short-term residents? (Check all that apply.)

   1) Help the resident understand carbohydrate-counting □

   2) Help the resident understand the effects of dietary intake on glucose levels □

   3) Help the resident understand the long-term effects of elevated glucose levels □

   4) Prevent emergency room visits from acute complications □

   5) Prevent hospitalizations resulting from acute complications □

   6) Educate family about their part in preventing complications □

   7) Keep blood glucose within a target range □

   8) Teach survival skills training for self-care □

   9) Enhance quality of life □

   10) Others □ ________________________________

2. What is the focus of diabetes care for long term residents? (Check all that apply.)

   1) Help the resident understand carbohydrate-counting □

   2) Help the resident understand the effects of dietary intake on glucose levels □
APPENDIX C (cont.)

3) Help the resident understand the long-term effects of elevated glucose levels □

4) Prevent emergency room visits from acute complications □

5) Prevent hospitalizations resulting from acute complications □

6) Educating family about their part in preventing complications □

7) Keeping blood glucose within a target range □

8) Teaching survival skills training for self-care □

9) Enhance quality of life □

10) Others □ ________________________________

______________________________

3. a. Are patient goals for residents with diabetes documented?

Yes □ No □ Not sure □ Varies too much among several nursing homes to say □

b. Are they individualized?

Yes □ No □ Not sure □ Varies too much among several nursing homes to say □

c. Are these goals discussed with the resident and the resident’s family?

Yes □ No □ Not sure □ Varies too much among several nursing homes to say □
APPENDIX C (cont.)

d. If yes, how is that accomplished? __________________________________________
_________________________________________________________

Residents Education

1. a. Do you educate residents about their diabetes?

   Yes □   No □   Not sure □   Varies too much among several nursing homes to say □

   b. If yes, do you have standardized resident education materials?

   Yes □   No □   Not sure □

   c. If yes, what standardized education materials used? (Check all that apply.)

      1) Carbohydrate counting □

      2) Exchange system for meal planning □

      3) Academy of Nutrition and Dietetics nutrition care manual □

      4) American Diabetes Association website information □

      5) Others □ _______________________________________________________

Special and Emerging Care

1. a. Is there a plan for residents with diabetes who are unable to eat?

   Yes □   No □   Not sure □   Varies too much among several nursing homes to say □
APPENDIX C (cont.)

b. If yes, briefly introduce the plan: __________________________________________

2. a. Is there a hydration plan for residents with diabetes?

   Yes □   No □   Not sure □   Varies too much among several nursing homes to say □

   b. If yes, what is it? __________________________________________

3. a. If dehydration is suspected, diagnosed, or a known problem, is there a general plan or guideline?

   Yes □   No □   Not sure □   Varies too much among several nursing homes to say □

   b. If yes, what is it? __________________________________________

Payment Structure

1. a. What is the payment structure for patients?

   All have insurance □   All private pay □   Mix □

   b. If a mix, the percentage of those covered by insurance is __________

      And the percentage of private pay is __________________________

Nursing Home Scale and Location

1. How many Medicare/Medicaid beds are in your nursing home? ______

2. What is your zip code? __________________________
APPENDIX C (cont.)

Thank you for your cooperation! Your effort in completing the survey is greatly appreciated!

Now you are provided a chance to get a $30 gift card or an American Diabetes Association book entitled Diabetes Management in Long-Term Care by L. Haas and S.D. Burke. You can choose the one you prefer.

If you would like to be entered in the drawing for a $30 gift card or an American Diabetes Association book entitled Diabetes Management in Long-Term Care by L. Haas and S.D. Burke, please enter your contact information below. This information will be saved separately from the survey responses.

If you do not want to be entered, please directly close the window to end. Thank you for your effort again!

Name:

Email:

Mailing address:

Phone:

Thank you for your cooperation! Your effort is appreciated!