A STUDY TO EVALUATE THE EFFECTIVENESS OF THE SALUS EDUCATION ONLINE DIABETES TRAINING PROGRAM FOR IMPROVING KNOWLEDGE AND SELF-EFFICACY OF SCHOOL DISTRICT EMPLOYEES

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To the Dean of the Graduate School:

I am submitting herewith a dissertation written by Cassity Gutierrez entitled "A Study to Evaluate the Effectiveness of the Salus Education Online Diabetes Training Program for Improving Knowledge and Self-efficacy of School District Employees." I have examined this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy with a major in Health Studies.

Kimberly Parker, Ph.D., Major Professor

We have read this dissertation and recommend its acceptance:

Department Chair

Accepted:

Dean of the Graduate School

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ABSTRACT

CASSITY GUTIERREZ

A STUDY TO EVALUATE THE EFFECTIVENESS OF THE SALUS EDUCATION ONLINE DIABETES TRAINING PROGRAM FOR IMPROVING KNOWLEDGE AND SELF-EFFICACY OF SCHOOL DISTRICT EMPLOYEES

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The number of children with diabetes continues to increase in epidemic proportions. The care of these students extends from the home into school, requiring school personnel to be adequately trained to administer care. Several studies have highlighted the necessity of diabetes training for school personnel to improve the provision of care for diabetic students in the school setting (Siminerio & Koerbel, 2000; Wagner & James, 2006; Mandali & Gordon, 2009; Hayes-Bohn, Neumark-Sztainer, Mellin & Patterson, 2004). Studies have explored diabetes training programs for school nurses (Fisher, 2006; Nabors, Troillett, Nash, & Masiulis, 2005); however, limited research has been devoted to looking at the efficacy of such programs for unlicensed personnel. The current study evaluated the effectiveness of the Salus Education Online Diabetes Education program by comparing the change in knowledge and self-efficacy scores of the participants by current occupation and prior diabetes training status. In addition, the study examined the association between user satisfaction with the online program and change in knowledge and self-efficacy scores.

Results of this study showed a significant increase in the knowledge and confidence scores of the participants from pre to posttest. Although unlicensed diabetes care assistants (UDCA's) had baseline knowledge and confidence scores that were lower than nurses, they had significant change scores resulting in similar posttest scores. In addition, those with no prior diabetes training had significant change in knowledge and confidence scores resulting in posttest scores that were almost equivocal to those with prior diabetes training. Knowledge and confidence change scores were not associated with the participants' rating of the usefulness of the program. Finally, there was a significant, positive relationship between the change in knowledge scores and change in confidence scores; demonstrating that as participants' knowledge increased from the training program, their confidence in administering diabetes care increased also. As a result of these findings, recommendations for follow up research were suggested to include assessing implications for practice and outcomes for diabetic students. Recommendations for the application of the findings were also provided. Schools can utilize online programs to train school staff on diabetes.

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CHAPTER I

INTRODUCTION

Diabetes is one of the most common diseases in children, impacting around 186,000 people in the United States under the age of 20 (National Diabetes Education Program [NDEP], 2008). The prevalence of both type 1 and type 2 diabetes in school-aged children continues to increase. The intensity of their medical management continues to increase and extends from the student's home into the school. Trained school staff are needed to assist students with diabetes-related care at any location in school as needed. Unfortunately, school staff are not adequately trained to deal with diabetic emergencies (Gagliardi, Neighbors, Spears, Byrd, & Snarr, 1994; Olympia, Wan & Avner, 2005) and often lack confidence to provide diabetes care (Fisher, 2006). Studies have demonstrated that providing training to school personnel creates a more supportive school environment for the diabetic child (Wagner & James, 2006) and significantly improves their glycemic control (Siminerio & Koerbel, 2000).

Schools are guided by local, state, and federal policy regarding student health support. In Texas, House Bill (HB) 984 was passed in 2005 to provide the legal framework under which schools must train a minimum number (one in districts with a full-time nurse and three in districts without a full-time nurse) of designated non-medical staff to assist or augment the services of a school nurse in caring for students with diabetes (Texas Diabetes Council [TDC], 2009). The TDC (2009) created guidelines for training

unlicensed school employees to serve as diabetes care assistants that includes both knowledge and skills components. The training must be provided by a Certified Diabetes Educator or by the school nurse (TDC, 2009). Currently, all of the twenty Education Service Centers (ESC's) (organizations providing professional development and technical assistance to school districts throughout Texas) are required to provide at least two Unlicensed Diabetes Care Assistant (UDCA) workshops each year to assist school districts with training their UDCA's. These limited trainings are typically three to six hours and are conducted at the ESC's, representing an additional commitment and cost for school staff to attend.

Numerous studies suggest that continuing education is essential for school staff to stay current on diabetes management; little attention has been directed toward using programs that can be accessed via the internet. Information exists on diabetes continuing education for school nurses (Vought-O'Sullivan, Meehan, Havice, & Pruitt, 2006; Fisher, 2006; Nabor, Troillet, Nash, & Masiulis, 2005); however, very little has been reported on the effectiveness of an online diabetes education program to improve the knowledge, skills, and self-efficacy to provide diabetes care in unlicensed school personnel.

The researcher expands upon the limited knowledge about the utilization of distance education to train unlicensed personnel to administer diabetes care in the school setting. The findings provide valuable information for providers of diabetes continuing education to sustain the need for such initiatives.

Statement of the Purpose

The purpose of this study was to evaluate the effectiveness of the Salus Education Online Diabetes Education program by comparing the change in knowledge and confidence scores of the participants. The change in knowledge and confidence scores were assessed based upon current occupation and prior diabetes training. In addition, the study examined the association between user satisfaction with the online program and change in knowledge and confidence scores.

Hypothesis

The null hypothesis for the study were as follows:

1. There will be no significant difference in the change in knowledge scores when comparing unlicensed diabetes care assistants with school nurses that completed the online Salus Education Diabetes Care at School: Bridging the Gap program.
2. There will be no significant difference in the change in confidence scores when comparing unlicensed diabetes care assistants with school nurses that completed the online Salus Education Diabetes Care at School: Bridging the Gap program.
3. There will be no significant difference in the change in knowledge scores among the Salus Education Diabetes Care at School: Bridging the Gap participants when compared by occupation and diabetes training variables.
4. There will be no significant difference in the change in confidence scores among the Salus Education Diabetes Care at School: Bridging the Gap participants when compared by occupation and diabetes training variables.

5. There will be no significant difference in user satisfaction when compared with change in knowledge and change in confidence scores.

Delimitations

This study was limited to public school districts in South Central Texas and did not examine private schools or schools from outside of Region 20. Only those participants throughout Region 20 that completed the Salus Education Diabetes Care at School: Bridging the Gap program between September 2010 through March 2011 were considered.

Limitations

The data was limited to those school district employees, specifically the school nurses and UDCA's, that decided to complete the online training program; thus, results are not generalizable to the public. The circumstances and knowledge of each UDCA varied. Some voluntarily chose to be the UDCA; whereas, others were appointed by the principal. In addition, some may have had existing knowledge and understanding of diabetes. The data in the study provided a good indication of differences in change in knowledge and self-efficacy scores among school personnel specifically in South Central Texas. However, given the data and sampling limitations, it should not be taken as completely generalizable to the entire population.

Assumptions

The online training modules were only accessible via the internet. The investigator assumed that the participants had access to and were able to utilize a

computer and the internet with ease. As the modules were in English, the investigator assumed that the participants were able to read at a level compatible with the training modules.

Definitions of Terms

Competency: adequate abilities to perform a particular task and the capacity to function in a particular setting with a prescribed set of skills (TDC, 2009).

Glycemic: level of glucose in the blood (ADA, 2009).

Self-Efficacy: person's confidence in performing a particular behavior (Glanz, Rimer, & Lewis, 2002).

Unlicensed Diabetes Care Assistant: the school employee identified by the principal to assist students with diabetes if/when a school nurse is not available (TDC, 2009).

Importance of the Study

This study was important because the number of children with diabetes continues to increase. Existing literature supports the need for quality care to assist students with diabetes and suggests that continuing education is essential for school staff to stay current on diabetes management (Barret, Goodwin, & Kendrick, 2002; Lindsey, 1987; Jameson, 2004). Texas law requires that school districts have unlicensed personnel trained to administer diabetes care. Unfortunately, very little research exists on the efficacy of training programs for unlicensed personnel to deliver diabetes care. Furthermore, little attention has been directed toward using programs that can be accessed via the internet.

The study provided valuable insight into the viability of using an online program such as the Salus Education program to improve the knowledge and self-efficacy of school personnel to administer diabetes care. Since training unlicensed personnel in Texas is a requirement, the results of this study provide important information about training options for school districts throughout the entire State. In addition, many other states are currently looking to develop similar laws and training guidelines. The study adds to the body of knowledge about online diabetes training, the utilization of technology to train unlicensed personnel, and an alternative to on-site workshops.

CHAPTER II

REVIEW OF LITERATURE

An Overview of Diabetes

Pathology and Types of Diabetes

Diabetes is a group of diseases characterized by high blood glucose levels that result from a defect in the body's ability to produce or use insulin (ADA, 2009). Insulin is a hormone produced in the pancreas that regulates the amount of glucose in the blood (ADA, 2009). There are three main types of diabetes: type 1, type 2, and gestational diabetes. Type 1 diabetes, formally called juvenile diabetes, is typically diagnosed in children and young adults (ADA, 2009). Type 1 diabetes accounts for approximately 5-10% of diagnosed cases of diabetes in the United States (National Diabetes Information Clearinghouse [NDIC], 2008). It is a chronic, autoimmune disease where the immune system attacks and destroys the insulin-producing beta cells in the pancreas resulting in little to no insulin production (NDIC, 2008). A person with type 1 diabetes must take insulin daily (ADA, 2009). Although it is unknown as to what exactly causes the body's immune system to attack the beta cells, autoimmune, genetic, and environmental factors are involved (NDIC, 2008).

Type 2 diabetes is the most common form of diabetes accounting for about 90-95% of all diabetes cases (NDIC, 2008). This form of diabetes is most often associated with ethnicity, physical inactivity, obesity, older age, prior gestational diabetes, and a

family history of diabetes; about 80% of people with type 2 diabetes are overweight (ADA, 2009). The prevalence of diabetes among children continues to increase, particularly among Mexican Americans, Pacific Islanders, and African Americans (NDIC, 2008).

Person's with type 2 diabetes are initially able to produce adequate amounts of insulin; however, the body is unable to use the insulin effectively (ADA, 2009). This condition often leads to insulin resistance (ADA, 2009). After several years, insulin production decreases. Similar to type 1 diabetes the excess glucose amounts build up in the blood and the body cannot make efficient use of it (ADA, 2009).

Gestational diabetes impacts women who have high blood sugar levels during pregnancy (ADA, 2009). This type of diabetes impacts around 4% of all pregnant women accounting for 135,000 cases annually in the United States (NDIC, 2008). Gestational diabetes typically disappears after the birth of the baby; however, women who have had it are at a substantially higher risk (40-60% chance) of developing type 2 diabetes within 5 to 10 years (NDIC, 2008). As with type 2 diabetes, gestational diabetes occurs more often in certain ethnicities and women with a family history of diabetes (NDIC, 2008). It begins when the body is not able to make and effectively use all the insulin needed during pregnancy resulting in hyperglycemia (the build-up of high levels of glucose in the body) (ADA, 2009). Pregnancy hormones and an insulin shortage are known contributors (ADA, 2009).

Symptoms

Symptoms of type 1 diabetes usually develop over a short period of time, although beta cell destruction can begin years earlier (NDIC, 2008). Common symptoms include increased thirst and urination, hunger, fatigue, weight loss, and blurred vision (ADA, 2009). If not diagnosed and treated with insulin, a person with type 1 diabetes can lapse into a life-threatening diabetic coma known as diabetic ketoacidosis (NDIC, 2008). Unlike the sudden onset with type 1 diabetes, the symptoms of type 2 diabetes develop gradually (NDIC, 2008). Symptoms include those listed for type 1 diabetes and slow healing cuts and bruises, tingling and numbness in the hands and feet, and frequent infections (ADA, 2009). Some people may not have any symptoms, particularly those with gestational diabetes.

Prevalence

Diabetes is a disease that continues to increase at expansive proportions. Globally, it is estimated that the number of people with diabetes will increase from 140 million in 2002 to over 300 million by 2030 (Wild, Roglic, Green, Sicree, & King, 2004). From 1980 to 2003 in the United States the number of Americans diagnosed with diabetes increased from 5.8 to 14.7 million (Wild et al., 2004). Furthermore, the total current number is estimated to be more than 19 million, as 5.2 million cases are undiagnosed (Wild et al., 2004).

Diabetes does not just impact adults; it is one of the most common diseases in children, impacting around 186,000 young people in the United States under age 20

(NDEP, 2008). The prevalence of both type 1 and type 2 diabetes in children continues to increase. Nearly 1 in every 400 to 600 children has type 1 diabetes (ADA, 2009). In addition, type 2 diabetes is a growing problem among children. In the 1980's, only 5% of children diagnosed with diabetes had type 2 diabetes (CDC, 2009a). Once thought to only afflict older adults, type 2 diabetes, is now being diagnosed in children as young as five (NDIC, 2008). According to the CDC (2009a), one in three children born in the United States will become diabetic. The incidence of Mexican American children diagnosed with type 2 diabetes is now considered to be an epidemic (Steinberger & Daniels, 2003). It is projected that nearly 50% of Mexican American children will eventually develop diabetes (Narayan, 2003).

Complications

The disease can cause numerous complications ranging from heart disease, stroke, blindness, amputations, or death (ADA, 2009). Children with type 1 diabetes are at risk of major complications associated with the disease to include hypoglycemia and diabetes ketoacidosis (Couch et al., 2008). Diabetes ketoacidosis has a mortality rate of 0.5 percent which is due to cerebral edema, the swelling of the brain from excess water (Couch et al., 2008). Cerebral edema occurs in an average of 40% of those presenting with diabetes and is the most frequent diabetes related cause of death (Couch et al., 2008). Risk factors include infection, insulin omission, and equipment malfunction, and treatment includes immediate hospitalization, insulin replacement, and rehydration (Couch et al., 2008).

Another complication associated with diabetes is hypoglycemia. Hypoglycemia, commonly known as low blood sugar, occurs when blood glucose drops below normal levels due to certain medications and diet (ADA, 2009). Symptoms include shakiness, sweating, nervousness, dizziness, sleepiness, confusion, and weakness and in severe cases there may be seizures or unconsciousness (ADA, 2009). In studies exploring the prevalence of severe hypoglycemia in children, a range of 4 to 86 episodes per 100 patient years were reported (Diabetes Control and Complications Research Group, 1994). It is important to note that the prevalence rates for this complication vary as a majority of minor episodes are unreported. Because of their higher rate of glucose utilization, hypoglycemia is often more severe in younger children and a possible cause of death (ADA, 2009). Symptom education, glucose monitoring, and meal planning can all help avoid hypoglycemia.

Additional complications associated with type 1 diabetes include microvascular complications such as neuropathy (disease of the nervous system), nephropathy (disease of the kidney), retinopathy (noninflammatory disease of the retina), and macrovascular complications to include circulatory and cardiovascular events such as heart attack and stroke (ADA, 2009). Although these are rare in children, risk factors such as cholesterol, smoking, and hypertension should be controlled (Couch et al., 2008). Poor glycemic control and disease duration have both contributed to chronic diabetes complications (Glastras, Mohsin, & Donaghue, 2005). In a study exploring the contribution of prepubertal years to diabetes complications, Donaghue et al. (2003)

found that prepubertal diabetes (the onset of diabetes before the age of 10) duration was a significant predicator of retinopathy in young adults. Specifically, the survival-free period of microalbinuria (appearance of small but abnormal amounts of albumin in the urine) and retinopathy was significantly longer for those diagnosed before age five compared with those diagnosed after age five (Donaghue et al., 2003). The risk of clinical retinopathy increased by 28% for every prepubertal year of diabetes duration (OR 1.28 [1.08–1.53]) and by 36% for every postpubertal year of duration (OR 1.36 [1.10–1.69]) (Donaghue et al., 2003). These findings are of major importance when setting glycemic control targets in children at greatest risk for hypoglycemia. It is important to note that there has been a declining incidence of some long-term diabetes complications such as neuropathy and retinopathy over recent decades as a result of improvements in the management of diabetes (Finne, Reunanen, Stenman, Groop, & Gronhagen-Riska, 2005; Pambianco et al., 2006). Diabetes management during childhood impacts the development of complications down the road. As a result, it is important that children have an opportunity to effectively manage their diabetes at all times throughout the day to include during school hours.

Federal and State Laws Addressing Diabetes Care in Schools

Students with chronic health conditions, such as diabetes, are at an increased level of risk as compared to the general student population. The medical management of diabetes is complex and extends from the student's home into the school. Therefore, trained school staff must be available to assist students with diabetes related care at any

location in school as needed. According to the ADA (2009), school staff should be trained to test blood glucose, know how to recognize and treat hypoglycemia and hyperglycemia, be trained to provide insulin injections, be trained to give glucagon injections, and know the child's meal plan.

Local, state, and national policies regarding student health services guide schools with the provision of diabetes care. The primary federal laws protecting children with diabetes include Section 504 of the Rehabilitation Act of 1973, the American with Disabilities Act, and the Individuals with Disabilities Education Act (ADA, 2011). According to these laws, diabetes is considered a disability and schools are not allowed to discriminate against children with this disease (ADA, 2011). Schools receiving federal funding must reasonably accommodate the needs of diabetic students. They must also conduct an individualized assessment of any diabetic child and document within a written plan developed under the relevant federal law such as an Individualized Education Program (IEP) or 504 Plan (Mandali & Gordon, 2009). It is important that the needs of diabetic students are provided for in the normal school environment with as little disruption from school as possible.

Although federal laws provide equivocal protection to students with diabetes in all states, state laws and regulations such as the Nurse Practice Act and the Department of Health and Education regulations determine who is allowed to provide diabetes care in schools. Laws in some states explicitly restrict who can provide diabetes care in the school setting, including restricting an individual student with diabetes from self-

managing his or her own disease (ADA, 2009). In other states, the issue of who can provide diabetes care is ambiguous, resulting in inconsistent care among schools and districts (ADA, 2009). Regardless of state laws about who can give care, schools are still ultimately responsible for meeting the needs of diabetic students as defined by federal law.

In Texas, the legislature passed House Bill (HB) 984 in 2005 to provide the legal framework under which schools must train a minimum number of designated non-medical staff to assist or augment the services of a school nurse in caring for students with diabetes (Texas Diabetes Council [TDC], 2009). HB 984 amends the Health and Safety Code requiring school principals to designate school employees that should be trained to assist diabetic students when there is not an available school nurse (TDC, 2009). At least three people should be trained for each campus that does not have a full-time school nurse, and at least one person must be trained if the school has a full-time nurse (TDC, 2009). The TDC created guidelines for training unlicensed school personnel to serve as diabetes care assistants that includes both knowledge and skills components. By law, the training has to be provided by either the school nurse or a healthcare professional with expertise in diabetes care such as a Certified Diabetes Educator (TDC, 2009).

Although both federal and state legislation exists, schools are often unaware that diabetes is included under the ADA (Siminerio & Koerbel, 2000) or familiar with the requirements of HB 984. This lack of knowledge surrounding laws, policies, and

procedures results in insufficient training for school personnel who work with diabetic children on a daily basis (Siminerio & Koerbel, 2000).

Diabetes Care in Schools

Providing appropriate care for students with diabetes is a challenge. Regardless of the students' type of diabetes, duration, and self-care knowledge and abilities, care in school can present unpredictable difficulties (Marschilok, 2008). The students' ability to manage and cope with diabetes, the school nurses availability, and unforeseen diabetic emergencies all impact the care of students with diabetes. Effective diabetes care in the school is imperative for the student's immediate safety, optimum academic performance, and overall health and wellness.

Studies have looked at the provision of diabetes care in school (Lewis et al., 2003; Melton & Henderson, 2007; Bradbury & Smith, 1983; Hellems & Clarke, 2007; Jacquez et al., 2008; Tahirovic & Toromanovic, 2006). Evidence of inadequate quality of school-based diabetes care has been reported in literature (Lewis et al., 2003; Melton & Henderson, 2007; Bradbury & Smith, 1983). In a study to identify and quantify barriers to good control of diabetes in the school setting, Lewis et al. (2003) discovered that of the 65 schools that responded to the survey, 10% did not have a policy regarding care of and 17% did not have any trained staff to care for diabetic students. In a similar study assessing whether or not public schools in Oregon provided optimal support for diabetic students, Melton and Henderson (2007) found that 25% of the surveyed schools did not have a policy addressing the care of diabetic students and 22% did not have trained staff.

Another study assessing the diabetic knowledge of 97 school teachers in Liverpool found that only 25% had a sufficient understanding of diabetes and there was inadequate knowledge, recognition and treatment of diabetes emergencies (Bradbury & Smith, 1983). Furthermore, a majority of the information that school staff had about diabetes came from the diabetic children and their parents as opposed to medical personnel or the school nurse (Bradbury & Smith, 1983).

Studies have also assessed parent satisfaction with diabetes care at school (Hellems & Clarke, 2007; Jacquez et al., 2008; Tahirovic & Toromanovic, 2006) . In 1999, Virginia passed legislation requiring non-medical school personnel to provide diabetes care to students in the absence of a school nurse (Hellems & Clarke, 2007). Hellems and Clarke conducted a study to determine which school personnel in Virgina assisted diabetic students and determine if students were being cared for in a safe manner. Of the185 surveyed parents whose children attended 153 different schools throughout Virginia, 75% were dissatisfied with the diabetes care provided at school (Hellems & Clarke, 2007). Parental concerns included lack of a school nurse present, unhealthy lunches, insufficient staff training, and lack of communication amongst school staff, students, and parents (Hellems & Clarke, 2007). Seventy-five percent of the parents reported that their child had experienced low blood glucose during the previous year, with a median of five episodes of hypoglycemia per student (Hellems & Clarke, 2007). It is important to note that although 92% of the parents indicated that they felt as if their child was safe at school, many of the parents of younger children reported that they were

solely responsible for caring for their diabetic child during school (Hellems & Clarke, 2007). The parents of diabetic high school students also reported insufficient care; specifically, 9% indicated that there was not anyone responsible for their child's care at school (Hellems & Clarke, 2007). Hellems and Clark found that more assistance with blood glucose monitoring, insulin administration, and treatment of hypoglycemic events was required for younger children, and various non-medical staff members providing diabetes care were identified. They concluded that the parental responses reflect insecurity with the provision of their child's diabetes care during the school day (Hellems & Clarke, 2007).

Another study exploring the parental perspective of diabetes care at school found that most parents possessed no or very little confidence in the ability of their school to care for their diabetic students (Jacquez et al., 2008). Jacquez et al. found that many children lacked a written diabetes care plan and did not have a school nurse to provide care. In addition, many of the students were not permitted to conduct blood glucose monitoring or insulin administration during class (Jacquez et al., 2008). The study found that although parents were worried about the management of their child's diabetes at school, most lacked an understanding of policies and laws to protect their children (Jacquez et al., 2008).

Similarly, Tahirovic and Toromanovic (2006) found that only 35% of the parents surveyed were satisfied with the care of their child with diabetes at school. Twenty-five percent of those surveyed felt that school personnel were adequately trained for diabetes

related tasks, specifically only 19% felt that staff were trained to treat hypoglycemia and only 13% felt that staff could administer glucagon (Tahirovic & Toromanovic, 2006).

In a qualitative study by Hayes-Bohn, Neumrk-Sztainer, Mellin, and Patterson (2004) exploring the care of type 1 diabetics in schools, 30 adolescent females and their parents participating in semi- structured, individual interviews expressed concerns that school employees lacked knowledge of diabetes. In addition, the participants indicated that school policies hindered diabetes self-care and healthy food and drinks were not readily available in vending machines, the cafeteria, and classrooms (Hayes-Bohn et al., 2004).

The absence of a school nurse on campus daily was a common finding in many studies (Lewis et al., 2003; Melton & Henderson, 2007; Jacquez et al., 2008). Although the National Association of School Nurses (NASN) recommends one school nurse for every 750 students, the current national ratio is just one for every 1350 children (Vail, 2004). Furthermore, many school districts in Texas do not even have school nurses. Over a third of the schools located within South Central Texas do not have a full-time school nurse (Texas Education Agency, 2008). That means the delivery of complex medical care like diabetes management is falling upon the shoulders of unlicensed personnel who have had little or no training. Given these circumstances, it is imperative that schools intensify their efforts to ensure safe and secure procedures are in place for providing optimal support for diabetic students while at school.

Recommendations for Improving Diabetes Care in Schools

Appropriate diabetes care in the school is necessary for the well-being, safety, and optimum academic performance of students. A significant link between blood glucose levels and the development of diabetes related complications was demonstrated in the Diabetes Control and Complications Trial (1993; 1994); improved glycemic control lowered the risk of diabetes related complications. According to the National Diabetes Education Program (NDEP) (2003), glycemic control in children is achieved through regular blood glucose monitoring, medication, monitored food intake, and engagement in regular physical activity. It is critical that the effects of physical activity, nutrition and insulin on glucose levels are understood by care providers in order to maintain glycemic control in children (NDEP, 2003).

To ensure the provision of appropriate care for students with diabetes at school, school staff must have an understanding of diabetes and be trained in the management and treatment of diabetic emergencies (NDEP 2003; ADA, 2005; Barret, Goodwin, & Kendrick, 2002; Jameson, 2004). It is imperative that school employees are knowledgeable about diabetes for students to avoid the immediate health risks associated with unregulated blood glucose levels and to achieve the metabolic control required to lower risks of diabetes complications later in life (NDEP, 2003; Jameson, 2004). Unfortunately, numerous research studies have shown that the majority of school employees lack an understanding of diabetes.

Consequently, diabetes education programs must be geared towards school staff that interface with diabetic students to include school nurses, administrators, bus drivers, teachers, secretaries, and nurses (NDEP, 2003; Jameson, 2004). NDEP (2003) and the ADA (2008) recommend that appropriate and current training programs and resources addressing the care of diabetic students in schools should be readily available for all school personnel.

Ample suggestions were provided within the literature on how to improve the care of diabetic students in school settings (Hayes-Bohn et al., 2004; Lewis et al., 2003; Hellems & Clarke, 2007). An overarching theme of providing access to adequate diabetes training for school employees emerged. Participants in the Hayes-Bohn et al. (2004) study reiterated the importance of training school staff, assessing school policies that may adversely impact diabetic students, and improving food and beverage options. Similarly, Lewis et al. (2003) provided recommendations to include improving food choices at school, diabetes training for school personnel, and communication among staff, parents, and diabetic students. Feedback from school nurses consisted of recommendations to ensure that non-medical school staff had sufficient information about caring for their diabetic students and the importance of supporting the diabetic student when the management becomes challenging (Nabors et al., 2005). In addition, school nurses recommended creating and following the diabetes care plan to assess the efficacy of the care provided (Nabors et al., 2005). Additional recommendations from the school nurses in the study by Nabors et al. included improving communication

amongst parents, students, and staff; enhancing education for school staff; improving support for diabetic students by permitting flexibility with testing, medical care, and food consumption; and updating the diabetes care plan regularly. Numerous studies reiterated the importance of a full-time school nurse on the campus (Amillategui et al., 2007; Nabors et al., 2005; Lehmkuhl & Nabors, 2007; Hellems & Clarke, 2007; Lewis et al., 2003; Melton & Henderson, 2007). Hellems and Clarke (2007) noted that although school employees should be trained to assist with diabetes management and emergencies, the presence of a school nurse on campus daily is the ideal situation for the students.

The American Association of Diabetes Educators (AADE) and the ADA have position statements specifically addressing diabetes care at school. The AADE recommends that schools work with the parents and healthcare providers to create individualized diabetes care plans and that school staff providing care for diabetic students be adequately trained to recognize and treat hypoglycemia and hyperglycemia (Lawlor et al., 2008; AADE, 2000). Similarly, the ADA recommends that schools provide training on diabetes for all staff; work with parents and healthcare providers to develop diabetes care plans; work with parents and students to coordinate meals and snack schedules; and provide a location for students to monitor blood glucose levels and administer insulin privately or allow these to be conducted during class (ADA, 2011).

The limited research addressing diabetes care in the school setting suggests that school employees are not sufficiently prepared to deal with diabetes management and emergencies. Furthermore, school nurses are not present on all campuses daily and self-

management is often restricted. The research findings to date clearly conflict with the recommendations set forth by the AADE and ADA. Additional aspects of diabetes care in schools have not been adequately addressed in the literature to include the knowledge levels of ancillary staff (Hayes-Bohn et al., 2004).

Diabetes Training for School Employees

The lack of assistance and support at school can adversely impact diabetic students. Previous studies have demonstrated that providing training to school staff considerably enhances the glycemic control of students with diabetes (Siminerio & Koerbel, 2000). In addition, improving the diabetes knowledge of school staff results in a more supportive school environment for diabetic students (Wagner & James, 2006). Hayes-Bohn et al. (2004) suggest that all school personnel receive basic training in diabetes management. Upon reviewing case reports addressing diabetes emergencies in schools, Mandali and Gordon (2009) also concluded that school administrators should provide diabetes training opportunities for all staff. It is imperative that all school personnel receive information on diabetes to provide adequate assistance with diabetes management, particularly managing hyperglycemia and hypoglycemia (Mandali & Gordon, 2009).

School personnel often feel incompetent to administer diabetes care. Fisher (2006) found that the self-efficacy of school nurses to deliver diabetes care was positively correlated to having children with diabetes in their school, experience with administering diabetes care to children, and access to a diabetes curriculum. Unfortunately, this study

revealed that very few school nurses have access to a diabetes curriculum for training purposes (Fisher, 2006). Furthermore, many school districts in Texas do not even have school nurses. Over a third of the schools located within South Central Texas do not have full-time school nurses (TEA, 2008); that means the delivery of complex medical care like diabetes management is falling upon the shoulders of unlicensed personnel who have had little or no training.

In a study exploring the extent of training and emergency care knowledge of public school teachers, Gagliardi, Neighbors, Spears, Byrd, and Snarr (1994) found considerable deficits in the recognition and appropriate treatment of student emergencies to include those associated with diabetes. The study concluded that although teachers represent a potentially effective first-response component for medical care, most were deficient in both training and knowledge of medical emergency care (Gagliardi et al., 2004). In another study addressing the preparedness of schools to respond to medical emergencies in children, the authors found that schools need to do a better job of identifying appropriate personnel to make emergency medical decisions and increasing the education of school personnel in the assessment and management of life-threatening emergencies such as diabetes (Olympia, Wan & Avner, 2005).

Several studies addressed how the care of diabetic students at school could be improved specifically through training of school staff. In a study with school nurses, Nabors et al. (2005) found that only 54% reported adequate knowledge when working with diabetic students and 97% felt that teachers and coaches needed more training on

diabetes. In a study by Amillategui et al. (2007) addressing parent perceptions of how the provision of diabetes care at school could be improved, 64% reported needing someone trained and available to administer glucagon, 70% preferred a nurse present daily, and 75% said school staff needed to increase their knowledge about diabetes. Specifically, Amillategui et al. found that parents thought that school staff needed to have a better understanding of and plan of action to address diabetic emergencies.

Hayes-Bohn et al. (2004) surveyed type 1 diabetic female teenage students and their parents and found an issue with the knowledge level of school staff; specifically, 20% of the youth and 33% of the parents expressed concern about the diabetes knowledge of the nurses and teachers within their schools. Respondents noted the desire for nutritional information about foods served at school, and youth participants suggested developing a nutritional analysis for all of the cafeteria foods (Hayes-Bohn et al., 2004). Some of the surveyed parents expressed discontent with the diabetes care plans, lunch schedules, and use of snacks (Hayes-Bohn et al., 2004). It was noted that many teachers refused to compromise on rules such as no food and beverages in class; although, one parent and teen expressed gratitude for a teacher that allowed a snack time for everyone within the class (Hayes-Bohn et al., 2004).

In another study assessing the training and attitudes of school counselors regarding support for diabetic students in the school setting, Wagner and James (2006) found inadequately trained school personnel and unsatisfied diabetic students. Forty percent of the participants stated that they worked directly with students with diabetes;

yet, 87% reported that they had received no training about diabetes management (Wagner & James, 2006). Although the participants' self-ratings consisted of 6.9 on a scale of 1 to 10 in the area of helpfulness to students with diabetes, student ratings of their helpfulness were significantly lower (Wagner & James, 2006). Wagner and James utilized a revised version of the Test of Diabetes Knowledge for teachers and Diabetes Attitude Scale and found that 15% of the participants had a diabetes knowledge deficit, 57% possessed basic diabetes knowledge, only 28% provided effective support to diabetic students, and many were neutral or supportive of statements that were considered unsupportive of diabetic students. Although counselors indicated that they felt diabetic students would have less problems with school staff than their peers, Wagner and James found that problems with staff occurred just as often as problems with peers.

Many studies found that schools did not have staff members with adequate diabetes training. In a study conducted with 135 schools in Oregon, Melton & Henderson (2007) found that at least one in five schools lacked what was necessary to facilitate a healthy environment for diabetic students to include a school nurse present during all school hours and diabetes training for school personnel. Similarly, Lewis et al. (2003) found that 17% of the 222 participating schools did not have staff members trained on diabetes care.

Wagner, Heapy, James, and Abbott (2005) investigated the relationships among perceived school experiences, diabetes control, and quality of life in 58 children with diabetes. Wagner et al. found that students exposed to school staff that had received

diabetes training showed significantly better diabetes control than those interfacing with untrained staff, and students with more flexibility in performing diabetes management at school had substantially better outcomes than those with less flexibility. These studies demonstrate the necessity of a supportive school environment for diabetic students facilitated through the possession of diabetes knowledge by school staff.

Online Diabetes Education

The literature is clear on the necessity for school staff to be trained on how to administer diabetes care and respond to diabetes emergencies (Siminerio & Koerbel, 2000; Wagner & James, 2006; Hayes-Bohn et al., 2004). The literature also suggests that there is a need for programs that allow opportunities for active learning, feedback to the learner, attention to learning styles, and outcome evaluation to determine the intervention effectiveness (Bell, Pestka, & Forsyth, 2007; Menix, 2007; Phillips, 2005). Online continuing education programs can enhance the nurses' and unlicensed diabetes care assistants' ability to care for children with diabetes in their schools by providing a format that is easier than face-to-face courses to attend, saving travel time and expenses.

Bachman & Hsueh (2008) piloted and evaluated an online continuing education program for school nurses addressing the care of diabetic students in the school setting. Of the 19 participants, 91% reported the education would enhance their ability to manage students with diabetes; thirty-three percent preferred online continuing education, 17% preferred face-to-face education, and 50% were unsure (Bachman & Hsueh, 2008). Those favoring the format indicated that they preferred online education because it fit into their

personal schedule, did not require them to travel, did not require them to miss work, and built on their previous knowledge at their own convenience and speed (Bachman & Hsueh, 2008). Furthermore, in a study exploring strategies for active learning in online continuing education, Phillips (2005) noted that online continuing education for nurses is on the rise because of accessibility, convenience, and quality learning. As a result of the dramatic increase in children with diabetes, it is essential that school personnel have access to continuing education on diabetes management for children via a method of delivery consistent with the learner's learning style preferences.

Ample literature exists supporting the need for quality care to assist students with diabetes management (Nordly, Jorgensen, Andreasen, Hermann, & Mortensen, 2003; Summersett, Richards, Melzer, Sugarman, & Kletter, 2003). Access to training continues to be an issue, though. The literature suggests that online diabetes education training programs are effective with providing the necessary knowledge and skills needed to provide diabetes care (Heidgerken, Lewin, Geffken, Gelfand, Storch, & Malasanos, 2005; Hall, Drab, Campbell, Meyer, & Smith, 2007; Nordfeldt, Johansson, Carlsson, & Hammersjo, 2005). In fact, studies show that online programs are just as effective as the traditional methods (Izquierdo, Knudson, Meyer, Kearns, Ploutz-Snyder, & Weinstock, 2003).

In a study evaluating the efficacy of a web-based diabetes educational module used to train volunteer camp counselors, Heidgerken et al. (2005) found a significant improvement in post-test knowledge scores supporting the utilization of online

educational websites for training individuals working with children with diabetes. Sixty-one camp counselors completed the program; the mean pretest scores were 80% and the mean posttest scores were 92% (Heidgerken et al., 2005). There was a significant improvement (P=0.001) of approximately 1.25 questions from pre to posttest (Heidgerken et al., 2005). The results of this study support the use of the online educational website for training individuals working with diabetic children.

Hall et al. (2007) also found a statistically significant increase in knowledge of pharmacy students that completed a diabetes education course via the internet. The web based course consisted of 12 topic modules with active learning exercises, video lectures, and test questions. There was a significant increase in the participant's knowledge as the average posttest score on the 34 question test was 26 as compared with an average of 14 on the pretest ($p < 0.001$) (Hall et al., 2007). There was also positive feedback from the participants regarding the flexibility of the online course (Hall et al., 2007).

In addition to the acquisition of knowledge and observation of skills, learner usability is an important component of online programs. Charron-Prochownik et al. (2007) completed a process evaluation to assess completion time, understanding of content, usability, and satisfaction with an online Diabetes Self-Management Assessment Report Tool (D-SMART). The authors found that 94% of the participants were satisfied with the tool, concluding that technological applications are feasible and time-saving tools that can greatly expand diabetes education (Charron-Prochownik et al., 2007). Another study comparing diabetes education delivered through telemedicine to the

traditional method found that participant satisfaction in the telemedicine group was high (Izquierdo et al., 2003). Improved access to online diabetes education is a cost-effective means for improving the health status of children with diabetes (Malasanos, Burlingame, Youngblade, Patel, & Muir, 2005; Tatti & Lehmann, 2003); thus, computer-aided diabetes education should play a more significant role in the future (Boren, Gunlock, Krishna, & Kramer, 2006).

Although studies suggest that continuing education is essential for school staff to stay current on diabetes management, little attention has been directed toward using programs that can be accessed via the internet. Furthermore, information exists on diabetes continuing education for school nurses; from reviewing literature, though, very little was found addressing training programs for unlicensed personnel. Nichols & Norris (2002) conducted a literature review on the effectiveness of diabetes educational interventions for school employees and found limited research, inadequate methodology, mixed results, and a focus on a narrow range of outcomes. Studies addressing online diabetes education for school staff will provide valuable information for providers of diabetes continuing education to sustain the need for such initiatives.

Theory of Self-Efficacy

The theoretical model that underpins this study is Bandura's Theory of Self-efficacy. Self-efficacy consists of person's confidence in their ability to perform an action (Glanz et al., 2002). This confidence influences how people think, feel, self-motivate, and behave (Bandura, 1997). Outcome expectations envelop a person's

estimate that a specific behavior will lead to a certain outcome (Bandura, 1997). If someone has a low sense of efficacy and lacks the effort to produce the results, then the person will abandon the cause resulting in an outcome expectancy that is not achieved (Bandura, 1997). Conversely, those with a strong efficacy are more likely to persist in attempting to meet the outcome expectations for that behavior. Self-efficacy beliefs are constructed from four principle sources: mastery experiences (practice and prior experience with a skill), vicarious experiences (observing others perform the skill), verbal persuasion (positive feedback from others), and affective states (physical and emotional responses) (Bandura, 1997).

According to Bandura (1997), "people's level of motivation, affective states, and actions are based more on what they believe than on what is objectively true" (p. 2). As a result, behavior is often better predicted by a person's beliefs about their capabilities as opposed to what they are actually capable of accomplishing. Perception of self-efficacy impacts what people do with the knowledge and skills they obtain. According to Pajares (2002), this helps explain why people's behaviors are sometimes disconnected from their actual capabilities and why their behavior may differ dramatically from others with similar knowledge and skills. Since people are often guided by their beliefs in their capabilities, accomplishments are often better predicted by self-efficacy beliefs than by their previous attainments, skills, and knowledge (Pajares, 2002). However, no amount of confidence can produce success when the essential knowledge and skills do not exist (Pajares, 2002).

Self-efficacy has been used frequently in health literature to document outcomes of education programs. Parsons (2007) conducted a study to evaluate the effect of a community health online preceptor education program on knowledge of and self-efficacy to perform in the preceptor role. Forty-eight community health nurses from five states completed the web-based program, a 32-item quiz and a preceptor self-efficacy instrument (Parsons, 2007). Parsons found that preceptor self-efficacy and knowledge scores improved significantly from pretest scores after the participants completed the online education program (Parsons, 2007). Although previous experience as a preceptor, place of employment, and age were not correlated with preceptor self-efficacy scores, highest level of education completed and prior preceptor education were positively correlated with preceptor self-efficacy scores (Parsons, 2007). The study results substantiate the utilization of web-based education for improving preceptor knowledge and confidence in the preceptor role.

In a study assessing the effects of computer-based clinical conferencing on nursing students' self-efficacy, Babenko-Mould, Andrusyszyn, and Goldenberg (2004) found a statistically significant difference between pretest and posttest self-efficacy scores (mean = 11.25, SD = 10.52, $t(11) = 3.70$, $p < .05$, $d = 1.07$) of the participants. The findings supported the use of computer conferencing as a teaching method that enhances learning. The challenges noted were time availability and internet access. The conclusion of Babenko-Mould et al. supported computer conferencing as an effective

teaching method for increasing self-efficacy through thoughtful, reflective dialogue between peers and colleagues.

O-Farrell, Ford-Bilboe, and Wong (2000) conducted a study that evaluated an advanced health assessment course for nurse practitioners using a pre- and post-course evaluation based on Bandura's Theory of Self-efficacy. The findings demonstrated a significant increase in health assessment skills and confidence in performing these skills (O-Farrell et al., 2000). Ngo and Murphy (2005) applied the theory as an educational intervention for catheter devises, hypothesizing that an increase in nurse knowledge and self-efficacy would be associated with a positive effect on patient outcomes. The results showed an increase in nurses' knowledge and self-efficacy following the intervention as well as a significant reduction in the catheter occlusion rate from 29% to 8.5% over a six month period (Ngo & Murphy, 2005).

Studies have also specifically explored the impact of diabetes education programson the self-efficacy of clinicians to administer care. Yu and Batty (2010) conducted a mixed-methods study to assess the effect of a diabetes education and self-efficacy training workshop on clinician knowledge, intention and self-efficacy. Fifteen subjects to include nurses, physicians and pharmacists completed the program. Mean knowledge scores increased significantly from before to three months after the workshop ($M=4.0$ before, $M=4.7$ immediately after intervention, and $M=5.1$ three months after intervention, $p<.05$) (Yu & Batty, 2010). However, there was no significant differences between the mean self-efficacy scores at any time point for any of the professions ($M=3.4$

before, M=3.6 immediately after, M=3.6 three months after) (Yu & Batty, 2010). This study demonstrated the necessity of assessing stages of readiness for change when designing curriculum and tailoring interventions accordingly (Yu & Batty, 2010).

Another study examined the utility of a self-efficacy scale for evaluating a diabetes training program for 119 registered dietitians (Lorenz, Gregory & Davis, 2000). Self-efficacy ratings following the training were significantly correlated with relevant prior experience ($r = .4$ and $.29$, $p < .01$) but not total experience and knowledge posttest scores ($r = .21$, $p < .02$) (Lorenz et al., 2000). The self-efficacy of the participants for all 12 program objectives increased significantly after training (Lorenz et al., 2000). Post-training self-efficacy for two program objectives were significantly correlated with self-reported successful practice changes related to those objectives ($r = .4$, $p < .04$ and $r = .51$, $p < .01$) (Lorenz et al., 2000). The findings demonstrate that the assessment of self-efficacy can positively contribute to the evaluation of training programs (Lorenz et al., 2000).

Engel, Crandall, Basch, Zybert, & Wylie-Rosett (1997) assessed the effectiveness of a computer-assisted diabetes nutrition education program for increasing the knowledge and self-efficacy of medical students. Forty-one medical students participated completing a 10-item knowledge test and an 8-item self-efficacy scale to evaluate the efficacy of the computer program (Engel et al., 1997). There was a significant increase in mean knowledge scores after using the program. In fact, the posttest knowledge scores for the medical students approached the scores of general practice dietitians (Engel et al.,

1997). There was also a significant increase in mean self-efficacy scores (Engel et al., 1997). Engel et al. concluded that the computer-assisted diabetes education program was an effective and efficient method for teaching basic nutrition competencies related to diabetes management to medical students.

Only one study was found specifically addressing the self-efficacy of school employees for providing diabetes care in schools. Fisher (2006) conducted an exploratory study to investigate school nurses' perceptions of self-efficacy in relation to caring for students with diabetes and to identify factors related to self-efficacy in performing these skills. Of the 70 respondents, the total mean of the scores from the Self-efficacy on Diabetes Education (SEDE) survey was 36.30, indicating school nurses perceived they were moderately confident with diabetes care and education for children (Fisher, 2006). Demographic variables were analyzed with the self-efficacy dependent variable using analysis of variance and Pearson product-moment correlation coefficients indicating significant positive relationships among high self-efficacy and variables to include participation in diabetes education ($df=1, p=.006$), current participation in care of children with diabetes ($df=1$, $p=.006$), having children with diabetes ($r=.397$, $p=.001$), and participation in blood glucose monitoring ($r=.296$, $p=.014$) (Fisher, 2006). Other variables such as age, education level, years as a school nurse, employment status, and certification were not significantly related to self-efficacy sores (Fisher, 2006). In addition, only 5.5% reported have a diabetes curriculum to provide training (Fisher, 2006).

This study was a first step toward understanding school nurses' confidence in caring for children with diabetes. The relationship between caring for students with diabetes and increased self-efficacy is an important finding. Although not all school staff have an opportunity to care for diabetic students on a daily basis, training programs provide an opportunity to learn new information and skills and get up-to-date on current best practice guidelines. Fisher (2006) concluded that additional research is needed to test the effectiveness of interventions designed to increase the self-efficacy of school personnel to provide diabetes care. As the number of children with diabetes continues to increase, study in this area is needed to assist school personnel with developing the skills and confidence in their ability to educate and manage the care of children with diabetes in the school setting.

CHAPTER III

METHODOLOGY

This quantitative study utilized secondary data from participants who completed the Salus Education Diabetes Care at School: Bridging the Gap online training program. The online program was specifically designed to help Texas schools (with or without a school nurse) meet their state and federal requirements and help school personnel to create a safe and supportive learning environment for students with diabetes. Participating districts received a one-year subscription for each campus which included 24/7 access to the online training program for all school personnel. In September 2011, 36 districts within Education Service Center, Region 20 in South Central Texas received free access to the program allowing each employee to receive a username and password to access the online training program.

Purposive sampling was used to focus on the employees from those 36 districts that completed the program between September 2010 through March 2011. This non-probability method was appropriate, as the focus of the analysis was specific to UDCA's and nurses that completed the program within those districts. The program consisted of three tracks with different training and evaluation requirements to include a basic training for general staff, a 12 chapter/module training for UDCA's, and an advanced training for school nurses to receive Type 1 Continuing Nursing Education hours. The following are the 12 chapters required for the UDCA and school nurse tracks: Chapter 1: Diabetes

Awareness Training, Chapter 2: Blood Glucose Monitoring, Chapter 3: Recognizing andTreating Hypoglycemia, Chapter 4: Recognizing and Treating Hyperglycemia, Chapter 5: Insulin and Insulin Regimens, Chapter 6: Insulin Delivery Devices, Chapter 7: Diet and Nutrition, Chapter 8: Physical Activity, Chapter 9: Psychosocial Issues, Chapter 10: Disaster Preparedness, Chapter 11: Insulin Pump Therapy, Chapter 12: Meeting the Requirements of Texas House Bill 984 and Other Key Legal Considerations. The general staff track only consisted of Chapter 1: Diabetes Awareness Training.

One hundred ninety-two individuals voluntarily completed the program to include 60 general staff, 81 UDCA's, and 51 school nurses. For the purpose of this study, the secondary data analysis only included the 81 UDCA's and 51 school nurses. The general staff were not utilized for this analysis because they did not complete the same program as the UDCA's and school nurses. Although small, the number of participants is indicative of a small percentage of UDCA's and school nurses throughout Texas.

Protection of Human Participants

Texas Woman's University Institutional Review Board granted exempt status approval for the current study (see Appendix A). Exempt status was deemed appropriate for this study because an existing data set was utilized.

Data Collection Procedures

The data for the secondary data analysis was collected utilizing a quasi-experimental design. This design was used because the participants were not randomly assigned to groups to observe outcomes; instead, participants were grouped according to

characteristics they already possessed. Specifically, participants completed a designated track based upon their status of being a school nurse or UDCA. A Pretest-Posttest Design was used to measure knowledge before and after completion of all of the modules. The Posttest Only Design was utilized to assess the participants' self-assessment of confidence with diabetes skills before and after completing the program and satisfaction with the online training program. The pretest, posttest, and evaluation surveys were administered electronically through the Salus Education Learning Management System (LMS). The investigator was provided with the demographic information, results of the pre and posttests, self-assessment rating of confidence to perform diabetes tasks, and self-assessment of the helpfulness of the tools for each participant, as captured in the LMS.

Instrumentation

The introductory survey required by each participant was created by Salus Education. This survey included questions addressing the participant's current occupation (Superintendent, Principal, Vice Principal, Classroom Teacher, Physical Education Teacher, School Nurse, Office Staff, Food Service, Bus Driver, Other), status of diabetes training in the past 12 months, and communication preferences.

The 30 question knowledge pretest and posttest was developed for this study by the Texas Diabetes Council and was reviewed by a committee of Certified Diabetes Educators. The instrument was designed to measure the knowledge of UDCA's on diabetes basic information, diabetes management, and diabetes laws in Texas. The

instrument had 30 multiple choice questions (see Appendix B). The pretest and posttest were reviewed by a committee of Certified Diabetes Educators to evaluate the tool for content and ease of completion. In addition, the survey was reviewed by the Texas Nurses Association for content validity. A pilot study was conducted with 150 school employees at Southside Independent School District in South Central Texas in 2009; the results were utilized to make necessary changes by Salus Education.

The instrument designed to measure the change in self-efficacy of the participants consisted of a self-assessment by participants addressing confidence level for assisting students with diabetes prior to and after completing the training program (see Appendix C). Utilizing a 7-point semantic scale ranging from not at all confident to extremely confident, participants were asked to rate their confidence in their ability to assist students with diabetes prior to completing the Diabetes Care at School: Bridging the Gap training program. Participants were also asked to rate their confidence level after completing the program. The instrument was designed by Salus Education, reviewed by Certified Diabetes Educators, and utilized in the pilot study with Southside Independent School District in 2009. In addition, the instrument addressed the program's effectiveness with preparing users to perform specific diabetes related tasks. This was measured on a 7-point semantic scale ranging from not at all effective to very effective based upon the following nine skills identified by the Texas Diabetes Council: understanding instructions within a Diabetes Management and Treatment Plan and Individualized Health Plan, performing a glucose check, determining the carbohydrate

content of a meal or snack, calculating an insulin dose, performing an insulin injection, performing a urine ketone test, recognizing low or high blood sugar, performing a glucagon injection, and working with an insulin pump. For the purpose of the current secondary data analysis, only the confidence level data from the first two questions assessing confidence level prior to and after completing the program were utilized.

Learner satisfaction with the online training format was also measured on a 7-point semantic scale that addressed the user's perception of the integrity of the 12 chapter online course (see Appendix C). On a 7-point semantic scale ranging from not at all effective to very effective, participants were asked to rate how helpful they felt the Diabetes Care at School: Bridging the Gap training resources were in preparing them to assist students with diabetes. The resources rated included the 12 Chapter Online Course, Companion Guide, Diabetes Skills Training Kit, and Sample Forms. Only the participants' rating of the 12 Chapter Online Course was used for this secondary data analysis, as the other items were not utilized by all participants. It is important to note that the school nurses and UDCA's received the same 12 module program, introductory survey, pre and posttest and evaluation. However, only the school nurses completed additional evaluation questions to receive nursing continuing education hours that were not included in the secondary data analysis.

Data Analysis

The data was analyzed using SPSS 17.0. The demographic data was described using frequencies and percentages. Knowledge and confidence change scores were calculated for each participant by subtracting each pretest score from the posttest score. Paired-samples t-tests were conducted to compare the means of the pre and posttest knowledge scores for UDCA's and school nurses. They were also performed to compare the pre and post confidence scores for UDCA's and school nurses. Independent samples t-tests was conducted to compare the change in knowledge and change in confidence level scores of the UDCA's and school nurses. Independent t-tests were also performed to determine if prior diabetes training impacted the change in knowledge and confidence scores of the participants. A one-way between subjects analysis of variance (ANOVA) was conducted to compare the effect of type of occupation on the change in knowledge and confidence scores. Finally, a bivariate correlation, using Pearsons correlation coefficient, was ran to look at the relationship between knowledge change scores and usefulness of program, confidence level change scores and usefulness of program, and the knowledge change scores and confidence level changes scores

CHAPTER IV

RESULTS

The purpose of this study was to evaluate the effectiveness of the Salus Education Online Diabetes Education program by comparing the change in knowledge and self-efficacy scores of the participants by current occupation and prior diabetes training status. In addition, the study examined the association between user satisfaction with the online program and change in knowledge and self-efficacy scores.

Demographics

The sample of the study included 132 participants. As shown in Table 1, almost two-thirds of the participants completed the UDCA training (63.6%) and one-third completed the School Nurse CNE training (36.4%). It is important to note that three of the school nurses completed the UDCA track as opposed to the School Nurse CNE, which is why the training type and status frequency and percentages for school nurses and UDCA's varied. Overall, a majority of the participants were school nurses (38.6%) followed by other (28%), classroom teachers (9.8%), physical education teachers (9.1%), office staff (7.6%), vice principals (3.8%), principals (1.5%), bus drivers (.8%), and food service workers (.8%). Those within the other category included teacher aides, counselors, paraprofessionals, clinic/health assistants, and librarians. By status, 38.6% were school nurses and 61.4% were UDCA's. A majority of the participants had no prior diabetes training within the past twelve months (68.9%).

Table 1

Frequencies and Percentages for Categorical Demographic Variables

	n	%
Training Type		
School Nurse CNE	48	36.4%
UDCA	84	63.6%
Status		
School Nurse	51	38.6%
UDCA	81	61.4%
Occupation		
School Nurse	51	38.6%
Principal	2	1.5%
Vice Principal	5	3.8%
Classroom Teacher	13	9.8%
Bus Driver	1	.8%
Food Service	1	.8%
Physical Education Teacher	12	9.1%
Office Staff	10	7.6%
Other	37	28%

(Continued)

Table 1 cont.

Frequencies and Percentages for Categorical Demographic Variables

	n	%
Prior Diabetes Training (in the last 12 months)		
Yes	41	31.1%
No	91	68.9%

Diabetes Knowledge Descriptives

The knowledge pre and posttest consisted of 30 questions assessing the participant's knowledge of diabetes basic information, diabetes management, and diabetes laws in Texas. The participants completed the pretest before beginning the first module and completed the posttest after the final module. As seen in Table 2, the pretest knowledge scores ranged from 0 to 100, with a mean pretest knowledge score of 57.41 (SD=18.44) and the posttest knowledge scores ranged from 70 to 100, with a mean posttest score of 91.67 (SD=6.67).

Table 2

Means and Standard Deviations for Diabetes Knowledge Pre and Post Subscale Scores

	n	Mean	SD	Min	Max
Diabetes Pretest	132	57.41	18.44	0	100
Diabetes Posttest	132	91.67	6.67	70	100

Due to the skewed distributions of the pre and posttest scores, change scores were calculated and used as the outcome measure for further analysis. Logarithmic transformations of the skewed data were also calculated; however, the transformed distributions were still too skewed to run parametric analysis, therefore change scores were deemed the most appropriate measure.

A change score was calculated for each participant by subtracting each pretest knowledge score from the posttest knowledge score. As shown in Table 3, the change in knowledge scores ranged from -3.33 to 86.67, with a mean change score of 34.25 (SD=16.42), indicating the overall knowledge scores increased from pretest to posttest.

Table 3

Means and Standard Deviations for Diabetes Knowledge Subscale Change Scores

	n	Mean	SD	Min	Max
All Participants	132	34.25	16.42	-3.33	86.67

Diabetes Confidence Descriptives

The confidence pre and post self-assessment consisted of a 7-point semantic scale assessing the participant's confidence level before and after completing the training. The participants completed the two questions (rating of confidence level prior to training and after training) after they completed all of the modules. As seen in Table 4, the pre

confidence scores ranged from 1.00 to 7.00, with an average of 4.36 (SD=2.04). The post confidence scores ranged from 1.00 to 7.00, with an average of 6.55 (SD=.98).

Table 4

Means and Standard Deviations for Diabetes Confidence Pre and Post Subscale Scores

	n	Mean	SD	Min	Max
Pre Confidence	132	4.36	2.04	1.00	7.00
Post Confidence	132	6.55	.98	1.00	7.0

Confidence change scores were calculated and utilized for further analysis. The confidence change scores were calculated for each participant by subtracting the pre confidence score from the post confidence score. As shown in Table 5, the change in confidence scores ranged from .00 to 6.00, with a mean change score of 2.18 (SD=1.72), indicating overall confidence scores increased.

Table 5

Means and Standard Deviations for Diabetes Confidence Subscale Change Scores

	n	Mean	SD	Min	Max
All Participants	132	2.18	1.72	.00	6.00

Primary Analysis

Paired-samples t-tests were conducted to compare the means of the pre and posttest knowledge scores for UDCA's and school nurses. They were also performed to compare the pre and post confidence scores for UDCA's and school nurses. Independent samples t-tests was conducted to compare the change in knowledge and change in confidence level scores of the UDCA's and school nurses. Independent t-tests were also performed to determine if prior diabetes training impacted the change in knowledge and confidence scores of the participants. A one-way between subjects analysis of variance (ANOVA) was conducted to compare the effect of type of occupation on the change in knowledge and confidence scores. Finally, a bivariate correlation, using Pearsons correlation coefficient, was ran to look at the relationship between knowledge change scores and usefulness of program, confidence level change scores and usefulness of program, and the knowledge change scores and confidence level changes scores.

Hypothesis One: Knowledge Change Scores by Status (UDCA vs. School Nurse)

As shown in Figure 1, the pretest knowledge scores for nurses was significantly higher than UDCA's; however, there was not a significant difference in the posttest knowledge scores between the two groups. Although UDCA's had larger change in knowledge scores, there was a significant increase from pre to post intervention for both groups.

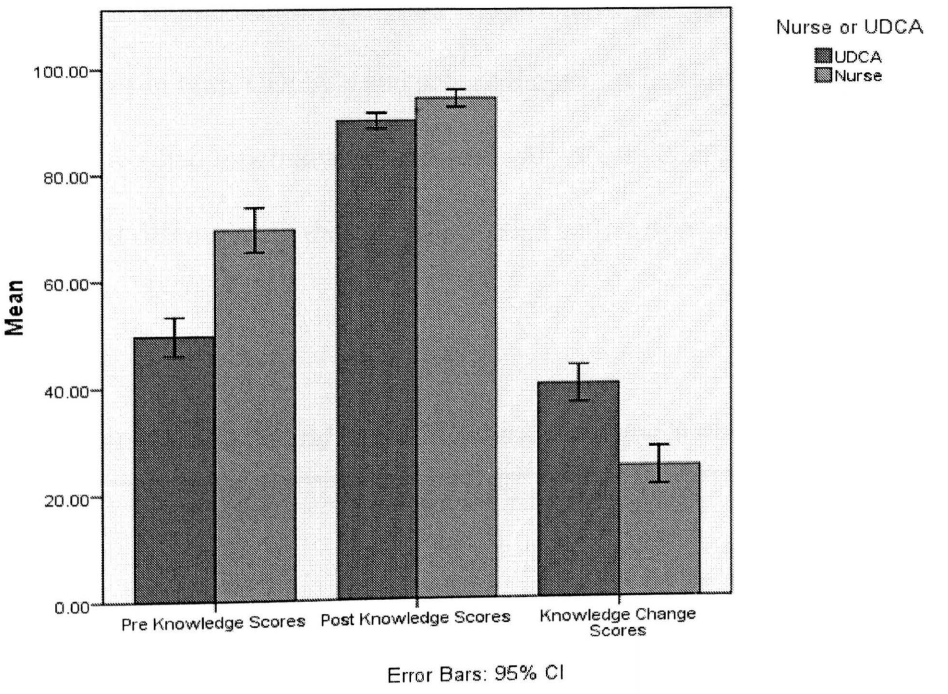

Figure 1: Overall subscale pretest, posttest, and change in knowledge scores.

A paired-samples t-test was performed to compare the pretest and posttest knowledge scores for UDCA's and school nurses. There was a significant difference in

the average pre (M=49.75, SD=16.25) and post (M=90.04, SD=6.66) knowledge scores for UDCA's; t(80)=-23.12, p=.000. School nurses also had a significant increase in knowledge scores from the pretest (M=69.58, SD=14.90) to the posttest (M=94.25, SD=5.89); t(50)=-13.92, p=.000. There was a positive correlation for both groups; UDCA's and school nurses that did well on the pretest also did well on the posttest. As the significance value was less than .05 for both UDCA's and school nurses, there was a significant difference between the pretest and posttest knowledge scores. This demonstrated that the online training program was effective in significantly improving the knowledge scores in both UDCA's and school nurses. It is important to note, though, that although UDCA's had much lower pre knowledge scores than school nurses, there was not a significant difference in the post knowledge scores between the two groups.

Table 6

Paired-samples t-test for UDCA and School Nurse Knowledge Scores

Pairs	M	N	SD	SE	t	DF	sig
UDCA Pre Knowledge Scores	49.75	81	16.25	1.81			
					-23.12	80	.000
UDCA Post Knowledge Scores	90.04	81	6.66	.74			
Nurse Pre Knowledge Scores	69.58	51	14.90	2.09			
					-13.92	50	.000
Nurse Post Knowledge Scores	94.25	51	5.89	.82			

An independent samples t-test was performed to compare the knowledge change scores between UDCA's and nurses. There was a significant difference in the scores for UDCA's (M=40.29, SD=15.68) and nurses (M=24.67, SD=12.65); t(130)=5.99. p=.000. These results suggest that UDCA's had significantly greater change in knowledge scores as a result of the training than school nurses.

Table 7

Independent t-test for Knowledge Changes Scores

Groups	N	Mean	SD	SE	t	DF	sig
UDCA	81	40.29	15.68	1.74			
					5.99	130	.000
Nurse	51	24.67	12.65	1.77			

Hypothesis Two: Confidence Level Change Scores by Status (UDCA vs. School Nurse)

As shown in Figure 2, the pre confidence level scores for UDCA's was significantly lower than school nurses; however, the UDCA's had much larger change in confidence level scores, resulting in similar post confidence level scores between both groups.

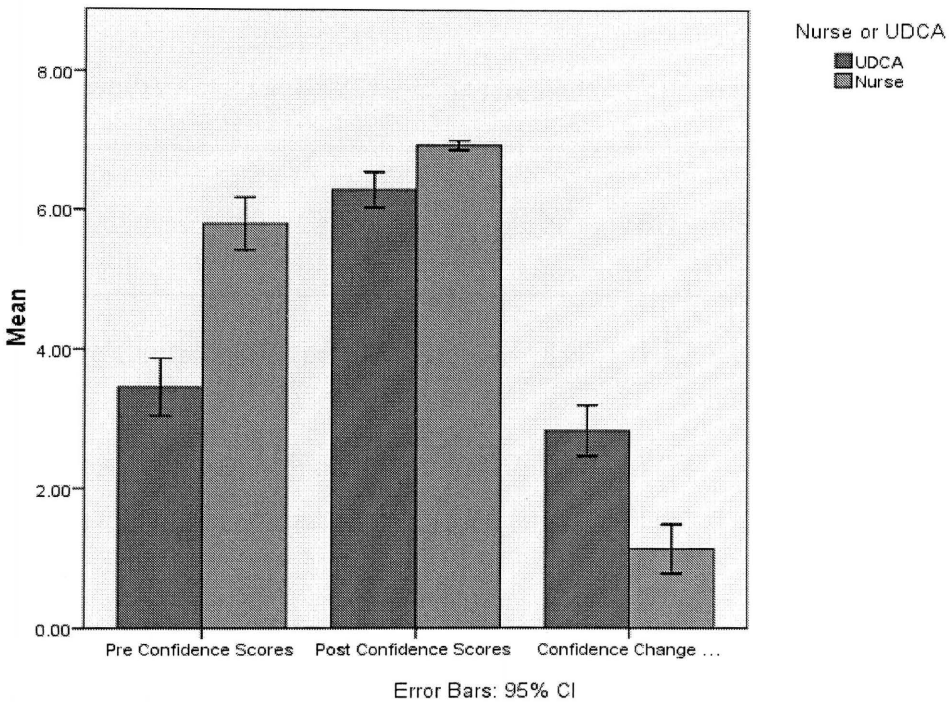

Figure 2: Overall subscale pretest, posttest, and change in confidence scores.

A paired-samples t-test was conducted to compare the means between the pre and post confidence scores for UDCA's and school nurses. There was a significant difference in pre confidence scores (M=3.46, SD=1.87) and post confidence scores (M=6.30, SD=1.17) for UDCA's; t(80)=-15.45, p=.000. Although not as much, there was also a significant difference in the pre confidence (M=5.80, SD=1.34) and post confidence scores (M=6.94, SD=.24) for school nurses; t(50)=-6.50, p=.000. These results suggest that the training program was effective with improving both the UDCA's and school nurses' confidence levels for performing diabetes care.

Table 8

Paired-samples t-test for UDCA and School Nurse Confidence Scores

Pairs	M	N	SD	SE	t	DF	sig
UDCA Pre Confidence Scores	3.46	81	1.87	.21			
					-15.45	80	.000
UDCA Post Confidence Scores	6.30	81	1.17	.13			
Nurse Pre Confidence Scores	5.80	51	1.34	.19			
					-6.50	50	.000
Nurse Post Confidence Scores	6.94	51	.24	.03			

An independent samples t-test was performed to compare the confidence change scores between UDCA's and nurses. There was a significant difference in the scores for UDCA's (M=2.84, SD=1.65) and nurses (M=1.14, SD=1.25); t(130)=6.30. p=.000. UDCA's had a much larger change in confidence as a result of the program than nurses.

Table 9

Independent t-test for Confidence Changes Scores

Groups	N	Mean	SD	SE	t	DF	sig
UDCA	81	2.84	1.65	.18			
					6.30	130	.000
Nurse	51	1.14	1.25	.17			

Hypothesis Three: Knowledge Change Scores by Occupation and Prior Diabetes Training

An independent t-test was conducted to determine if prior diabetes training impacted the change in knowledge scores of the participants. Participants with no prior diabetes training within the past 12 months experienced a greater change in knowledge (M=36.28, SD=16.78) than those with training (M=29.76, SD=14.80); the difference was significant t(130)=2.14, p=.03. However, there was no significant difference between the post knowledge score of those with prior diabetes training (M=91.76, SD=6.86) than those without (M=91.46, SD=6.33); t(130)=.234, p=.815. These results demonstrate that although those with prior diabetes training had initially higher pretest knowledge scores, after completing the modules, there was no significant difference in knowledge scores between those with and without prior diabetes training.

Table 10

Independent t-test for Pre Knowledge Scores by Training Status

Groups	N	Mean	SD	SE	t	DF	sig
No Prior Training	91	55.48	18.94	1.99			
					-1.81	130	.072
Prior Training	41	61.71	16.70	2.61			

Table 11

Independent t-test for Post Knowledge Scores by Training Status

Groups	N	Mean	SD	SE	t	DF	sig
No Prior Training	91	91.76	6.86	.72			
					.23	130	.82
Prior Training	41	91.46	6.33	.99			

Table 12

Independent t-test for Change in Knowledge Scores by Training Status

Groups	N	Mean	SD	SE	t	DF	sig
No Prior Training	91	36.28	16.78	1.76			
					2.14	130	.034
Prior Training	41	29.76	14.80	2.31			

A one-way between subjects analysis of variance (ANOVA) was conducted to compare the effect of type of occupation on the change in knowledge scores in principals, vice principals, classroom teachers, physical education teachers, office staff, food service, nurses, bus drivers, and other. There was a significant effect of the occupation on the change in knowledge scores at the $p<.05$ for the conditions [$F(8, 123)=4.63$, $p=.000$]. Of

the nine occupation groups identified, principals had the greatest mean change in knowledge score (M=45.00) and nurses had the smallest change in knowledge score (24.67). Taken together, these results suggest that the participant's occupation does have an effect on the participant's change in knowledge scores.

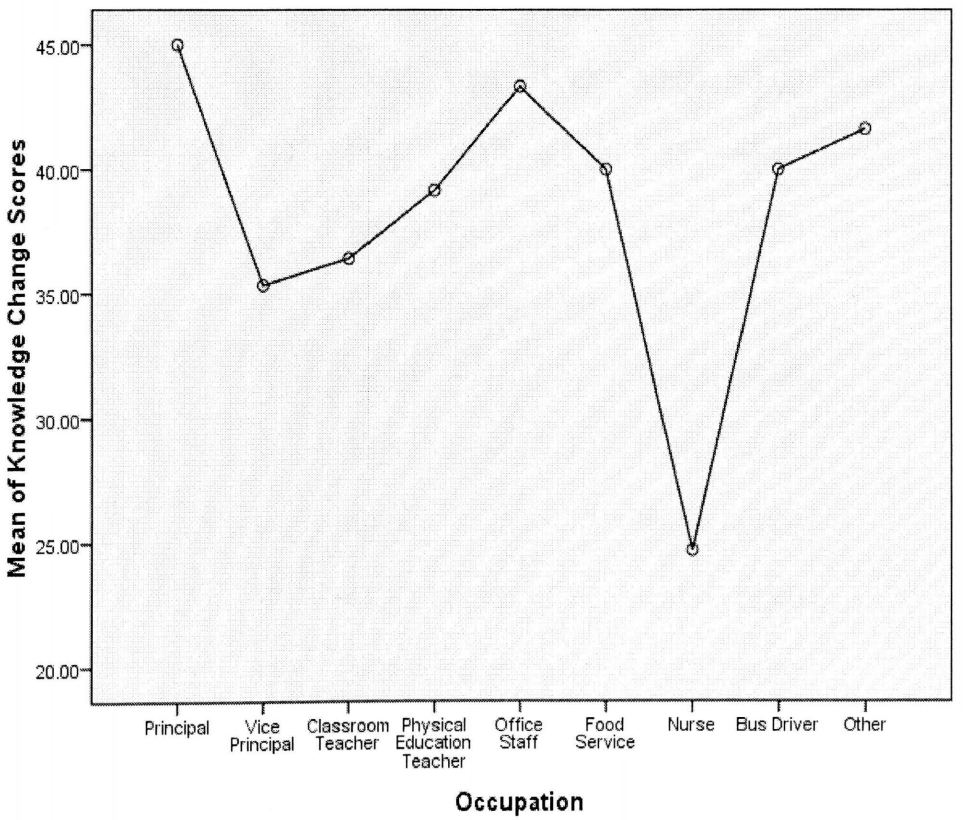

Figure 3: Mean change in knowledge scores by occupation.

Table 13

One-way ANOVA for Change in Knowledge by Occupation

Occupation	N	M	SD	SE	Min	Max
Principal	2	45.00	7.07	5.00	40.00	50.00
Vice Principal	5	35.33	3.80	1.70	30.00	40.00
Classroom Teacher	13	36.41	22.09	6.13	3.33	86.67
Physical Education Teacher	12	39.17	15.12	4.36	23.33	80.00
Office Staff	10	43.33	18.66	5.90	20.00	86.67
Food Service	1	40.00			40.00	40.00
Nurse	51	24.67	12.65	1.77	-3.33	60.00
Bus Driver	1	40.00			40.00	40.00
Other	37	41.62	14.46	2.38	6.67	70.00
Total	132	34.25	16.42	1.43	-3.33	86.67

Hypothesis Four: Confidence Change Scores by Occupation and Prior Diabetes Training

An independent samples t-test was also conducted to assess whether prior diabetes training impacted the confidence of the participants to administer diabetes care. Participants with no prior diabetes training had lower pre confidence scores (M=4.09,

SD=2.08) than those with prior training (M=4.98, SD=1.81); t(130)=.-2.359, p=.020; however, those without prior training (M=2.38, SD=1.74) had a greater increase in change in confidence than those with prior training (M=1.73, SD=1.60) and the difference was significant; t(130)=2.042, p=.04. For the post confidence level scores, Levene's test was significant at p<.05 supporting the hypothesis that the variances between the two conditions were significantly different which violates the assumption of homogeneity of variance. Those with no prior training (M=6.47, SD=1.08) had lower post confidence levels than those with prior training (M=6.71, SD=.68); however, the difference was not significant; t(115.91)=-1.51, p=.13. These results demonstrate that although those with prior diabetes training had lower pre confidence scores, the program was effective with increasing their confidence levels, as there was no significant difference in the post confidence scores between those with and without prior diabetes training.

Table 14

Independent t-test for Pre Confidence Scores by Training Status

Groups	N	Mean	SD	SE	t	DF	sig
No Prior Training	91	4.09	2.08	.22			
					-2.36	130	.02
Prior Training	41	4.98	1.81	.28			

Table 15

Independent t-test for Post Confidence Scores by Training Status

Groups	N	Mean	SD	SE	t	DF	sig
No Prior Training	91	6.47	1.08	.11			
					-1.51	115.91	.13
Prior Training	41	6.71	.68	.11			

Table 16

Independent t-test for Confidence Change Scores by Training Status

Groups	N	Mean	SD	SE	t	DF	sig
No Prior Training	91	2.38	1.74	.18			
					2.04	130	.04
Prior Training	41	1.73	1.60	.25			

A one-way between subjects ANOVA was conducted to compare the effect of type of occupation on the change in confidence scores in principals, vice principals, classroom teachers, physical education teachers, office staff, food service, nurses, bus drivers, and other. When assessing the change in confidence scores by occupation, food service had the largest (M=5.0) average change score and nurses had the smallest

(M=1.14). There was a significant effect of the occupation on the change in confidence scores at the $p<.05$ for the conditions [$F(8, 123)=5.44$, $p=.000$]. These results suggest that the participant's occupation does have an effect on the participant's change in confidence scores.

Table 17

One-way ANOVA for Change in Confidence by Occupation

Occupation	N	M	SD	SE	Min	Max
Principal	2	3.5	.71	.50	3.00	4.00
Vice Principal	5	2.60	1.34	.60	1.00	4.00
Classroom Teacher	13	3.00	1.15	.32	1.00	5.00
Physical Education Teacher	12	3.17	1.85	.53	.00	6.00
Office Staff	10	2.30	1.95	.62	.00	6.00
Food Service	1	5.00			5.00	5.00
Nurse	51	1.14	1.25	.17	.00	5.00
Bus Driver	1	3.00			3.00	3.00
Other	37	2.76	1.77	.29	.00	6.00
Total	132	2.18	1.72	.20	.00	6.00

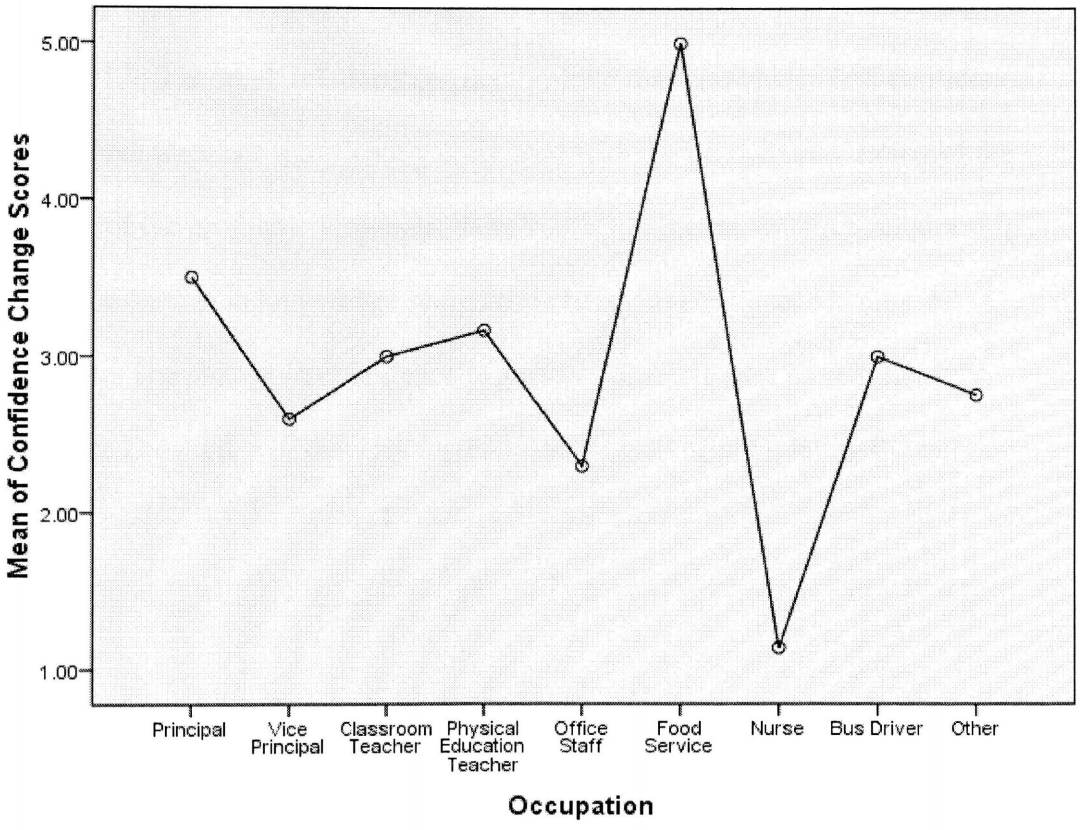

Figure 4: Mean confidence change scores by occupation.

Hypothesis Five: Knowledge and Confidence Change Scores by User Satisfaction with Usefulness of Program Scores

A bivariate correlation, using Pearsons correlation coefficient, was ran to look at the relationship between knowledge change scores and usefulness of program, confidence level change scores and usefulness of program, and the knowledge change scores and confidence level changes scores. Although there was a negative relationship between knowledge change scores and usefulness of program, it was very weak r=-.092. The

relationship between confidence change scores and usefulness was positive and also very weak, r=.017. The weak relationships demonstrate that knowledge and confidence change scores were not significantly correlated with the participants' rating of the usefulness of the program. However, there was a significant, positive relationship between the change in knowledge scores and change in confidence scores, r=.442, p (one-tailed)<.01. The change in confidence to perform diabetes care increased as the participants knowledge of diabetes increased as a result of completing the online program.

Table 18

Correlations between Knowledge Change Scores, Confidence Change Sores, and Usefulness of Program

		Knowledge	Confidence	Usefulness
Pearson Correlation	Knowledge	1	.422**	-.092
	Confidence	.422**	1	.017
	Usefulness	-.092	.017	1
Sig. (1-tailed)	Knowledge		.000	.146
	Confidence	.000		.422
	Usefulness	.146	.422	
N	Knowledge	132	132	132
	Confidence	132	132	132
	Usefulness	132	132	132

Summary

The results of the present study show a significant increase in knowledge and confidence change scores, indicating the scores for the two subscales increased from pre to post test. Although UDCA's had lower pre knowledge and confidence scores than nurses, the UDCA's had greater change scores resulting in similar post knowledge and confidence scores between the two groups. In addition, those with prior diabetes training had initially higher pre knowledge and confidence scores; after completing the program, though, there was no significant difference in knowledge and confidence level scores between those with and without prior diabetes training. The data analysis also demonstrated that occupation did impact knowledge and confidence change scores. There was a weak relationship between the knowledge and confidence change scores and the participants' rating of the usefulness of the program. Finally, there was a significant, positive relationship between the change in knowledge scores and change in confidence scores; demonstrating that as participants' knowledge increased from the training program, their confidence in administering diabetes care increased also. These findings are further discussed in Chapter V.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to evaluate the effectiveness of the Salus Education Online Diabetes Education program by comparing the change in knowledge and confidence scores of the participants by current occupation and prior diabetes training status. In addition, the study examined the association between user satisfaction with the online program and change in knowledge and confidence scores. Analysis involved the comparison of knowledge and confidence pre and posttest subscale scores of the participants. In addition, the study examined the differences in pre and post knowledge and confidence scores by occupation and prior diabetes training status. This study utilized secondary data collected from participants who completed the Salus Education Online Diabetes Education Program from September 2010 through March 2011. The participants completed a survey before beginning the modules that required them to designate their occupation and prior diabetes training status. The participants completed a 30 question knowledge test before and after completing the 12 module program. They also completed a survey at the end of the program ranking the following on a 7-point semantic scale: confidence level for administering diabetes care before completing the program, confidence level for administering diabetes care after completing the program, and usefulness of the program.

Conclusions and Discussion

Hypothesis One: There will be no significant difference in the change in knowledge scores when comparing unlicensed diabetes care assistants with school nurses that completed the online Salus Education Diabetes Care at School: Bridging the Gap program.

The hypothesis was rejected because there was a statistically significant difference in the change in knowledge scores of UDCA's and school nurses. UDCA's experienced a greater change in knowledge (M=40.29, SD=15.68) then school nurses (M=24.67, SD=12.65). This is an important finding, as it demonstrates that although school nurses had initially higher pretest knowledge scores, the online program significantly increased the knowledge of unlicensed personnel to the extent that there was not a significant difference between the posttest knowledge scores of UDCA's and school nurses.

Although very little research has been conducted specifically addressing online diabetes education programs for school staff, the results from the current study align with those of Heigerken et al. (2005) and Hall et al. (2005). Both studies resulted in statistically significant increases in posttest diabetes knowledge scores of unlicensed personnel to include camp counselors and pharmaceutical students (Heigerken et al., 2005; Hall et al., 2007). The results also aligned with the study by Engel et al. (1997) which found a computer-assisted diabetes nutrition education program effective with increasing the post knowledge scores of the participants.

Hypothesis Two: There will be no significant difference in the change in confidence scores when comparing unlicensed diabetes care assistants with school nurses that completed the online Salus Education Diabetes Care at School: Bridging the Gap program.

The hypothesis was rejected because there was a statistically significant difference in the change in confidence scores of UDCA's and school nurses. UDCA's experienced a greater change in confidence (M=2.84, SD=1.65) then school nurses (M=1.14, SD=1.25). As with the change in knowledge, this is an important finding as it demonstrates that although UDCA's had initially lower confidence levels than school nurses for administering diabetes care, after completing the program there was not a statistically significant difference in the confidence levels of the two groups.

The results of the study indicate that the Salus Education Diabetes Care at School program was effective with increasing the self-efficacy of all participants. The study by Engel et al. (1997) found similar results, as a computer-assisted diabetes nutrition education program significantly increased the self-efficacy of medical students to administer diabetes care. Yu and Batty (2010) found a different result, though, when exploring the impact of a diabetes education program on the self-efficacy of clinicians to administer care. This study found no significant difference in self-efficacy before, immediately following, or three months following the intervention. Yu and Batty offered the following explanations for why the program narrowed the knowledge gap without impacting self-efficacy: firstly, workshop activities may have been mismatched for

clinician stage of readiness for change; secondly, both agreement with and intention to adopt the proposed change must exist prior to improving self-efficacy for the proposed change; thirdly, the outcome measure may have been mismatched to participants' stage of readiness.

There are multiple reasons why the Salus Education Diabetes Care at School program was successful at improving the knowledge and self-efficacy of the participants. First of all, the program was self-paced. Unlike the traditional diabetes education programs offered for school personnel that are one day for three to six hours in duration, the participants could access the modules at their leisure, proceed at their own pace, and revisit information as needed.

Like the programs utilized by Engel et al. (1997), Heigerken et al. (2005) and Hall et al. (2005), the Salus Education Diabetes Care at School online program was divided into modules that progressively addressed the necessary content. This permitted participants to cover and digest the content in logical sections. The program also incorporated video demonstrations into the modules, allowing the participants to view demonstrations of the necessary skills.

It is important to note that the program feedback provided on the final evaluation was very positive from both UDCA's and school nurses. When asked about comments or suggestions UDCA feedback included statements such as, "I really learned a whole lot on the online-course. It was very helpful." "Great program." "Being able to go through the training at my pace was great." "I thought the course was very well planned and

effective." "I enjoyed it more than I thought I would. I feel better prepared to help care for these students." Comments from nurses included, "I really liked the program; very clear and thorough." "This on-line training was very informative and has helped me to review." "Great online training!" "Very informative. Great Program. Thanks." "This is a very informative guide and I will definitely utilize this at my school." "This is a great training program for everyone on campus." "Very informative; I learned some new things, feel more updated on diabetes in school settings." " Good program, easy to read, use and understand all materials." It is evident by these comments that the program was well-received by participants, resulting in statistically significant increases in knowledge of and confidence to administer diabetes care in both UDCA's and school nurses.

Hypothesis Three: There will be no significant difference in the change in knowledge scores among the Salus Education Diabetes Care at School: Bridging the Gap participants when compared by occupation and diabetes training variables.

The hypothesis was rejected because there was a significant difference in the change in knowledge scores between those who did and did not have prior diabetes training. Participants with no prior diabetes training within the past 12 months experienced a greater change in knowledge (M=36.28, SD=16.78) than those with training (M=29.76, SD=14.80). These results demonstrate that although those with prior diabetes training had initially higher pretest knowledge scores, after completing the modules, there was no significant difference in knowledge scores between those with and without prior diabetes training. This is an important finding as it demonstrates that the

program can be utilized to train those with no prior diabetes training. In addition, the study demonstrated that participant's occupation does have an effect on the participant's change in knowledge scores.

Hypothesis Four: There will be no significant difference in the change in confidence scores among the Salus Education Diabetes Care at School: Bridging the Gap participants when compared by occupation and diabetes training variables.

The hypothesis was rejected because there was a significant difference in the change in confidence scores between those who did and did not have prior diabetes training. Participants with no prior diabetes training within the past 12 months experienced a greater change in confidence (M=36.28, SD=16.78) than those with training (M=29.76, SD=14.80. This is an important finding as it demonstrates that the program can be utilized to train those with no prior diabetes training. In addition, the study demonstrated that participant's occupation does have an effect on the participant's change in confidence scores.

Hypothesis Five: There will be no significant difference in user satisfaction when compared with change in knowledge and change in confidence scores.

The hypothesis was not rejected as there was a weak relationship between knowledge and confidence change scores and the rating of usefulness of the program. Knowledge and confidence change scores were not significantly correlated with the participants' rating of the usefulness of the program. However, there was a significant, positive relationship between the change in knowledge scores and change in confidence

scores, r=.442, p(one-tailed)<.01. The change in confidence to perform diabetes care increased as the participants knowledge of diabetes increased as a result of completing the online program.

Limitations

Although the results of this study are encouraging, several limitations need to be mentioned. The data was limited to those school district employees in South Central Texas, specifically the school nurses and UDCA's that decided to complete the online training program. By law, the UDCA should be delegated by the campus principal. The circumstances and knowledge of each UDCA varied. Some voluntarily chose to be the UDCA; whereas, others were appointed by the principal. In addition, some may have had existing knowledge and understanding of diabetes. The demographic information gathered in the Learning Management System was limited and did not include information such as education level, primary language, and computer literacy. The data in the study provided a good indication of differences in change in knowledge and self-efficacy scores among school personnel specifically in South Central Texas. However, given the data and sampling limitations, it should not be taken as completely accurate or generalizable to the entire population. Additional studies should be performed across Texas and other states.

Recommendations for Future Research

Although significant changes in the knowledge and confidence of participants to administer diabetes care in school was demonstrated within the study, additional follow-

up is necessary to assess the implications to practice and care of diabetic students in schools. Multiple studies have addressed the parental perspective of diabetes care at school (Hellems & Clarke, 2007; Lewis et al., 2003; Jacquez et al., 2008; Tahirovic & Toromanovic, 2006). However, very few studies have specifically assessed the parental perspective of diabetes care after an educational program was delivered to staff. Future research should be devoted to surveying the parents of diabetic students from the campuses that participated in the online training program to assess their satisfaction with the diabetes care at school. In addition, questions should specifically assess whether or not care improved after the program was administered.

Follow-up studies also need to be conducted at six and twelve months to explore the outcomes for diabetic students. Specifically, the number of hypo and hyperglycemic events and other diabetic emergencies at schools should be assessed and compared with reported numbers before the program was administered. In addition, surveys with diabetic students and parents can further assess their perspective of blood glucose monitoring, insulin administration, and other aspects of diabetes care at school. Further research should be conducted with the campus principals and school nurses to assess their view of diabetes care at their campuses following the online training program. Finally, follow-up with those that completed the program to include both UDCA's and school nurses should be conducted six and twelve months later to further assess their confidence for and actual administration of care.

Further studies are also needed to compare the utilization of and preference for online versus traditional diabetes education programs for staff administering care. Specifically, very few studies have been conducted assessing programs for unlicensed personnel in the school setting. Additional research should be conducted to assess the impact of these programs, both online and traditional methods, on the knowledge and confidence level of school personnel to administer diabetes care. These types of studies will provide valuable information for school campuses to ensure that they have effective diabetic training programs in place, so their employees are prepared to deal with the care of their diabetic students. In addition, these studies will provide insight for those creating and administering diabetes continuing education programs. Although the use of the internet for continuing education is increasing, barriers to effective use of this format still exist. These barriers include lack of computer access and competence by users and technical difficulties with programs. Continuing education providers need to be more proactive with addressing these potential issues.

Finally, further work is needed to identify practice outcomes related to online diabetes education programs and to assess the sustainability of knowledge gains and practices changes with this educational platform. With the exponential growth of the internet and distance education, further studies are necessary to maximize the use and effectiveness of this educational format.

Implications for School Health Practice

With the increasing prevalence of children with diabetes in schools, an important finding of this study is that online programs with current information on diabetes care may enhance the ability of school personnel to manage children with diabetes in their schools. The online method allows for continuing education opportunities for school nurses, teachers, and UDCA's that find it difficult to attend face-to-face workshops. The online program allows flexibility with completing the modules, allowing participants to access and complete at their own pace. In addition, they can access in the future if they want to review materials, videos, or link to resources. The online format also saves travel time and substitute teacher expenses. However, it is important to note that access to a computer and computer skills are needed to complete the program. Another important finding is that online programs are not preferred by everyone. In fact, this study found a weak relationship between change in confidence and knowledge and the participants' rating of the usefulness of the program.

Finally, the findings from this study provide valuable insight for those delegating the role of the UDCA on school campuses. As demonstrated by the results, change in knowledge and self-efficacy scores varied by occupation. Principals may find this information valuable when deciding who to appoint as the UDCA.

Summary

This study attempted to examine the impact of a primary online diabetes education program on the knowledge and self-efficacy of the participants. The program

produced overall positive and promising results. It is recommended that follow-up studies be conducted to further assess the impact of the program on the health outcomes of the diabetic students receiving care from the participants. With up-to-date diabetic information delivered in a user friendly and accessible format, more school personnel can be trained throughout the United States. Hopefully, this will result in better daily diabetes management and fewer diabetic emergencies of students while at school. Ultimately, the goal is to create an environment that is safe and conducive for learning for all students!

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APPENDIX A

Institutional Review Board (IRB) Approval

TEXAS WOMAN'S UNIVERSITY
DENTON DALLAS HOUSTON

Institutional Review Board
Office of Research and Sponsored Programs
P.O. Box 425619, Denton, TX 76204-5619
940-898-3378 Fax 940-898-3416
email: IRB@twu.edu

April 15, 2011

Ms. Cassity Gutierrez
6 Devon Wood
San Antonio, TX 78257

Dear Ms. Gutierrez:

Re: A Study to Evaluate the Effectiveness of the Salus Education Online Diabetes Training Program for Improving Knowledge and Self-Efficacy of School District Employees (Protocol #: 16663)

The above referenced study has been reviewed by the TWU Institutional Review Board (IRB) and was determined to be exempt from further review.

If applicable, agency approval letters must be submitted to the IRB upon receipt PRIOR to any data collection at that agency. Because a signed consent form is not required for exempt studies, the filing of signatures of participants with the TWU IRB is not necessary.

Any modifications to this study must be submitted for review to the IRB using the Modification Request Form. Additionally, the IRB must be notified immediately of any unanticipated incidents. If you have any questions, please contact the TWU IRB.

Sincerely,

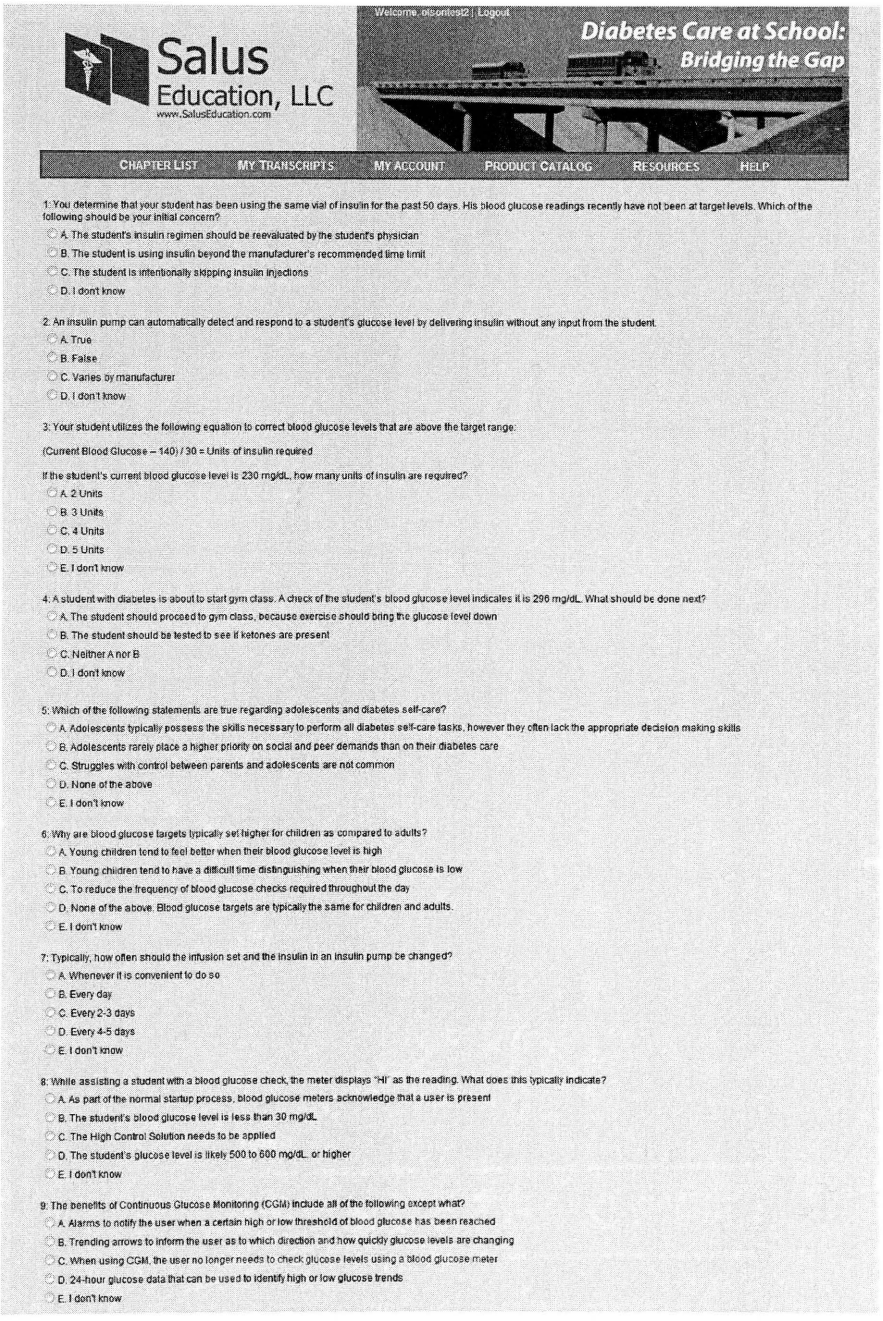
Rhonda R Buckley

Dr. Rhonda Buckley, Co-Chair
Institutional Review Board - Denton

cc. Dr. Gay James, Department of Health Studies
Dr. Kimberly Parker, Department of Health Studies
Graduate School

APPENDIX B

Data Collection Instrument: Pretest/Posttest Questions



1: You determine that your student has been using the same vial of insulin for the past 50 days. His blood glucose readings recently have not been at target levels. Which of the following should be your initial concern?

- A. The student's insulin regimen should be reevaluated by the student's physician
- B. The student is using insulin beyond the manufacturer's recommended time limit
- C. The student is intentionally skipping insulin injections
- D. I don't know

2: An insulin pump can automatically detect and respond to a student's glucose level by delivering insulin without any input from the student.

- A. True
- B. False
- C. Varies by manufacturer
- D. I don't know

3: Your student utilizes the following equation to correct blood glucose levels that are above the target range:

(Current Blood Glucose – 140) / 30 = Units of insulin required

If the student's current blood glucose level is 230 mg/dL, how many units of insulin are required?

- A. 2 Units
- B. 3 Units
- C. 4 Units
- D. 5 Units
- E. I don't know

4: A student with diabetes is about to start gym class. A check of the student's blood glucose level indicates it is 296 mg/dL. What should be done next?

- A. The student should proceed to gym class, because exercise should bring the glucose level down
- B. The student should be tested to see if ketones are present
- C. Neither A nor B
- D. I don't know

5: Which of the following statements are true regarding adolescents and diabetes self-care?

- A. Adolescents typically possess the skills necessary to perform all diabetes self-care tasks, however they often lack the appropriate decision making skills
- B. Adolescents rarely place a higher priority on social and peer demands than on their diabetes care
- C. Struggles with control between parents and adolescents are not common
- D. None of the above
- E. I don't know

6: Why are blood glucose targets typically set higher for children as compared to adults?

- A. Young children tend to feel better when their blood glucose level is high
- B. Young children tend to have a difficult time distinguishing when their blood glucose is low
- C. To reduce the frequency of blood glucose checks required throughout the day
- D. None of the above. Blood glucose targets are typically the same for children and adults.
- E. I don't know

7: Typically, how often should the infusion set and the insulin in an insulin pump be changed?

- A. Whenever it is convenient to do so
- B. Every day
- C. Every 2-3 days
- D. Every 4-5 days
- E. I don't know

8: While assisting a student with a blood glucose check, the meter displays "HI" as the reading. What does this typically indicate?

- A. As part of the normal startup process, blood glucose meters acknowledge that a user is present
- B. The student's blood glucose level is less than 30 mg/dL
- C. The High Control Solution needs to be applied
- D. The student's glucose level is likely 500 to 600 mg/dL or higher
- E. I don't know

9: The benefits of Continuous Glucose Monitoring (CGM) include all of the following except what?

- A. Alarms to notify the user when a certain high or low threshold of blood glucose has been reached
- B. Trending arrows to inform the user as to which direction and how quickly glucose levels are changing
- C. When using CGM, the user no longer needs to check glucose levels using a blood glucose meter
- D. 24-hour glucose data that can be used to identify high or low glucose trends
- E. I don't know

10. If a student injects a fixed-dose of pre-meal insulin, it is most important that the student:
- A. Eats a predetermined amount of protein at the meal
- B. Eats a predetermined amount of carbohydrate at the meal
- C. Eats a predetermined amount of fat at the meal
- D. All of the above
- E. I don't know

11. Provided the student can safely swallow without choking, which of the following would be the best treatment for hypoglycemia?
- A. A full (12 oz) can of soda
- B. A 15 gram glucose source
- C. Corrective insulin per the student's diabetes management and treatment plan
- D. 8 oz of water
- E. B & C
- F. I don't know

12. Insulin pumps use only one type of insulin. Typically, what type is it?
- A. Long Acting
- B. Short Acting
- C. Rapid Acting
- D. Intermediate Acting
- E. I don't know

13. Before gym class a blood glucose reading indicates 296 mg/dL. A subsequent ketone test indicates that ketones are present. What should be done next?
- A. Allow the student to participate in gym class, but test for ketones again in 1 hour
- B. Refer to the student's Individualized Health Plan or Diabetes Management and Treatment Plan for direction on how to clear the ketones
- C. Don't allow the student to exercise until the ketones are cleared
- D. Both B & C
- E. I don't know

14. Why is it recommended that a 2-unit air shot be performed prior to each injection with an insulin pen?
- A. To be certain all crystallized insulin has been purged from the needle
- B. To be certain all air has been purged from the needle
- C. To be certain the depth gauge is set correctly
- D. Both A and B
- E. I don't know

15. Which of the following would a student most likely experience with hypoglycemia?
- A. Shakiness
- B. Sweating
- C. Thirst
- D. A & B
- E. All of the above
- F. I don't know

16. Which of the following is NOT a cause of hypoglycemia?
- A. More exercise than usual
- B. Not enough carbohydrate
- C. Too much insulin
- D. Not enough insulin
- E. I don't know

17. Which of the following factors are likely to affect blood glucose during a disaster situation?
- A. Not getting meals and snacks at regular times
- B. Increased activity
- C. Reduced activity
- D. Acute stress
- E. Limited access to medication and diabetes supplies
- F. All of the above
- G. I don't know

18. Which of the following would be the best treatment for hyperglycemia?
- A. A 15 gram glucose source
- B. Corrective insulin per the student's diabetes management and treatment plan
- C. 8 oz of water
- D. A & B
- E. I don't know

19. What nutrient can cause blood glucose levels to rise significantly?
- A. Protein
- B. Carbohydrate
- C. Fat
- D. Both A and B
- E. I don't know

20: Which of the following would a student most likely experience with hyperglycemia?

- A. Shakiness
- B. Thirst
- C. Frequent urination
- D. B & C
- E. All of the above
- F. I don't know

21: Which of the following federal and state laws may apply to federally-funded Texas schools with regard to caring for students with diabetes.

- A. Texas House Bill 984
- B. Section 504 of the Rehabilitation Act of 1973
- C. Americans with Disabilities Act (ADA)
- D. Americans with Disabilities Act Amendments Act (ADAAA)
- E. Individuals with Disabilities Education Act (IDEA)
- F. All of the above
- G. I don't know

22: It is important to inject insulin into the fatty layer beneath the skin to ensure the insulin is absorbed properly.

- A. True
- B. False
- C. I don't know

23: In general, exercise tends to:

- A. Decrease blood glucose levels
- B. Increase blood glucose levels
- C. Have no effect on blood glucose levels
- D. I don't know

24: A primary cause of Diabetic Ketoacidosis (DKA) is not getting enough what?

- A. Carbohydrate
- B. Water
- C. Exercise
- D. Insulin
- E. I don't know

25: If fasting blood glucose levels reach 100 mg/dL, or higher, or if blood glucose remains above 140 mg/dL two hours after eating, it is considered hyperglycemia.

- A. True
- B. False
- C. I don't know

26: For students who use an insulin pump, which of the following events could indicate an interruption in the student's insulin delivery?

- A. No delivery alarm
- B. Dislodged infusion set
- C. Pump has run out of insulin
- D. Pump is in suspend mode
- E. Student's glucose level does not respond to boluses of insulin
- F. All of the above
- G. I don't know

27: Hypoglycemia is defined as a blood glucose level less than what?

- A. Less than 80 mg/dl
- B. Less than 70 mg/dl
- C. Less than 60 mg/dl
- D. Less than 50 mg/dl
- E. I don't know

28: Which of the following will NOT cause hyperglycemia?

- A. Less activity than usual
- B. Eating more carbohydrate than planned
- C. Using damaged or expired insulin
- D. Forgetting an insulin dose
- E. Taking too much insulin
- F. Malfunction with insulin delivery device
- G. I don't know

29: What two things are generally required to clear ketones from the student's system?

- A. A glucose source and fluid
- B. Exercise and fluid
- C. Rest and fluid
- D. Insulin and fluid
- E. I don't know

30: A carbohydrate exchange or "choice" contains how many grams of carbohydrate?

- A. 25 grams
- B. 20 grams
- C. 15 grams
- D. 5 grams
- E. I don't know

Grade Exam

APPENDIX C

Data Collection Instrument: UDCA Course Evaluation

Data Collection Instrument: UDCA Course Evaluation

1. Prior to completing the Diabetes Care at School: Bridging the Gap training program, how confident were you in your ability to assist a student with diabetes?
   (7-point semantic scale ranging from Not at All Confident to Extremely Confident)
2. After completing the Diabetes Care at School: Bridging the Gap training program, how confident are you in your ability to assist a student with diabetes?
   (7-point semantic scale ranging from Not at All Confident to Extremely Confident)
3. Please indicate how effective you feel the Diabetes Care at School: Bridging the Gap training program was preparing you to perform the following diabetes related tasks:
   (7-point semantic scale ranging from Not at All Effective to Very Effective)

   Understanding instructions within a Diabetes Management and Treatment Plan an Individualized Health Plan

   Performing a glucose check

   Determining the carbohydrate content of a meal or snack

   Calculating an insulin dose

   Performing an insulin injection

   Performing a urine ketone test

   Recognizing a threating a low or high blood sugar

   Performing a glucagon injection

   Working with an insulin pump

4. Please indicate how helpful you feel in the Diabetes Care at School: Bridging the Gap training resources were in preparing you to assist a student with diabetes.
   (7-point semantic scale ranging from Not at all Effective to Very Effective)

   12 Chapter Online Course

   Companion Guide

   Diabetes Skills Training Kit

5. Did viewing material from the Diabetes Care at School: Bridging the Gap training program influence your decision in any way to become an Unlicensed Diabetes Care Assistant