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## Developing Registered Nurse Competency in Diabetes Care

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DEVELOPING REGISTERED NURSE COMPETENCY  
IN DIABETES CARE

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A doctoral document submitted in partial fulfillment  
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Doctor of Nursing Practice

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## **Doctoral Project Approval**

The Graduate College  
The University of Nevada, Las Vegas

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This doctoral project prepared by

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entitled

Developing Registered Nurse Competency in Diabetes Care

is approved in partial fulfillment of the requirements for the degree of

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## ABSTRACT

**Background and purpose:** As the cost of health care continues to climb in the United States, hospitals are seeing longer lengths of stay and associated costs resulting from the complications of diabetes mellitus (DM). Registered nurses (RNs) play a critical role in caring for patients with DM. Rapid changes in the care of DM require continuing education on the current trends and the use of evidence-based practices to prevent hypoglycemia as a serious complication of lowering blood glucose levels. This doctoral project assessed the knowledge levels of RNs caring for patients with DM in the hospital setting.

**Methods:** Eighty-five RNs from a single urban hospital's intensive care units were asked to complete a fill-in-the-blank survey based on an electronic version of the validated Diabetes Awareness Questionnaire© (Rubin, Moshang, & Jabbour, 2007).

**Results:** With 23 respondents from two intensive care units, the overall mean percentage score for the DAQ was 48.8%. Respondents scored below this mean value in three of the six survey categories: perioperative insulin management, 0%; diagnosis and treatment of DM, 32.61%; and diabetic ketoacidosis management, 42.75%. Thus, these topics represented particular knowledge gaps. A 2-hour education program was developed on these topics to improve RN knowledge levels related to DM care.

**Conclusion:** The DAQ survey results support the view that RNs in the hospital setting do not have the most current knowledge in caring for patients with DM. Continuing efforts to increase RN knowledge of DM care are needed to decrease hypoglycemic events and improve the quality of care for patients during their hospitalization.

## **ACKNOWLEDGMENTS**

As I reflect on the journey to completing this project, I am reminded of a quote by Thomas Edison: “Our greatest weakness lies in giving up. The most certain way to succeed is always to try just one more time.” I would like to thank Dr. VanBeuge as chair of my committee for always encouraging me to keep on trying and do my best work. I would also like to thank Dr. Sabo and Dr. Bungum for willingly participating as additional committee members and making this dream possible. To my family and friends, we are soon to reunite, and I thank you all for your selflessness and willingness to support my journey.

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# CHAPTER 1

## Introduction

Chronic diseases and health conditions are among the leading causes of death and disability in the United States. According to the Centers for Disease Control and Prevention (CDC), some of the most common health conditions are stroke, heart disease, cancer, obesity, arthritis, and diabetes mellitus (DM). As of 2012, 117 million people had one or more chronic health condition, and one in every four people had two or more (CDC, 2014a). The cost of caring for people with chronic diseases and conditions continues to rise; at the current pace, the cost will exceed the ability of health care systems to manage these conditions without a significant financial impact. In 2012, health care costs in the United States accounted for 17.4% of the gross domestic product and averaged \$8,000 per person; the average life expectancy was 78.2 years (Hawks, 2013).

DM affects 29.1 million people in the United States, which equates to 9.3% of the population. Among the 29.1 million, 21 million have been diagnosed with DM, and 8.1 million are undiagnosed. The number of adults aged 65 and older with DM dropped slightly from 26.9% in 2010 to 25.9% in 2012, accounting for 11.8 million older adults. Each year 1.7 million new cases of DM are diagnosed. DM is seen in significant proportions in minority populations, with the highest prevalence in American Indians/Alaskan Natives at 15.9%, followed by non-Hispanic blacks, 13.2%; Hispanics, 12.8%; Asian Americans, 9%; and non-Hispanic whites, 7.6% (American Diabetes Association, 2014b). The number of Americans with pre-DM continues to rise, and the current rate is 37% of the population aged 20 and older. This is an increase from 35% in 2010, totaling 86 million people. Adults aged 65 and older account for 51% of Americans with pre-DM, which is an alarming number. These figures are indicative of the

prevalence of the disease and a predictor of the percentage of people who will enter the health care system in the future with a DM-related condition.

The estimated cost of caring for patients with DM is \$176 billion of direct care costs and another \$69 billion of indirect costs. The direct costs of caring for patients with DM are 2.3 times higher than the costs of caring for those without DM. The indirect costs of this diagnosis are associated with disability, work loss, and early death (CDC, 2014b). The number of patients entering the hospital with a diagnosis of DM is continuing to rise and is resulting in increased lengths of stay and readmissions, costing approximately \$244 billion in health care dollars (Hawks, 2013).

In the acute care hospital setting, more than 25% of the patients have a diagnosis of DM (Young, 2011). The Centers for Medicare and Medicaid Services (CMS) recognized that patients with DM are at high risk for longer lengths of stay and readmission. Through its unplanned readmission measure, CMS is reducing payments for patients who are readmitted with a DM-related condition within 30 days of discharge (Medicare, n.d.). As CMS continues to bundle payments and decrease reimbursements, hospitals must look for ways to improve the management of patients with DM, whether DM is of new onset or is a secondary diagnosis.

Registered nurses (RNs) who are licensed to practice by state boards of nursing play a crucial role in caring for patients with DM in the hospital. According to Abduelkarem and El-Shareif (2013), nursing knowledge reaches its peak at an unspecified point during the RN's career and does not increase beyond that point without additional education. Rapid changes in DM care require continuing education for RNs on current trends and the use of evidence-based practices for treating and preventing complications of DM in hospitalized patients.

## **Problem Statement**

In the United States, DM was the seventh leading cause of death in 2010 and was listed as the primary diagnosis in these patients (CDC, 2014b). In 2011, there were 282,000 emergency department encounters for patients 18 years and older with hypoglycemia as the first diagnosis and DM as an additional diagnosis. The number of patients of all ages seeking care in the emergency department for hyperglycemia was significantly less, at 175,000 encounters in 2011. Both hyperglycemia and hypoglycemia are DM-related complications that can lead to complex health issues (American Diabetes Association, 2014a).

Hypoglycemia is a common complication of DM therapies to control blood glucose and is known to cause serious complications such as seizures, loss of consciousness, and death. Children with type 1 diabetes mellitus (T1DM) and older adults with type 2 diabetes mellitus (T2DM) are at highest risk for hypoglycemia (CDC, 2014b). According to Kalra et al. (2013), hypoglycemia is often considered to be less serious than hyperglycemia. However, it is the most serious side effect associated with insulin therapy and other oral medications to lower blood glucose levels. Severe episodes of hypoglycemia lead to significant increases in health care costs related to hospitalization and increased lengths of stay. Patients who suffer from a severe hypoglycemic episode will have an increased length of stay estimated between 6.6 and 9.5 days, which is 3 days higher than the mean length of stay without an episode (Kalra et al., 2013).

The incidence of DM and pre-DM continues to escalate, and the number of adults affected with this disease accounts for nearly half of the adult population. At the current rate, by 2050 one in three adults will be diagnosed with DM (Fonseca, Kirkman, Darsow, & Ratner, 2012). Health care systems, providers, hospital administrators, clinicians, patients, and families

should be concerned about the rising cost of health care and the increasing number of individuals with DM and other chronic diseases.

As the number of patients entering the hospital with DM increases, RNs will be faced with the complex health care needs of these patients. RNs do not have the most current knowledge in caring for patients with DM and may not understand the signs and symptoms of hypoglycemia and its complications. A study assessing DM-related knowledge among RNs through a questionnaire addressing nine key areas found overall knowledge lacking, with a mean score of 48.5%, and a score of 47.8% for knowledge of hypoglycemia and 51.3% for knowledge of chronic complications of DM (Abduelkarem & El-Shareif, 2013). Inadequate awareness and understanding of DM care can lead to decreased quality and safety for patients. The goal of this project was to assess RN knowledge in caring for the patient with DM and to develop education tailored to the RNs' identified needs. Increasing RN knowledge of DM care will decrease hypoglycemic events and improve the quality of care for patients during their hospitalization.

## **CHAPTER 2**

### **Review of the Literature**

The core curriculum for a baccalaureate-degree nurse provides a broad base of knowledge and skills to prepare the registered nurse (RN) to carry out the plan of care and be the link between the patient and the health care system. A key element that defines professional nursing practice is the focus on health promotion and reducing risks. An RN needs to have strong communication and assessment skills, critical reasoning, and clinical judgment to care for patients within a changing environment. A commitment to lifelong learning is an essential part of the profession of nursing (American Association of the Colleges of Nursing, 2008). This literature review demonstrates the RNs' limited understanding of diabetes mellitus (DM) and its related complications requiring advanced education and instruction on caring for the patient with DM.

#### **Nursing Knowledge of Diabetes Mellitus**

RNs' confidence and competence in caring for patients with DM are diminished when they do not have the relevant knowledge to practice. In a cross-sectional study, Hollis, Glaister, and Lapsley (2014) conducted a National Association of Diabetes knowledge test in a convenience sample of acute care RNs. The RNs had attended at least one education course related to DM within the previous 12 months. The test consisted of 14 multiple-choice questions that addressed pathophysiology, blood glucose monitoring, diet, and medication. The RNs scored highest in pathophysiology and blood glucose monitoring. They scored lowest in medication management, specifically related to timing and storage. Additionally, one question related to sources of carbohydrates had a low score, although the overall score for diet was above 75% out of a possible 100%. The RNs' role in teaching patients about medication management

and healthy eating is significant, and yet there was a lack of knowledge related to both topics. These findings are concerning, considering the rising number of patients with DM and the major role the RN is expected to play in blood glucose management and patient teaching. This study suggests that RNs are not sufficiently prepared to care for and teach patients about DM in the hospital setting, which may potentially adversely affect patients' well-being.

Health care professionals treating patients with DM have limited understanding, knowledge, and resources to adequately care for and educate patients with DM and improve self-management (Holt et al., 2013; Korytkowski, Koerbel, Kotagal, Donihi, & DiNardo, 2014). Based on a 13-question knowledge assessment related to various topics in DM care, Young (2011) asserted that RNs have knowledge deficits related to managing patients with DM in the hospital. Education was most needed on the topics of pathophysiology, medication management, nursing care, hyperglycemia outcomes, and current guidelines. When RNs were offered instruction to increase their knowledge related to these deficiencies, results showed improved scores, whether the instruction was provided online or through in-person teaching methods. The live session had the least participation: 10 RNs attended the session, with 100% satisfaction with the entire course. The online instruction had 36 participants; 58% were satisfied with the online format, and only 42% were satisfied with the material. For the online class, the mean quiz score was 95%, which was slightly better than the mean live learning quiz score of 88%. The study demonstrated that using multiple approaches to increasing RNs' knowledge about DM met the needs of a larger number of RNs. Addressing the knowledge gaps of evidence-based care and teaching patients about their condition is essential to achieving positive outcomes. This study showed that RNs are interested in learning about DM and can be taught using a variety of methods that allow them to work around their busy schedules (Young, 2011).



Perceived and actual level of knowledge is important to understand when teaching blood glucose management to acute care RNs. In a 2009 study, Gerard, Griffin, and Fitzpatrick focused on the importance of blood glucose management by acute care RNs in the absence of a diabetes educator. Results of the study showed that RNs' perceived knowledge level was higher than the actual results of the DM knowledge test that they were administered. Consequently, RNs may be treating patients with outdated knowledge and practices. More than half of the study participants had not received education on DM within the last 2 years, and there was no measurable difference in knowledge between nurses with different levels of academic preparation. The knowledge gap may explain, in part, why patients with DM experience care that is not consistent with current professional nursing knowledge. This study demonstrates the importance of increasing RN knowledge to improve morbidity and mortality associated with a complex condition such as DM. Ongoing education in the rapidly changing field of DM care must include current research, evidence-based protocols, and competency assessments to increase professional nursing knowledge.

Recent trends in caring for patients with DM in the hospital have focused on blood glucose targets and insulin management. These trends require RNs to stay abreast of new knowledge that translates into evidence-based practice changes. In a descriptive study by Modic et al. (2014), RNs' confidence, skill mastery, and knowledge of DM care was examined to identify knowledge gaps and was reexamined after 4 hours of education. Education was provided by two certified diabetes educators (CDEs) based on a prior knowledge assessment and covered hyperglycemia, hypoglycemia, insulin therapy, and survival skills. The study looked at the relationship between level of knowledge and age, level of knowledge and education level or years of nursing experience, difference in RNs' knowledge level and self-rated confidence and

skill mastery, and knowledge gained after 4 hours of education. The results of the study showed a negative correlation between the age of the RN and knowledge, with assessment scores decreasing as the age of the RN increased. When controlling for age, there was no correlation between level of knowledge and education level and years of nursing experience. Self-rated confidence and skill mastery of the RN did not have a correlation with DM care knowledge. The education provided by the CDEs did increase the overall knowledge of DM care, resulting in higher scores on a post-test. Three problematic questions were of concern on the post-test. The questions related to insulin regimens were answered incorrectly by 68% of the RNs. The researchers did have concerns that the questions may have been worded poorly, which resulted in a higher percentage of RNs answering incorrectly. A possible limitation of the study was that it was conducted in a single facility, although the sample size was large and the participants were diverse in age, education, and experience. The evidence presented in this study demonstrates that novice and experienced RNs do not have adequate levels of knowledge regarding recent trends in the management of DM. It is concerning that RNs may not be aware of their knowledge deficit and may overestimate their current skills related to DM care. These findings can help educators plan curricula and explore innovative ways to relay knowledge to the diverse population of RNs on the rapidly changing trends in DM care.

A study by Abduelkarem and El-Shareif (2013) assessed the DM knowledge of RNs in the hospital and found findings similar to those of Modic et al. (2014). The mean score on a pretest of DM knowledge given to 116 RNs was 48.5%. RNs with more experience (greater than 10 years) and higher education scored better than the mean pretest scores. Another important finding was that despite continuous years of experience, the RNs' knowledge about DM reached a threshold during their career and did not increase without additional formal education.

Identifying gaps in knowledge related to DM care among RNs is important to determining the specific education topics that need to be presented. The researchers asserted that RNs with more than 10 years of work experience and a degree higher than a diploma in nursing have a higher level of insulin-related knowledge, but overall, RNs lacked basic knowledge of DM. In order to properly manage DM in the hospital, resources for education must be allocated as a priority. Legislators and hospital administrators must support and encourage continuing education related to DM in an effort to improve quality and translate evidence into outcomes.

The complexity of DM management therapies has placed greater emphasis on nurse educators teaching RNs to provide the highest level of care possible to patients with DM. A study by Corl, McCliment, Thompson, Suhr, and Wise (2014) investigated the effect of group teaching on RN confidence and expertise in inpatient DM care led by a clinical nurse specialist. Researchers looked at RNs who joined the diabetes nurse expert team and attended four half-day workshops to determine if the content increased their confidence and expertise in DM care. The expert team was led by an RN specializing in DM, and the workshops allowed a sharing of knowledge and skills that increased the knowledge level of the RN. The data demonstrated that RNs participating in the workshops had an increase in both their confidence and expertise, thus allowing them to care for complex patients with DM.

### **Hypoglycemia Awareness, Risks, and Costs**

Identification and awareness of the signs and symptoms of hypoglycemia and its serious effects can reduce further complications. The most serious risk of hypoglycemia is the lack of glucose needed for proper brain function, which can result in decreased mental ability. Hypoglycemia is linked to a lower quality of life in patients with type 2 diabetes (T2DM). A cross-sectional epidemiological study was conducted by Rombopoulos, Hatzikou, Latsou, and

Yfantopoulos (2013) with patients with T2DM to estimate the prevalence of hypoglycemic events and the impact on quality of life using the Audit of Diabetes-Dependent Quality of Life 19 questionnaire. The study concluded that patients experiencing hypoglycemia and uncontrolled T2DM, defined as hemoglobin (Hb) A1c greater than 7%, have many restrictions for how they live, which affects their overall quality of life. The goal of DM treatment is to provide glycemic control without causing hypoglycemia that can severely compromise patients. The increased prevalence of hypoglycemia is positively correlated with decreased quality of life and affects self-management. Implications of the study include identifying a health strategy that supports interventions and developing policies to decrease serious hypoglycemic events and improve the well-being of patients with T2DM.

Several studies have shown the benefits and risks of strict glycemic control in the management of type 1 diabetes (T1DM) and T2DM. A systematic review by Kalra et al. (2013) found that strict glycemic control can result in an increased risk of hypoglycemia, which offsets the benefits of keeping tight control over blood glucose levels. The goal of the review was to increase the understanding and awareness of hypoglycemia risk factors, causes, and symptoms impacting patients with DM. The review highlighted several key factors related to hypoglycemia. The most significant risk factor found to increase the incidence of severe hypoglycemic events was tight glucose control. Many hypoglycemic events occur as a result of medications used to treat DM and lower blood glucose. Another factor was the decreasing intensity of symptoms that occurs over time, resulting in unawareness of hypoglycemia; this decreasing intensity increased the risk of increased episodes of hypoglycemia by six times in those with in T1DM and by nine times in those with T2DM. Major strategies for preventing hypoglycemia included prevention, the use of low-risk therapies and regimens, and treating

hypoglycemia. The authors concluded that hypoglycemia is often overlooked by health care professionals as a key complication of DM, but it has a significant impact on quality of life and can have life-threatening complications. Educating patients on DM and the effects of hypoglycemia is essential to improving DM-related outcomes.

A retrospective observational study by Lipska et al. (2014) compared hospital admissions for hyperglycemia and hypoglycemia for Medicare beneficiaries from 1999 to 2011. The hypothesis of the researchers was that the use of glycemic control practices would reduce the rate of hyperglycemia and in turn increase the incidence of hypoglycemia. During the study period, DM quality care metrics rewarded target-based lowering of glucose levels based on HbA1c. Using incentives to increase tight glucose control practices placed patients at risk for hypoglycemia and other treatment complications. The study looked at five outcome measures: hypoglycemia hospitalization rates, hyperglycemia hospitalization rates, 30-day mortality post-hospitalization, 1-year mortality post-hospitalization, and 30-day all-cause readmission rates. Overall, the results showed that over a 12-year period, the change in treatment targeting lowering blood glucose levels had a positive effect on hyperglycemia rates but a negative effect on rates of hypoglycemia admissions for Medicare beneficiaries. According to the authors, care guidelines for patients with DM must be examined to improve quality and prevent hypoglycemia in all patients, and such changes would especially benefit those older than 75, African Americans, and women enrolled in Medicare.

Hypoglycemia places an economic burden on health care systems and payers, but the extent of the costs is not well known in the United States. Patients with T2DM taking oral agents to control blood glucose are at risk for hypoglycemia and the resulting complications that can lead to increased health care costs and increased morbidity and mortality. A retrospective

cohort study by Quilliam, Simeone, Ozbay, and Kogut (2011) assessed the incidence of hypoglycemia in a study sample of people aged 18 and older with T2DM and estimated the direct costs of hypoglycemia-related medical visits. The researchers found that 3.5% of the study sample had at least one inpatient, emergency department, or outpatient visit for hypoglycemia. The total cost associated with medical treatment for hypoglycemia in 2008 was \$52 million. The cost of hypoglycemia-related inpatient admissions was more than the costs of the emergency department and outpatient visits for hypoglycemia combined. The investigators found that the rate of hypoglycemia was highest in the 18- to 34-year age group and was higher in women than in men. Adults aged 65 and older also had a high prevalence of hypoglycemia, and the rate was the same in women and men in this age group. The study concluded that women and young adults aged 18 to 34 with T2DM are at a higher risk of having hypoglycemic events that will lead to medical intervention. Monitoring and preventing hypoglycemic episodes in at-risk populations will aid in controlling health care costs.

The DIALOG study by Cariou et al. (2015) looked at the frequency of hypoglycemia and predictive factors in patients with T1DM and T2DM receiving insulin. The study was a multicenter, prospective and retrospective observational review of patients using a questionnaire to determine how often hypoglycemia occurred and its characteristics. The prospective survey patients answered questions over a 30-day period indicating if they had a hypoglycemic event and then describing the characteristics. The retrospective survey patients were asked questions about severe episodes of hypoglycemia over the past year. The results of the study showed that 61% of the prospective cohort had at least one episode of hypoglycemia in a 30-day period, and the rate was higher in patients with T1DM than in those with T2DM. In patients with T1DM, the frequency of hypoglycemia increased the longer they had had the disease and had been on

insulin. In the retrospective survey, 25.9% of the patients reported experiencing severe hypoglycemia, and again the rate was higher among T1DM than T2DM patients. The DIALOG study supported the premise that hypoglycemia is a significant concern in patients receiving insulin therapy, including those patients with T2DM. Predictive factors included a history of severe or nonsevere hypoglycemia, more than two daily insulin injections, a body mass index less than 30 kg/m<sup>2</sup>, and a greater than 10-year history of insulin treatment for T1DM and T2DM. Severe hypoglycemia can lead to hospitalization and increased health care costs. Understanding that both T1DM and T2DM patients receiving insulin are at risk for hypoglycemia, along with the predictive factors, can help RNs identify patients needing close monitoring of insulin therapy to decrease the potential for further complications.

The length of hospitalization and the mortality of patients with DM who have a hypoglycemic episode in the non-critical care setting was the focus of a retrospective study by Nirantharakumar et al. (2012). Data analysis consisted of reviewing hospital laboratory and point-of-care testing stored in a computerized patient information system from 2007 to 2010. The analysis proved the researchers' assertion that hypoglycemic episodes in patients with DM raised the length of stay and mortality rates. The length of stay for patients with moderate hypoglycemia (2.3-3.1 mmol/L) was 51% higher than in those who did not have a hypoglycemic episode. A severe hypoglycemia episode (<2.2 mmol/L) increased patients' length of stay by 133% compared with patients who did not have a hypoglycemic event. The odds of death for a patient with hypoglycemia increased by 62% in moderate hypoglycemia and by 105% in severe hypoglycemia. These findings suggest that hypoglycemia is an indicator of increased risk for less favorable outcomes and a poor prognosis.

Research evidence points to the acute and long-term complications in patients with DM. Hypoglycemic episodes are not recognized for their severity of complications by RNs. These complications can be reduced or controlled by health care providers working together to use the most current evidence-based practices. Health care organizations need to compare the cost of educating RNs on DM with the risk of potentially severe outcomes related to hypoglycemia. The time has come to encourage advanced nursing knowledge on DM care and the use of current evidence-based practice measures to improve the care and outcomes of patients with DM while they're in the hospital.

### **Needs Assessment and Description of the Project**

DM is a growing concern nationally and in the state of Texas. In 2010, the population of Texas was 25.14 million people. Texas is a diverse state; 38% of the population is Hispanic, 12% is African American, and 4% are another ethnic minority (Asian, American Indian, Alaskan Native, Native Hawaiian, and Pacific Islander). Data collected during the same year identified that 9.7% of adults in Texas aged 18 and older were diagnosed with DM, exceeding the U.S. rate of 9.3% (see Appendix A). African Americans had the highest prevalence of DM, at 16.5%, followed by Hispanics at 11% and Caucasians at 8.2%. A lower rate of DM was associated with higher education. The number of patients hospitalized in Texas with DM was 17.7 per 10,000 persons per year; this rate was higher in males, at 17.1, and in African Americans, at 31.9 per 10,000. In North Texas, Region 3, the total population was 6.7 million people; of that number, 16.7 per 10,000 persons per year were hospitalized with DM, compared with the state rate of 17.7 (see Appendix B). The average length of stay in Texas hospitals for patients with T1DM and T2DM is 6 days. As age increased, so did the length of stay; at age 65 and older, the length of hospital stay doubled to 8 days, compared with 4 days for patients aged 45 and younger.



Patients in the 4% other ethnicity category had the highest length of stay, at 10 days (Texas Department of Health and Human Services, 2013).

The payer source with the highest average length of stay is Medicare, at 8 days for all ethnicities. The average length of stay for the 11 health service regions in Texas was 5 to 7 days. Total hospital days were 596,200 for patients with DM, and the charges for 2010 were \$1.7 billion, with an average charge per stay of \$38,630 (see Appendix C). The cost was well over \$29 billion when DM as a secondary diagnosis was included in the data.

The number of patients with DM in Texas and the cost associated with caring for them in the hospital is significant and will continue to increase. According to the Behavioral Risk Factor Surveillance System, in 2010 5.2% of Texans had prediabetes; nationally, that percentage is 6.4% (Texas Department of Health and Human Services, 2013). Chronic diseases such as DM are concerning for health care systems and providers as costs increase. Medicare rates for reimbursement continue to decline, and Medicare is the biggest payer source for patients presenting to the hospital. The number of patients diagnosed with DM, along with the alarming rate of prediabetes, requires a strategic plan to manage acute illness and improve outcomes.

### **Population Identification**

The project site was an acute care hospital located in North Central Texas. As shown in Table 1, 11.32% of the intensive care unit (ICU) patients in the project organization had an episode of hyperglycemia in fiscal year 2014, and the Society of Hospital Medicine (SHM) recommendation is 5.2%. The rate of hypoglycemia was 0.59%, which is above the recommendation of the SHM of 0.40% and is indicative of patients with DM having multiple comorbidities, tight glucose control practices, and lack of current knowledge of evidence-based care of DM by RNs.

**Table 1. Rate of Hyper- and Hypoglycemia at the Project Site in 2014.**

Unit	Days (n)*	Rate of hyperglycemia >300 mg/dL	Rate of hypoglycemia <40 mg/dL
Non-critical care	4,418	10.52%	0.68%
Critical care	1,025	11.32%	0.59%

\*Days represent the number of days with electronically recorded results of blood glucose levels from point-of-care glucose monitoring.

*Note:* Data from project site quality reports.

To decrease the rate of hypoglycemia as a serious complication of controlling blood glucose, the project focused on RNs, and particularly the critical care subgroup of RNs. Among the 90 RNs working in the ICUs, 90% have a bachelor's of science degree in nursing or higher, and the remaining 10% have an associate's degree. RNs are responsible for collaboratively creating and acting upon the plan of care, assessing the patient to identify changes in condition, managing medications, teaching, and other essential nursing functions. For adequate care of the patient with DM, it is important for the RNs to recognize the signs and symptoms, along with causal factors, associated with hypoglycemia. New medication regimens and insulin order sets have emerged, and RNs lack the contemporary skill set necessary to provide optimal care for patients with DM.

### **Project Sponsors and Key Stakeholders**

The project sponsors included the acute care hospital chief nursing officer, leaders of the nursing units, and this doctorate of nursing practice (DNP) student who was not affiliated with this hospital in a leadership capacity. Other key stakeholders included the patients, families, community, providers, and other interprofessional health care team members, such as the CDE, education coordinator, dietitian, care coordinators, health care improvement coordinator, and

other informal and formal leaders in the hospital who were working to improve patient outcomes.

### **Organizational Assessment**

The acute care hospital in which the project was conducted serves an urban population. The population of this Texas city is approximately 812,238; 71% of the population is over 18 years of age, and 8% of that group is over 65 years of age (U.S. Census Bureau, 2014). The primary and secondary service areas of the hospital included the county in which it is located and sections of three adjoining counties. There are three adult care hospitals within a 5-mile radius of the project hospital, offering similar services and competing for the market share. The hospital continues to recruit physicians and RNs with the expertise and education level to improve the health of patients with acute and chronic diseases. The organization's culture and values are consistent with improving quality and becoming a center of excellence in identified areas of care.

### **Assessment of Available Resources**

In the project hospital, the identified resources were a dietitian, CDE, education coordinator, nurse managers for the ICUs, and the DNP student. System resources were available for DM education programs and included up-to-date education videos, handouts, and classrooms with high-technology video and conferencing equipment. Education and training were a primary focus of the organization, and resources were allocated to conduct evidence-based practice projects and quality improvement projects to improve patient outcomes. There was an allotted budget for RN education each year that focused on the highest priority needs.

## **Team Selection and Formation**

The team consisted of the DNP student, dietitian, CDE, nursing educator, pharmacist, physician, and a direct care RN. The DNP student administered a validated knowledge assessment to the RNs to identify knowledge gaps. The team was formed to review the data related to hypoglycemia in the project organization and to assist with the content review for the education.

## **Cost-Benefit Analysis**

Conducting an online assessment of RN knowledge related to DM care and developing education did not require a financial investment. The time needed for the DNP student to prepare the knowledge assessment and develop education was not a cost to the organization and was part of the project.

The benefits of completing a knowledge assessment and providing education on DM care for the RNs far outweighed the cost of allowing even one patient to receive less than optimal care. The cost of caring for one patient with DM in Texas was estimated at an average charge per stay of \$38,630 (Texas Department of Health and Human Services, 2013).

## **Scope of Project**

The project entailed assessing RN knowledge in caring for the patient with DM and developing education. Increasing RN knowledge of DM care decreases hypoglycemic events and improves the quality of care for patients during their hospitalization. This assessment included only RNs in critical care areas. The DNP student recruited the RNs through flyers communicating the dates of the survey, email communication, and presenting the project in unit staff meetings and the hospital-wide glycemic task force meeting. The unit leaders and charge

nurses assisted in recruiting with rounding on the units and reminding staff that the survey was available. Once the assessment was completed, an analysis of the results determined the needs of the RNs, and education was tailored to the specific needs identified.

### **Mission, Goals, and Objectives of the Project**

The goal of the project was to assess RN knowledge of DM care in the inpatient hospital setting. The project had three main objectives:

- Assess RNs on two critical care units for their knowledge related to hypoglycemia and DM
- Develop an education program based on the identified knowledge gaps from results of the Diabetes Awareness Questionnaire
- Provide the project organization's education department with an education program based on the survey results to increase RN knowledge of DM

## CHAPTER 3

### Theoretical Underpinnings of the Project

#### Theory to Support Change

In the evolving health care landscape of rising costs, an aging population, and federal health care reform, change is inevitable. Registered nurses (RNs) must be open and responsive to new knowledge and evidence to improve outcomes in their practice setting. Planned change is purposeful and collaborative, requiring well-developed action plans. The implementation of evidence-based practices requires knowledge of change theory, and one of the most commonly used theories that can be applied to evidence-based nursing practice is Everett Rogers' diffusion of innovation theory (Keele, 2011).

The diffusion of innovation theory was originally centered on technology and has been adapted by many disciplines, including nursing. The focus of this theory is to explain and guide the implementation of an innovative idea, practice, or project. Communication channels, time, and social systems are essential to the success of the decision-making process tied to the innovation (Keele, 2011).

Rogers (2003, as cited by Mitchell, 2013) used his diffusion of innovation theory to expand upon and modify Kurt Lewin's change theory. He correlated his concepts of knowledge, persuasion, decision, implementation, and confirmation to create five phases of planned change to guide change agents. Rogers' change theory lists the phases as awareness, interest, evaluation, trial, and adoption (Mitchell, 2013).

The first phase of Rogers' theory is awareness, and in this phase of change for the project, the data that support the number of hypoglycemic episodes and the increased costs and readmission rate was presented to the RNs to increase their awareness and sense of urgency. The

previous fiscal year's data by unit, showing the frequency of both hyperglycemia and hypoglycemia, was reviewed, along with associated increased lengths of stay and complications for patients with diabetes mellitus (DM). This information provided the RNs with a sense of uneasiness about the current practice of caring for patients with DM.

The next three phases of change, according to Rogers' theory, parallel Lewin's moving phase and include developing an interest, evaluation, and trial (Mitchell, 2013). Developing an interest was correlated with the organizational goal to decrease hypoglycemia in patients who are hospitalized and the RNs' inherent desire to improve patient outcomes. The evaluation phase involved examining the role of the RNs in managing hypoglycemia and determining the knowledge deficits by conducting a knowledge assessment. Once the knowledge gaps were identified and communicated, the findings moved the RNs in the direction of change. The trial phase included developing the education based on the RNs' identified needs. Additional learning activities and resources are planned by the project organization after the initial education is provided based on ongoing needs.

The last phase of Rogers' change theory consists of adopting the change (Mitchell, 2013). This effort means ensuring consistent practice of evidence-based care for patients with DM. The development of a specific set of guidelines to care for the patient with DM that incorporates parameters for monitoring blood glucose values, assessing the patient for signs and symptoms associated with hypoglycemia on a routine basis, and engaging all staff in the observation of these patients will develop these practices as the new standard of care. Achieving the objective of decreasing hypoglycemia benefits the patient and providers by improving outcomes and satisfaction. In this project, once the units completed the knowledge assessment, the education was developed.

In Rogers' adaptation of change theory, success of the planned change requires five factors: It must offer an advantage over what is currently being done; it must be compatible with existing values; the more complex the change is, the more likely that it will persist; it must be introduced on a small scale; and it must be easily described for it to spread (Mitchell, 2013). The project meets these criteria.

### **Theoretical Framework**

The theoretical framework for this project was the nursing intellectual capital theory. This theory provides a way to understand how nursing knowledge influences patient and organizational outcomes. Intellectual capital can be the knowledge of an individual RN or a group and resource knowledge that impacts the success of the health care organization. Nursing intellectual capital theory consists of two concepts: nursing human capital and nursing structural capital. Nursing human capital consists of the RN's knowledge, skills, and experience. The concept of nursing structural capital is described as practice guidelines, care maps, and technology that aid in the delivery of evidence-based care (Covell & Sidani, 2013).

Nursing human capital is linked to patient outcomes and quality of care. Two factors influence nursing human capital: staffing and support for continuing education and professional development. Nursing structural capital is also directly related to outcomes and quality with the use of information and diagnostic technology. Using the theory of nursing intellectual capital helped to frame the need to invest in advanced education in DM care to increase knowledge and awareness among the RNs caring for patients with DM. According to Covell and Sidani (2013), investing in nursing human capital has demonstrated improved patient outcomes and workplace environment.



The focus of this project was to increase nursing knowledge in DM care as a way to decrease hypoglycemia and improve outcomes for patients with DM. Assessing the level of knowledge RNs possess and then supporting them with an education program positively influences the RN, the patient, and the work environment. Nursing intellectual capital theory is a middle-range theory that can be used to understand the impact of RN knowledge on the overall success of the organization.

## **CHAPTER 4**

### **Project Plan**

#### **Setting and Population**

The project took place in a 574-bed acute care hospital in Texas. The hospital employs a registered nurse (RN) who is a certified diabetes educator (CDE). Her primary focus is inpatient teaching for patients with new-onset diabetes mellitus (DM). The educator is consulted by the physician for DM education in the hospital setting.

The project participants worked in a 16-bed general intensive care unit (ICU) and a 15-bed cardiovascular ICU (CVICU) with an average daily census of 12 and 13 patients, respectively. The method of nursing care was a total patient care model where RNs are responsible for delivering and coordinating the care of a patient or group of patients during their assigned shift. The RN-to-patient ratio was 2:1, and the patient care technician-to-patient ratio was 16:1. There were 90 RN full-time equivalents budgeted annually to provide 17.3 hours of care per patient day in the general ICU and 16.4 hours of care per patient day in the CVICU. Among the RNs employed in these units, 90% had a bachelor's of science degree in nursing or higher. Thirty-one RNs in the units had specialty nursing certification, giving the units a certification rate of 34%. Specialization in critical care nursing improves the care of critically ill patients and provides an expert resource for RNs on the unit. The manager acted as an additional resource and stepped in to help when needed.

#### **Measures, Instruments, and Activities**

The RNs participating in the project provided demographic data, including age, education, and years of nursing experience. They were then asked to complete the Diabetes

Awareness Questionnaire<sup>®</sup> (DAQ; see Appendix D) to assess knowledge of evidence-based practices in caring for the patient with DM. Rubin, Moshang, and Jabbour (2007) validated the DAQ with a cohort of resident physicians and nurses; the instrument had a high overall internal consistency, with a raw Cronbach  $\alpha$  score of 0.78 and a test-retest reliability of 0.71, as assessed by Pearson correlation coefficient based on 20 test-retest pairs.

## **Timeline**

Activities for this project began once the proposal was approved and institutional review board approval was granted. The project timeline is outlined in Table 2.

**Table 2. Project Timeline.**

Time	Activities
September 2015– December 2015	<ul style="list-style-type: none"> <li>• Complete the knowledge assessment with RNs on two units in identified hospital</li> <li>• Compile results of the knowledge assessment, identifying gaps in knowledge</li> <li>• Develop education based on the knowledge assessment</li> </ul>
January 2016– March 2016	<ul style="list-style-type: none"> <li>• Complete DNP project chapters</li> <li>• Defend DNP project</li> </ul>

## **Project Task and Personnel**

A communication plan was created to explain the problem and the opportunities for advancing nursing knowledge on the most current evidence-based practice related to DM care to nursing leaders and the RNs on the project units. Recruitment of the RNs involved working with charge nurses and nurse leaders, presenting the hypoglycemia data and project plan at unit staff meetings, hospital-wide glycemetic task force meetings, and rounding one-on-one with the RNs to promote the desire to change practice and improve outcomes. The knowledge assessment was

administered by way of an online survey sent to the ICU RNs as the an email explaining the project and consenting participants with a link to the survey. The education was developed by the DNP student after the knowledge assessment was completed and analyzed for gaps in knowledge.

### **Resources and Supports**

The project required input and feedback from the identified team members—i.e., a dietitian, CDE, nursing educator, pharmacist, physician, and a direct care RN—on the knowledge assessment results and the education content. In order to conduct the knowledge assessment, the assistance of information technology staff was requested. Computers were needed to complete the online survey.

Along with the resources identified, the support needed to meet the project goals included executive leadership acknowledgment of the problem and commitment to the plan. Executive leadership support was also required to allow the DNP student to complete the project and to have the cooperation of an interprofessional team for input and feedback on the knowledge assessment and education.

### **Risks and Threats**

One risk to the project's success was presenting the need for change effectively to the chief nursing officer and the RNs on the identified units. If the problem was not seen as significant, it would be difficult to get complete acceptance and support from nursing leadership. The plan also needed to engage the RNs to maximize participation in completing the knowledge assessment. Lack of engagement by the nursing team could result in a less than optimal number of assessments, which may not represent the knowledge needs of the RNs in the ICUs. A

strategy to effectively communicate the importance of increasing nursing knowledge was completed prior to conducting the knowledge assessment.

Another possible threat to the project was a lack of adequate staffing on the ICUs during the time planned for the knowledge assessment. An increased census results in increased overtime and the potential for burnout of the staff, which can lead to decreased RN readiness to focus on education. The time required to complete the fill-in-the-blank survey questions is a potential barrier to higher participation rates. Once RNs begin taking the survey, communication of time commitment between staff members, nursing leadership, and the survey type might decrease RNs desire to participate during or after their work shift. No other significant risks for the project were identified.

### **Evaluation Plan**

#### **Financial Plan**

There was no cost associated with completing the online assessment or having the DNP student develop education after the analysis of the results.

#### **Institutional Review Board Approval**

The project proposal was sent to the institutional review board at the University of Nevada, Las Vegas, and the project organization for approval prior to the initiation of the project. The project adhered to all ethical guidelines, including informed consent and confidentiality of records.

## **CHAPTER 5**

### **Summary of Implementation and Results**

#### **Initiation of the Project**

The project was implemented after receiving notification on October 7, 2015, from the University of Nevada, Las Vegas biomedical institutional review board that the project was reviewed and was deemed exempt (see Appendix E). The project hospital was contacted to arrange for meetings with the registered nurses (RNs) in the general intensive care unit (ICU) and cardiovascular ICU (CVICU) to introduce the project. A presentation of the project goals was conducted during two unit staff meetings and at the glycemic control task force meeting the week of October 12-16, 2015.

A Qualtrics online survey was prepared from the 20 fill-in-the-blank questions of the Diabetes Awareness Questionnaire<sup>®</sup> (DAQ). Due to the translation of the paper-based survey into an electronic form, Questions 7 and 9 (now Questions 7 and 8, 10 and 11) each had two parts and had to be separated into two distinct questions, resulting in 22 total questions. The DAQ was sent to 85 RNs during the survey period of October 20 to November 9, 2015.

#### **Threats and Barriers to the Project**

Concerns and threats during the survey that reduced participation included overburdening RNs with multiple surveys, staffing shortages, and high patient census and acuity warranting long hours and overtime. At the proposal stage, there was concern regarding adequate communication about and endorsement of the project, but the DNP student was able to develop a clear communication plan and receive the support and engagement of the chief nursing officer, certified diabetes educator (CDE), nursing leaders, and RNs. The communication plan was well

developed, and the project was embraced by the organization's nursing leadership and the ICU RNs.

The fill-in-the-blank style of the DAQ was a barrier to increased participation in the survey and posed several disadvantages. The main disadvantage of collecting data in this manner was the narrow response choices. The responses were either correct or incorrect and had little margin for interpretation by the DNP student. If a question had more than one correct response credit was given for either answer. Based on the 2015 American Diabetes Association (ADA) guidelines, one question on the DAQ survey had an updated answer and both answers were accepted as correct. An additional disadvantage was the lack of familiarity of the RNs with a non-traditional format of a fill-in-the-blank questionnaire testing the recall of information. Fill-in-the-blank or short answer is typically used in critical thinking and math calculations and is not the primary way to measure nursing knowledge but can be used based on the type of assessment needed (Oermann & Gaberson, 2013). Feedback from the ICU leaders indicated that the RNs conveyed concern regarding the difficulty of this survey and feelings of inadequate knowledge levels regarding DM care. Communication of these feelings throughout the units by the RNs and ICU leaders may have discouraged others from completing the survey. A multiple choice survey requiring recognition as opposed to the recall of information may have increased participation and decreased the negative perception of the RNs and nurse leaders. Well written multiple choice questions can assess higher order thinking and cover more content in less time (Brookhart, 2015).

Overtasking of the RNs with multiple surveys was a barrier to increased participation in the project survey. Two days prior to the DAQ survey link deployment, the RNs in the ICUs had just completed the National Database for Nursing Quality Indicators survey that ran for two

weeks. Two additional surveys covering patient education and the electronic health record were also running at the same time as the DAQ survey.

### **Monitoring of the Project**

The presence of the DNP student at the project site to introduce the goals and the outcomes of the project played a significant role in establishing relationships with the leaders and RNs. Contact was initiated with the nursing leadership team twice a week to address questions and concerns about the survey. The survey link was sent to the RNs weekly during the survey period to encourage participation and make it easily accessible. The nursing leaders and CDE also reminded the RNs about the survey.

### **Data Collection**

The Qualtrics survey tool, an online software application, was managed during the survey period by the DNP student. The survey tool provided graphs and comparison data. Email notifications of completed surveys allowed the DNP student to keep track of the responses in real time. The survey tool also provided downloadable reports with the raw data set up in a spreadsheet for analysis and export into a statistical software program.

### **Data Analysis**

The results of the DAQ survey were downloaded from Qualtrics into a Microsoft Excel spreadsheet and scored. To identify specific diabetes mellitus (DM) management topics for education, the questions were grouped into related categories. Statistical analysis was performed using the SAS<sup>®</sup> computer software application. Comparisons were made for each question and stratified by demographic characteristics to determine if there was a correlation between correct responses and a specific demographic category. Nonparametric tests were conducted using



correct responses by category to obtain a *p*-value based on the small sample size. The analysis of the data determined if there was a significant knowledge gap in any of the specified questions or categories related to caring for patients with DM.

### **Giving Meaning to the Data**

#### **Quantitative Data**

The survey response rate was 27%; 23 of the 85 eligible RNs completed the survey. The dropout rate for the survey was 21%; 6 of 29 RNs who started the survey did not answer all 22 questions. As shown in Table 3, the participants' mean age was 35.3 years, and they had a mean of 7.9 years of experience; 95.6% of the respondents had at least, a bachelor's degree in nursing. The CVICU had the highest rate of participation, with 73.9%.

**Table 3. Descriptive Statistics of the Sample Completing the DAQ Survey.**

Variable	Result
Age, mean $\pm$ SD	35.3 $\pm$ 9.7
Age group, n (%)	
30 or younger	10 (43.5%)
Older than 30	13 (56.5%)
Years of experience, mean $\pm$ SD	7.9 $\pm$ 9.1
Years of experience, n (%)	
Less than 5 years	12 (52.2%)
5–10 years	6 (26.1%)
More than 10 years	5 (21.7%)
Highest degree earned, n (%)	
Associate's	1 (4.3%)
Bachelor's	19 (82.6%)
Master's	3 (13.0%)
Unit, n (%)	
Cardiac intensive care unit	17 (73.9%)
General intensive care unit	6 (26.1%)

The DAQ survey questions were placed in one of six categories: (1) diagnostic criteria and treatment guidelines for patients with type 1 diabetes mellitus (T1DM) and type 2 diabetes mellitus (T2DM); (2) oral glucose control agents and their contraindications; (3) insulin characteristics covering peak, onset, and duration; (4) diabetic ketoacidosis (DKA) management; (5) treatment of hypoglycemia; and (6) perioperative insulin management of T1DM and T2DM.

## Results

The overall mean percentage score for the DAQ was 48.8% for the two units. The categories scoring below the overall mean were perioperative insulin management, 0%; diagnosis and treatment of DM, 32.6%; and DKA management, 42.8% (Table 4).

**Table 4. DAQ Survey Questions Grouped by Category with Mean Percent.**

Category	Questions	Description	Mean score
1	1-4	Diagnosis and treatment of diabetes	32.6%
2	5-6	Oral glucose control agents	78.3%
3	7-12	Insulin characteristics	63.8%
4	13-18	Diabetic ketoacidosis management	42.8%
5	19-20	Treatment of hypoglycemia	73.9%
6	21-22	Perioperative insulin management	0%
1-6	1-22	All categories	48.8%

**Differences by demographic subgroups.** The number of correct answers for each question and the comparison by demographic characteristics for the 23 RNs who completed the DAQ survey are provided in Appendix F. There were no correct answers for Questions 17, 21, and 22 by any of the age groups, experience levels, or education levels. RNs older than 30 years and those with 5 to 10 years of experience had the highest percentage of correct answers on the

survey, at 45.5% and 36.3%, respectively. Respondents from the general ICU scored higher than those from the CVICU in 13 of 22 questions.

When comparing results by demographic characteristics, there were only two statistically significant differences (see Appendix G). In category 2 questions pertaining to oral glucose control agents, RNs who were 30 years or older did significantly better than those who were younger than 30 years ( $p < 0.05$ ), and respondents from the general ICU scored better than those from the CVICU on questions related to DKA management ( $p < 0.05$ ).

**Category 1: Diagnostic criteria and treatment guidelines for DM.** Questions 1 to 4 on diagnostic criteria and treatment guidelines for patients with DM had a mean score of 32.6%, which was the second lowest scoring category next to perioperative management. RNs had difficulty identifying the fasting blood glucose level that confirms the diagnosis of DM, the hemoglobin A1c goal in nonpregnant patients with DM, and the blood pressure goal determined by the American Diabetes Association. Although blood glucose measurement for the diagnosis of DM is done in the outpatient setting, it is important for RNs to know the criteria and the goals for treatment to effectively manage blood glucose levels and to educate the patient.

**Category 2: Oral glucose agents.** Questions 5 and 6 tested the knowledge level of the RNs on the oral glucose control agent classes of biguanides (metformin) and thiazolidinediones (glitazones) to treat T2DM, with an overall score of 78.3%. RNs older than 30 years and with more than 5 years of experience scored higher on these questions. The level of education was not a factor since 95.6% of RNs had a bachelor's or master's degree. The oral glucose control agents addressed in these questions have been on the market for some time, and nurses with increased years of experience are more familiar with their contraindications.

**Category 3: Insulin.** On Questions 7 to 12, RNs had a mean score of 63.8%—better than the overall survey mean score of 48.8%. Question 7 had the highest score, 95.7%, with RNs correctly identifying glargine as the longest-acting insulin. They also identified short-acting insulins in Question 8 correctly 65.2% of the time and the composition of 70/30 insulin correctly 52.2% (for the 70) and 69.6% (for the 30) of the time. A key component of caring for patients with DM is adjusting insulin based on meals. Although RNs scored better than the mean in this category, additional education on insulin characteristics could reduce the potential for hypoglycemia and improve DKA management and perioperative management of blood glucose.

**Category 4: DKA management.** Questions 13 to 18 addressing DKA had a combined mean score of 42.8%. The general ICU RNs scored 58.3%, while the CVICU RNs scored 37.3%. This variance may be related to the patient population differences between the units, since a DKA diagnosis is seen more in the general ICU than the CVICU. Question 14 asked at which glucose level a patient with DKA on an insulin drip should be changed to D5½ NS but did not specify the current fluid type. The mean score for that question was 26.1%. Question 17, which asked about the best time of day to convert an insulin drip for a patient with DKA to subcutaneous insulin, received no correct responses. Administering and discontinuing intravenous and subcutaneous insulin based on insulin characteristics was a barrier to effective DKA management for the RNs. RNs were able to recognize which electrolyte to follow in DKA as a critical part of managing these patients. Need for additional education was identified in DKA insulin management.

**Category 5: Treatment of hypoglycemia.** RNs scored well on Questions 19 and 20 with a mean of 73.9% regarding treatment of severe hypoglycemia for asymptomatic and symptomatic patients. Question 20 was not scored incorrect for an answer of one ampule based

on hospital-specific order sets requiring a full ampule of 50% dextrose (D50) for blood glucose levels less than 40 mg/dL in contrast to the DAQ correct answer of half of an ampule for blood glucose of 30 mg/dL as the preferred dose.

**Category 6: Perioperative insulin management.** The lowest scores occurred in Questions 21 and 22 covering perioperative insulin management of T1DM. There were no correct answers in this category among the 23 participants who completed the survey. The correct answers were to treat with an insulin drip in Question 21 and to half the Neutral Protamine Hagedorn (NPH) dose in Question 22. The RNs in the project opted to give nothing or to call the doctor, which was not the correct answer but was appropriate based on the RNs' role and organization policies. The number of incorrect answers demonstrated a significant knowledge gap related to managing the insulin requirements of patients with DM prior to surgery.

## **Discussion**

The DAQ survey results support the problem statement that RNs in the hospital setting do not have the most current knowledge in caring for patients with DM and may not understand the signs and symptoms of hypoglycemia and its complications. RNs completing the survey had knowledge levels below the mean score of 48.8% in three of the six categories: perioperative insulin management of T1DM and T2DM, 0%; diagnosis and treatment guidelines of DM, 32.6%; and DKA management, 42.8%. These results indicate that RNs require additional education in these specific areas. Limited understanding of the diagnostic criteria of DM and insulin characteristics (peak, onset, and duration) can cause severe hypoglycemia and result in poor outcomes for patients.

The RNs in this study worked in the general ICU and CVICU. The RNs' mean score in the original study by Rubin et al. (2007) was 66%. That study involved 48 RNs, 13 of whom had additional diabetes education scoring 82%. Those nurses also scored less than 50% on many of the questions, similar to the results of this study. The DAQ may not have been the ideal tool to assess knowledge on diabetes care specific to the role of the RN in the hospital setting. The original audience of the questionnaire was resident physicians and RNs in an academic medical center. The mean score of 48.8% by the ICU RNs participating in the project was unexpected and questioned the validity of the survey tool format and appropriateness of the level of knowledge assessed.

A knowledge gap was identified in perioperative insulin management, which could be related to the target audience of the original DAQ, which was resident physicians in surgery, internal medicine and family practice, along with RNs. The RNs in the project opted to give nothing or to call the doctor, which was not the correct answer but was appropriate based on the RNs' role and organization policies. The RNs responses raised questions about the role of the RN in using evidence-based practice when contrary to organization policy. RNs did answer the questions in alignment with their current organizational policies and should be commended for their diligence in following policy. The current policy requires RNs to contact the physician to change or hold an order without an established nurse-driven protocol or standard delegated medical order approved by medical leadership. A recommendation to establish current perioperative insulin management protocols allowing RNs to adjust the treatment regimen based on specific parameters will promote evidence-based practice.

The low response rate of 27% may have impacted the validity of the data obtained from the RNs. Higher response rates lead to larger data samples and better statistical power, giving

greater credibility to the results. Email surveys typically yield a higher response rate than mailed surveys, but more important than response rate is response representation (Baruch & Holtom, 2008). The number of participants in the CVICU was 42.5% (17 of 40), which was significantly higher than that of the general ICU, with 13.3% (6 of 45). Therefore, there is greater confidence that the DAQ survey results are representative of the CVICU RNs' knowledge level.

### **Education Plan**

Based on the DAQ survey results, an educational program was created to address the three key areas scoring less than the overall mean survey score. Education to improve RN knowledge in DM consisted of content related to perioperative insulin management, diagnosis and treatment guidelines for DM, and DKA management. Additionally, education on insulin characteristics was added based on the importance of having a thorough understanding of peak, onset, and duration of insulin to manage patients with DM and prevent hypoglycemia. The educational program had seven objectives:

- Review the pathophysiology of T1DM and T2DM
- Familiarize RNs with the diagnostic criteria used in the diagnosis of DM
- Describe the current treatment guidelines for patients with DM
- Outline the most common types of insulin and provide a quick reference chart
- Discuss the signs and symptoms and treatment of hypoglycemia
- Describe the pathophysiology of DKA and review current management guidelines
- Describe current guidelines in managing insulin needs in the perioperative period

Education was created by the DNP student using current literature and teaching tools known to be effective for adult learners. Education content was collected and organized in a

Microsoft PowerPoint presentation and reviewed with the CDE for recommendations and guidance. Table 5 outlines the content covered.

**Table 5. Diabetes Mellitus Management Education.**

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1. Introduction
    - a. Objectives
    - b. Epidemiology of diabetes mellitus
    - c. Problem statement
    - d. Project plan
  2. Diabetes Awareness Questionnaire results
  3. Pathophysiology
    - a. Type 1 diabetes mellitus
    - b. Type 2 diabetes mellitus
    - c. Prediabetes
  4. Diagnostic criteria for diabetes mellitus
    - a. Hemoglobin A1C
    - b. Fasting blood glucose
    - c. Oral glucose tolerance testing
  5. Treatment guidelines for diabetes management
    - a. Control blood glucose
    - b. Reduce cardiovascular risk
  6. Insulin
    - a. Insulin quick reference table
  7. Diabetes management
    - a. Hypoglycemia
      - 1) Signs and symptoms
      - 2) Treatment guidelines
    - b. Diabetic ketoacidosis
      - 1) Pathophysiology
      - 2) Signs and symptoms
      - 3) Treatment guidelines
    - c. Perioperative blood glucose management
      - 1) Blood glucose targets
      - 2) Treatment guidelines
- 

The education will be delivered as a 2-hour presentation (see Appendix H). All RNs from the general ICU and CVICU will be asked to register for a live presentation or complete



online training. The presentations will be offered over a specified period by the CDE and the leadership team. Additional methods of disseminating the education will be determined by the project organization. The project organization will be responsible for sharing the presentation with the RNs, testing knowledge, and tracking outcomes.

### **Dissemination and Utilization of the Results**

The results of this project, along with an education plan to meet the educational needs identified, will be shared with the project organization's nursing leadership and RNs. The dissemination of the results of the DNP student's project will raise awareness to inpatient care RNs regarding the importance of continuing education as a way to stay abreast of the recent changes in DM care and the utilization of evidence-based practices to improve outcomes. Hypoglycemia is a serious complication of tight glucose control, and RNs need to understand the implications of treating patients with glucose-lowering agents, both oral and injectable. The results of the DAQ survey will be used to provide education specific to the categories identified as knowledge gaps for the project organization's general ICU and CVICU.

### **Limitations**

The limitations of the project are the small sample size and the involvement of only one organization, which make it difficult to generalize the results to all ICU RNs in inpatient care settings. The CVICU, which had the highest response rate, may not have a significant number of patients admitted with DM, resulting in less experience with guidelines and treatment.

The number of questions in the DAQ survey and the fill-in-the-blank format may have also been a factor in why RNs did not score higher in all categories. The fill-in-the-blank nature of the DAQ required the recall of information at a higher level of knowledge than multiple

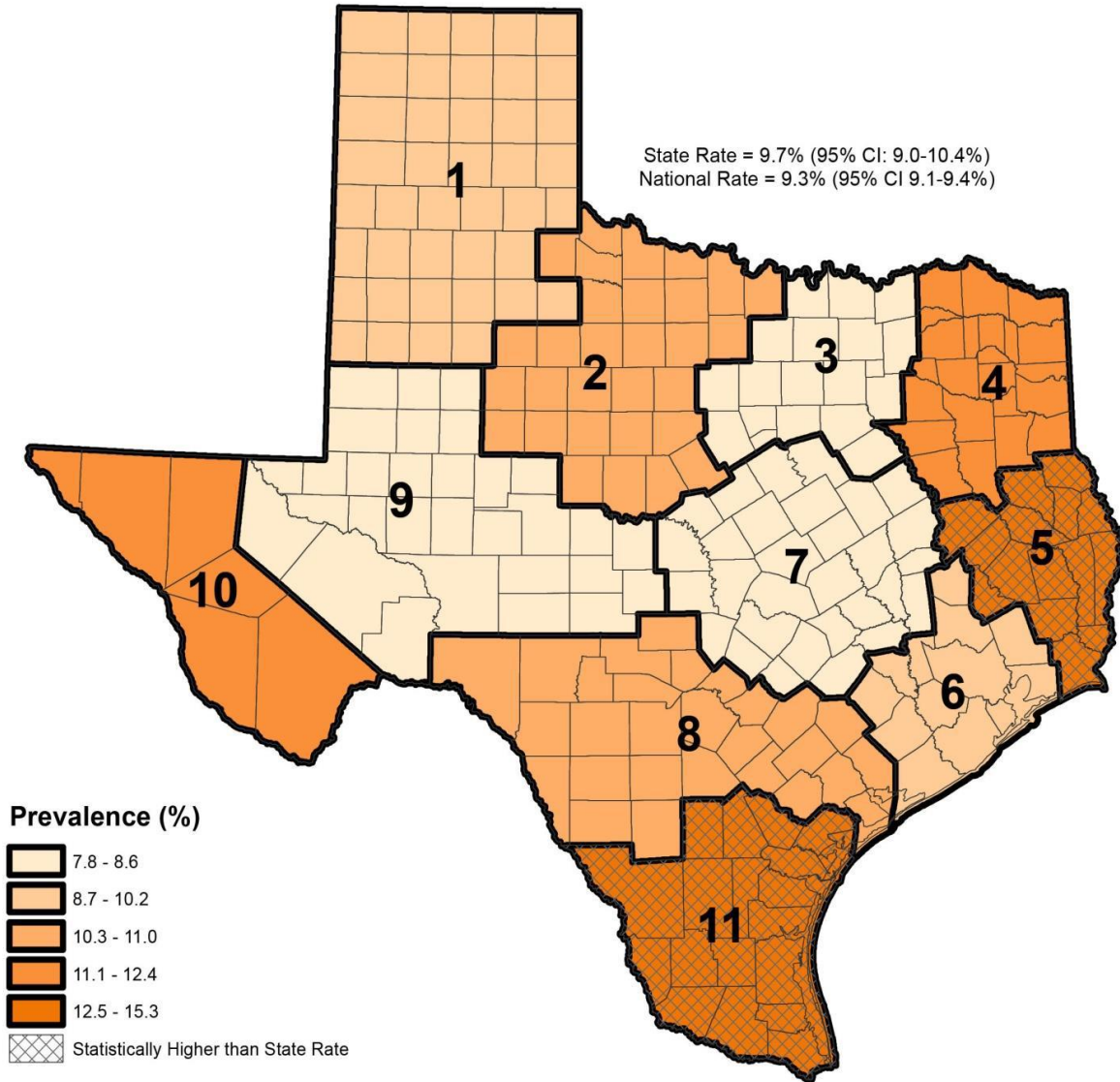
choice examinations (Oermann & Gaberson, 2013). The lowest scoring areas on the survey were identified, and education was created, but the fill-in-the-blank nature of the survey may have overstated the knowledge gaps. Although there were barriers and limitations of the DAQ survey, the overall content was broad and assessed important categories in caring for patients with DM. The format of the survey, low participation rates, and the low confidence levels of the RNs communicated after taking the survey suggest that the assessment tool format and target audience be carefully considered when assessing RN knowledge in DM care in future projects.

## **Conclusion**

DM is a chronic health condition affecting millions of people in the United States, and the number continues to grow as more people who are undiagnosed gain access to health care providers. RNs play a critical role in caring for patients with DM and recognizing the potentially serious complications of the disease, if it is not managed appropriately. This knowledge assessment of inpatient care RNs identified knowledge gaps, and nurse leaders were provided with an education plan tailored to the identified needs. Increasing the knowledge level of RNs in DM care will decrease hypoglycemia and increase the quality and safety of care for patients.

# APPENDIX A

## Texas Diabetes Prevalence by Health Service Region



*Note.* Reprinted from *Diabetes Data: Surveillance and Evaluation*, by the Texas Department of Health and Human Services, 2013. Retrieved from <http://www.dshs.state.tx.us/diabetes/tcddata.shtm>.

## APPENDIX B

### Diabetes Crude Hospitalization Rate

	Population	Crude Hospitalization Rate per 10,000 Persons per Year
<b>TOTAL</b>	25,145,561	17.7
<b>Age Group</b>		
< 45	16,510,648	9.4
45-64	6,033,027	29.1
65+	2,601,886	44.0
<b>Sex</b>		
Female	12,673,281	15.9
Male	12,472,280	17.1
<b>Race/Ethnicity</b>		
White	11,562,682	14.9
African American	3,003,149	31.9
Hispanic	9,460,921	16.2
Other	1,118,809	18.7
<b>Health Service Region</b>		
1	839,586	19.4
2	550,250	14.8
3	6,733,179	16.7
4	1,111,696	18.8
5	767,222	20.8
6	6,087,133	16.1
7	2,948,364	14.1
8	2,604,647	19.8
9	571,871	18.7
10	825,913	20.0
11	2,105,700	20.0

*Data Source: Texas Health Care Information Collection (THCIC), DSHS, 2010*

\*ICD-9 codes used for diabetes are 25000, 25001, 25002, 25003, 25010, 25011, 25012, 25013, 25020, 25021, 25022, 25023, 25030, 25031, 25032, 25033, 25040, 25041, 25042, 25043, 25050, 25051, 25052, 25053, 25060, 25061, 25062, 25063, 25070, 25071, 25072, 25073, 25080, 25081, 25082, 25083, 25090, 25091, 25092, 25093.

*Note.* Reprinted from *Diabetes Data: Surveillance and Evaluation*, by the Texas Department of Health and Human Services, 2013. Retrieved from <http://www.dshs.state.tx.us/diabetes/tdcdata.shtm>.

## APPENDIX C

### Length of Stay and Hospital Charges for Diabetes Patients (Type 1 and Type 2), 2010

	Total Number of Discharges		Length of Stay (LOS)		Hospital Charge	
	#	%	Total Days	Mean	Total Charge (\$)	Avg. Charge per Stay (\$)
<b>Total</b>	<b>44,416</b>	<b>100.0</b>	<b>267,708</b>	<b>6</b>	<b>1,715,790,671</b>	<b>38,630</b>
<b>Age Group</b>						
<45	15,442	34.8	62,347	4	411,068,086	26,620
45-64	17,531	39.5	116,400	7	751,225,075	42,851
65+	11,438	25.8	88,941	8	553,326,986	48,376
Invalid	5	0.0	20	4	170,524	34,105
<b>Sex</b>						
Female	20,181	45.4	114,628	6	727,708,828	36,059
Male	21,309	48.0	138,603	7	892,330,435	41,876
Unknown	2,926	6.6	14,447	5	95,751,408	32,724
<b>Race</b>						
White	17,237	38.8	102,873	6	659,820,062	38,279
Black	9,566	21.5	54,794	6	349,216,500	36,506
Hispanic	15,302	34.5	86,484	6	587,942,712	38,423
Other	2,094	4.7	20,328	10	103,874,712	49,606
Invalid	217	0.5	3,229	15	14,936,685	68,833
<b>Payer</b>						
Medicare	17,791	40.1	135,835	8	865,414,429	48,643
Medicaid	6,093	13.7	31,838	5	205,329,138	33,699
Commercial	10,594	23.9	53,823	5	362,297,504	34,198
Self Pay	8,471	19.1	38,387	5	239,107,523	28,227
Other	1,426	3.2	7,011	5	40,712,122	28,550
Missing	41	0.1	814	20	2,929,955	71,462
<b>HSR</b>						
1	1,626	3.7	9,881	6	59,833,145	36,798
2	817	1.8	5,197	6	29,930,170	36,634
3	11,272	25.4	67,818	6	415,973,942	36,903
4	2,086	4.7	11,684	6	82,845,299	39,715
5	1,595	3.6	9,376	6	55,971,491	35,092
6	9,813	22.1	67,374	7	433,808,330	44,208
7	4,146	9.3	20,447	5	129,737,055	31,292
8	5,167	11.6	27,347	5	172,971,276	33,476
9	1,068	2.4	6,086	6	31,511,173	29,505
10	1,650	3.7	9,783	6	83,919,341	50,860
11	4,212	9.5	27,065	6	179,157,355	42,535
Other	964	2.2	5,650	6	40,132,093	41,631

*Data Source: Texas Health Care Information Collection (THCIC), DSHS, 2010*

*Note.* Reprinted from *Diabetes Data: Surveillance and Evaluation*, by the Texas Department of Health and Human Services, 2013. Retrieved from <http://www.dshs.state.tx.us/diabetes/tcdcdata.shtm>.

## APPENDIX D

### Diabetes Awareness Questionnaire<sup>®</sup>

The purpose of this study is to assess your knowledge of diabetes. Participation is completely voluntary and anonymous. Names are not recorded, nor are answers disclosed to anyone outside of the study. Your job status will not be affected by your answers.

Please circle highest degree attained:            A.D.N.            B.S.N.            M.S.N.

Age: \_\_\_\_\_ Years of RN experience: \_\_\_\_\_ Unit: \_\_\_\_\_

Questions (short-answer only please). The following questions reflect standard of care:

1. A fasting blood glucose of greater than or equal to \_\_\_\_\_ on two separate occasions confirms the diagnosis of diabetes.
2. According to the American Diabetes Association (ADA) guidelines, the *HbA1c* goal in non-pregnant diabetics should be less than \_\_\_\_\_.
3. According to the Adult Treatment Panel III guidelines, the LDL goal in diabetics (without known heart disease) should be less than \_\_\_\_\_.
4. According to the ADA guidelines, the blood pressure goal in diabetics should be less than \_\_\_\_\_/\_\_\_\_\_. .
5. Which oral anti-diabetic agent is *absolutely* contraindicated in renal insufficiency?  
\_\_\_\_\_
6. A diabetic patient on glipizide (Glucotrol), pioglitazone (Actos), and 70/30 insulin develops CHF. Which agent should be discontinued? \_\_\_\_\_
7. The longest acting insulin is \_\_\_\_\_
8. The shortest acting insulin is \_\_\_\_\_
9. What is the peak time of action of regular insulin? \_\_\_\_\_
10. 70/30 insulin is a mixture of 70% \_\_\_\_\_ and
11. 30% \_\_\_\_\_.
12. What is the best time to administer 70/30 insulin relative to meals? \_\_\_\_\_

13. A patient is admitted with DKA (serum glucose 600, 3+ urine ketones) and is started on an insulin drip at 4 units/hr and saline at 150 cc/hr. Six hours later, the serum glucose is 120 and there are 2+ urine ketones. Would you stop the insulin drip at this time? \_\_\_\_\_
14. For a patient admitted with DKA on an insulin drip, at which glucose value would you change the IV fluids to D5½ saline? \_\_\_\_\_
15. What is the most important electrolyte to follow in DKA patients on an insulin drip?  
\_\_\_\_\_
16. What should be the average blood glucose decline per hour on an insulin drip? (provide a range) \_\_\_\_\_
17. When is the best time of day to convert an insulin drip to SQ insulin? \_\_\_\_\_
18. A patient is on an insulin drip at 7 a.m. when the blood glucose is 100 and there are no ketones in the urine. Food will be served at 7:30 a.m. You give the patient 20 units of 70/30 insulin at 7 a.m. At what time should the insulin drip be stopped? \_\_\_\_\_
19. An asymptomatic, alert patient, who is able to eat, is found with a blood glucose of 35 mg/dL. What is the best treatment approach? \_\_\_\_\_
20. In a patient with mental status change and a blood glucose of 30 mg/dL, what is the preferred amount of D50 you would give to accomplish euglycemia? \_\_\_\_\_
21. A 25 year-old, type 1 diabetic on combination therapy (20 N and 10 H in the morning, 10 H in the evening, and 15 N at bedtime) is admitted for elective surgery and is made NPO after midnight. The morning of the surgery, the blood glucose is 250. What would you do with the insulin at this time? (N=NPH, H=Humalog or lispro). \_\_\_\_\_
22. A 50-year-old, type 2 diabetic is admitted on 70/30 insulin (30 units in the morning and 20 units at night) for elective surgery and is made NPO after midnight. The morning of surgery, the blood glucose is 140. What would you do with the insulin at this time?  
\_\_\_\_\_

**Thank you for your participation.**

Diabetes Awareness Questionnaire © 2005, Daniel Rubin and Serge Jabbour.  
Reprinted with permission of Dr. Daniel J. Rubin.

Minor modifications from the original were made to the demographic questions and Question 6. In addition, questions were renumbered so that questions with two parts in the original version were listed as separate questions (Question 7 and 8 and Questions 10 and 11 above) for formatting in the online survey.

## Letter of Permission to Use the Diabetes Assessment Questionnaire©

Office of Research Integrity – Human Subjects  
University of Nevada Las Vegas  
4505 Maryland Parkway Box 451047  
Las Vegas, NV 89154-1047

Subject: Letter of Permission to use the Diabetes Awareness Questionnaire©


Dear Office of Research Integrity – Human Subjects:

This letter will serve as permission for the University of Nevada, Las Vegas (“UNLV”) researcher/research team, Dr. Susan VanBeuge, DNP, APRN, FNP-BC, CNE, FAANP (Faculty Committee Chair) and Elizabeth Ortiz MBA, BSN, RN, NEA-BC (DNP Student) entitled Developing Acute Care Nursing Competency in Diabetes Care to use the Diabetes Awareness Questionnaire© as their assessment tool for the project. The following change to the questionnaire is granted:

6. A diabetic patient on glipizide (Glucotrol), ~~rosiglitazone (Avandia)~~ pioglitazone (Actos), and 70/30 insulin develops CHF. Which agent should be discontinued? \_\_\_\_\_

If you have any concerns or require additional information, please contact the researcher and/or myself.

Sincerely,

  
\_\_\_\_\_  
Signature

8/3/2015  
\_\_\_\_\_  
Date

Daniel J. Rubin, MD, MSc, FACE  
Assistant Professor of Medicine, Division of Endocrinology  
Associate Program Director, Endocrinology Fellowship  
Temple University School of Medicine  
Chair, Glycemic Control Taskforce, Temple University Hospital  
Office: 215-707-4746

\_\_\_\_\_  
Printed Name and Title



## APPENDIX E

### IRB Exemption Notice



#### UNLV Biomedical IRB - Exempt Review Exempt Notice

**DATE:** October 7, 2015

**TO:** Susan VanBeuge, DNP  
**FROM:** Office of Research Integrity - Human Subjects

**PROTOCOL TITLE:** [755066-1] DNP Project - Developing Registered Nurse Competency in Diabetes Care

**ACTION:** DETERMINATION OF EXEMPT STATUS  
**EXEMPT DATE:** October 7, 2015  
**REVIEW CATEGORY:** Exemption category # 2

Thank you for your submission of New Project materials for this protocol. This memorandum is notification that the protocol referenced above has been reviewed as indicated in Federal regulatory statutes 45CFR46.101(b) and deemed exempt.

We will retain a copy of this correspondence with our records.

#### **SUGGESTIONS:**

1. Revise your informed consent to use the Information Sheet for Exempt Studies.
2. On the Information Sheet, please leave the risk level at minimum. There are always risks in research so you should not state "no risks."
3. It is recommended that at minimum, a copy of the data be located with the PI. This is so that in case of an audit, this information is readily available.
4. It is also suggested that in the Flyer and introduction letter, it state that it is a UNLV research study and that it is being conducted under the direction of Dr. Van Beuge.

#### **PLEASE NOTE:**

Upon final determination of exempt status, the research team is responsible for conducting the research as stated in the exempt application reviewed by the ORI - HS and/or the IRB which shall include using the most recently submitted Informed Consent/Assent Forms (Information Sheet) and recruitment materials. The official versions of these forms are indicated by footer which contains the date exempted.

Any changes to the application may cause this protocol to require a different level of IRB review. Should any changes need to be made, please submit a **Modification Form**. When the above-referenced protocol has been completed, please submit a **Continuing Review/Progress Completion report** to notify ORI - HS of its closure.



**American Diabetes Month**

**November**

**Take Your Diabetes Awareness Survey**

**October 20 – November 9, 2015**

**(UNLV study under the direction of Dr. Susan VanBeuge.**

**For questions or to resend the survey link please contact**

**[susan.vanbeuge@unlv.edu](mailto:susan.vanbeuge@unlv.edu) (Principal Investigator) or**

**[Elizabeth Ortiz \(DNP student\) at Ortiz8@unlv.nevada.edu](mailto:Ortiz8@unlv.nevada.edu)**

## APPENDIX F

### Correct Responses by Demographic Categories for Diabetes Awareness Questionnaire

Question	Age (years)		Years of experience			Unit		All
	≤30 (n=10)	> 30 (n=13)	<5 (n=12)	5–10 (n=6)	>10 (n=5)	Cardiac (n=17)	General (n=6)	
1	2 (20%)	1 (7.7%)	3 (25%)	0 (0%)	0 (0%)	3 (17.7%)	0 (0%)	3 (13%)
2	3 (30%)	2 (15.4%)	3 (25%)	2 (33.3%)	0 (0%)	4 (23.5%)	1 (16.7%)	5 (21.7%)
3	6 (60%)	7 (53.9%)	6 (50%)	4 (66.7%)	3 (60%)	9 (52.9%)	4 (66.7%)	13 (56.5%)
4	4 (40%)	5 (38.5%)	5 (41.7%)	3 (50%)	1 (20%)	7 (41.2%)	2 (33.3%)	9 (39.1%)
5	7 (70%)	12 (92.3%)	9 (75%)	6 (100%)	4 (80%)	14 (82.4%)	5 (83.3%)	19 (82.6%)
6	5 (50%)	12 (92.3%)	7 (58.3%)	5 (83.3%)	5 (100%)	12 (70.6%)	5 (83.3%)	17 (73.9%)
7	9 (90%)	13 (100%)	12 (100%)	5 (83.3%)	5 (100%)	16 (94.1%)	6 (100%)	22 (95.7%)
8	7 (70%)	8 (61.5%)	10 (83.3%)	3 (50%)	2 (40%)	12 (70.6%)	3 (50%)	15 (65.2%)
9	5 (50%)	5 (38.5%)	6 (50%)	2 (33.3%)	2 (40%)	8 (47.1%)	2 (33.3%)	10 (43.5%)
10	4 (40%)	8 (61.5%)	5 (41.7%)	5 (83.3%)	2 (40%)	9 (52.9%)	3 (50%)	12 (52.2%)
11	5 (50%)	11 (84.6%)	8 (66.7%)	5 (83.3%)	3 (60%)	11 (64.7%)	5 (83.3%)	16 (69.6%)
12	4 (40%)	9 (69.2%)	6 (50%)	3 (50%)	4 (80%)	9 (52.9%)	4 (66.7%)	13 (56.5%)
13	6 (60%)	9 (69.2%)	6 (50%)	4 (66.7%)	5 (100%)	11 (64.7%)	4 (66.7%)	15 (65.2%)
14	3 (30%)	3 (23.1%)	5 (41.7%)	0 (0%)	1 (20%)	2 (11.8%)	4 (66.7%)	6 (26.1%)
15	8 (80%)	11 (84.6%)	9 (75%)	5 (83.3%)	5 (100%)	13 (76.5%)	6 (100%)	19 (82.6%)
16	5 (50%)	5 (38.5%)	5 (41.7%)	2 (33.3%)	3 (60%)	7 (41.2%)	3 (50%)	10 (43.5%)
17	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
18	2 (20%)	7 (53.9%)	3 (25%)	3 (50%)	3 (60%)	5 (29.4%)	4 (66.7%)	9 (39.1%)
19	8 (80%)	10 (76.9%)	9 (75%)	5 (83.3%)	4 (80%)	13 (76.5%)	5 (83.3%)	18 (78.3%)
20	6 (60%)	10 (76.9%)	6 (50%)	5 (83.3%)	5 (100%)	10 (58.8%)	6 (100%)	16 (69.6%)
21	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
22	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

## APPENDIX G

### Correct Responses by Demographic Characteristics

#### for Diabetes Awareness Questionnaire Categories

	Category 1		Category 2		Category 3		Category 4		Category 5		Category 6		Total	
	Mean ± SD	p-value	Mean ± SD	p-value	Mean ± SD	p-value	Mean ± SD	p-value	Mean ± SD	p-value	Mean ± SD	p-value	Mean ± SD	p-value
Age		0.242		0.024		0.1892		0.501		0.686		1		0.257
30 or Younger	37.5 ± 17.7		60 ± 39.4		56.7 ± 25.1		40 ± 21.1		70 ± 42.2		0 ± 0		45 ± 13.6	
Older than 30	28.9 ± 24.7		92.3 ± 18.8		69.2 ± 23.4		44.9 ± 23.9		76.9 ± 38.8		0 ± 0		51.8 ± 12.9	
Years of Experience		0.323		0.241		0.9655		0.251		0.309		1		0.531
Less than 5 Years	35.4 ± 24.9		66.7 ± 38.9		65.3 ± 15		38.9 ± 26		62.5 ± 43.3		0 ± 0		46.6 ± 10.6	
5 - 10 Years	37.5 ± 20.9		91.7 ± 20.4		63.9 ± 38.6		38.9 ± 17.2		83.3 ± 40.8		0 ± 0		50.8 ± 20	
More than 10 Year	20 ± 11.2		90 ± 22.4		60 ± 27.9		56.7 ± 14.9		90 ± 22.4		0 ± 0		51.8 ± 11.9	
Unit		0.816		0.835		0.885		0.039		0.246		1		0.256
Cardiac	33.8 ± 24.9		76.5 ± 35.9		63.7 ± 27.8		37.3 ± 22.5		67.7 ± 43.1		0 ± 0		46.8 ± 14.5	
General	29.2 ± 10.2		83.3 ± 25.8		63.9 ± 12.6		58.3 ± 13.9		91.7 ± 20.4		0 ± 0		54.6 ± 7.6	
Overall	32.6 ± 21.9		78.3 ± 33.1		63.8 ± 24.4		42.8 ± 22.4		73.9 ± 39.5		0 ± 0		48.8 ± 13.4	

## APPENDIX H

### Diabetes Mellitus Management Education

# Diabetes Mellitus Management Education

Elizabeth Ortiz RN, BSN, MBA, NEA-BC, DNP Student  
University of Nevada, Las Vegas  
School of Nursing



## Objectives

- Provide an overview of the epidemiology of Diabetes Mellitus (DM) and problem
- Describe the project plan and results
- Present education of identified needs
  - Review the pathophysiology of T1DM and T2DM
  - Familiarize RNs with the diagnostic criteria used for DM



## Objectives

- Describe the current treatment guidelines for patients with DM
- Review insulin and provide a quick reference chart
- Discuss the signs, symptoms and treatment of hypoglycemia
- Describe the pathophysiology of DKA and review current management guidelines
- Describe current guidelines in managing insulin needs in the perioperative period



## Epidemiology of DM

- Prevalence
  - As of 2012, DM affects 29.1 million Americans 9.3% of the population
  - 11.8 million are seniors 65 and older
  - 1.4 million new cases diagnosed annually
  - 86 million with Pre-DM, 37% of population 20 and older
  - 7<sup>th</sup> leading cause of death in the United States in 2010



## Epidemiology of DM

- **Distribution**
  - Rates by race and ethnic background
    - 15.9% - American Indians/Alaskan Natives
    - 13.2% - non-Hispanic African Americans
    - 12.8% - Hispanics
    - 9.0% - Asian Americans
    - 7.6% - non-Hispanic Caucasian



## Epidemiology of Diabetes Mellitus (DM)

- **Impact on Health care**
  - **Complications and Comorbidities**
    - Hypoglycemia, hypertension, dyslipidemia, cardiac disease, stroke, blindness, renal disease, and vascular disease
  - 282,000 ED visits in 2011 for patients 18 or older with hypoglycemia and DM diagnosis
  - 245 billion in health care costs in 2013
    - 176 billion direct costs, 69 billion indirect costs
    - 25% of hospitalized patients have a diagnoses of DM



## Problem Statement

- As the number of patients entering the hospital with DM increases, RNs will be faced with the complex health care needs of these patients. RNs do not have the most current knowledge in caring for patients with DM and may not understand the signs and symptoms of hypoglycemia and its complications leading to decreased quality and safety.



## Project Plan

- Why?
  - Rate of hypoglycemia in the critical care units was above target at 0.59%
  - Recommendation from the Society of Hospital Medicine (SHM) was 0.40%
- What?
  - Assessed RN knowledge of DM
  - Identified knowledge gaps in management of DM
- Plan - created education to address identified needs



## Survey Results

- Diabetes Awareness Questionnaire© (DAQ)
  - Mean Score – 48.8%
  - RNs in the ICUs
  - Identified knowledge needs
    - Injectable insulins
    - Hypoglycemia
    - Diagnostic criteria and treatment goals for DM
    - Diabetic Ketoacidosis (DKA)
    - Perioperative Insulin Management

## Diabetes Mellitus (DM)

- What is DM?
  - A complex metabolic condition that affects the body's ability to produce or use insulin. When food is turned into glucose, insulin is released to help transport glucose into the cells. If there is little or no insulin produced, or the cells are insulin resistant, too much glucose remains in the blood. Blood glucose levels are higher than normal for individuals with diabetes.



## Type 1 Diabetes Mellitus (T1DM)

- Etiology of T1DM
  - Autoimmune disorder that attacks and destroys the beta cells in the pancreas
  - Antibodies present in the blood
  - Results in an insulin deficiency
  - Presence of ketones
- Symptoms – polydipsia, polyphagia, polyuria, weight loss, fatigue
- Insulin injections are required to regulate blood glucose



## Type 2 Diabetes Mellitus (T2DM)

- Etiology of T2DM
  - Most common type of DM
  - Declining number of beta cells
  - Peripheral Insulin resistance
- Symptoms – same as T1DM
- Oral glucose control agents or insulin injections to regulate blood glucose



## Pre-Diabetes Mellitus (pre-DM)

- What is pre-DM?
  - A condition that causes a person's blood glucose levels to be higher than normal but not high enough to be diagnosed with diabetes
  - Precursor to Type 2 DM – cells in the body are becoming resistant to insulin
  - Signs and symptoms may or may not be present



## Diagnostic Criteria for DM

- HgbA1C – measurement of blood glucose levels over previous 2-3 months -  $\geq 6.5\%$
- Plasma glucose testing
  - Fasting blood glucose (FPG) -  $\geq 126\text{mg/dL}$
  - Oral glucose tolerance test (OGTT) -  $\geq 200\text{mg/dL}$

## Diagnostic Criteria for DM

	HgbA1C	Fasting Plasma Glucose (FPG)	Oral glucose tolerance test (OGTT)
No Diabetes	<5.7%	<100 mg/dL	<140 mg/dL
Prediabetes	≥5.7% - <6.5%	≥100 mg/dL - <126 mg/dL	≥ 140 mg/dL - <200 mg/dL
Diabetes	≥6.5%	≥126 mg/dL	≥200 mg/dL

## Treatment Guidelines for DM Management

- **Control Blood glucose**
  - Maintain HgbA1C of <7%
  - Medication – insulin and non-insulin
  - Exercise
  - Diet changes
- **Reduce Cardiovascular Risk**
  - Lower Blood Pressure - goal of 140/90 mmHg
  - Prevent hardening and narrowing of the arteries – LDL-C goal <100 mg/dL

# Insulin

- Hormone made in the beta cells of the pancreas
- What does it do?
  - Stimulates cells to use glucose for energy
  - Causes Liver to store excess glucose as glycogen
- How does it work?
  - Attaches to receptors to signal cells to absorb glucose
  - Release is triggered by rising blood glucose

## Insulin Quick Reference Table

Generic Name	Brand Name	Onset	Peak	Duration
<b>Rapid-acting</b>				
Insulin Aspart	NovoLog	10 to 20 min.	30 to 90 min.	3 to 5 hours
Insulin Glulisine	Apidra	10 to 20 min.	30 to 90 min.	3 to 5 hours
Insulin Lispro	Humalog	10 to 20 min.	30 to 90 min.	3 to 5 hours
<b>Short-acting</b>				
Regular	Humulin R, Novolin R	30 to 60 min	2 to 4 hours	5 to 8 hours
<b>Intermediate-acting</b>				
NPH	Humulin N, Novolin N	1 to 3 hours	8 hours	12 to 16 hours
<b>Long-acting</b>				
Insulin Detemir	Levemir	1 hour	No peak	20 to 26 hours
Insulin Glargine	Lantus	1 hour	No peak	20 to 26 hours
<b>Mixtures</b>				
75% Lispro protamine (NPL)/25% insulin Lispro	Humalog Mix 75/25	10-15 min	Varies	10 to 16 hours
70% NPH/30% Regular	Humulin 70/30	30 to 60min	Varies	10 to 16 hours

## Hypoglycemia

- Blood glucose <70 mg/dl
  - Insulin shock or Insulin reaction
  - Too much insulin, not enough glucose
- Signs and Symptoms
  - Nausea, dizziness, confusion, nervousness, sweating, irritable, blurred vision, weakness
- Treatment
  - 15-20 grams glucose
  - 15 grams of simple carbohydrates – 4 oz. juice, 8 ounces of non-fat or 1% milk
  - Dextrose 50% (D50) 12-25 grams IVP

## Diabetic Ketoacidosis (DKA)

- What is DKA
  - Acute, life threatening complication
  - Absolute insulin deficiency causing hyperglycemia, dehydration, acidosis
  - Mainly in T1DM but can occur in T2DM
  - Diagnostics - blood glucose >250 mg/dl, increased anion gap and serum osmolality

## Diabetic Ketoacidosis (DKA)

- Signs
  - Hyperglycemia
  - Ketoacidosis
  - Ketonuria
- Symptoms
  - Excessive thirst, frequent urination, dehydration, Kussmaul respirations, N&V, abdominal pain, decreased level of consciousness

## Treatment of DKA

Dehydration	➡	IV Fluids
Electrolytes	➡	K <sup>+</sup>
Acidosis/ Hyperglycemia	➡	Insulin
Acid-Base	➡	Bicarbonate
Infection	➡	Antibiotic



## DKA Insulin Management

- Low dose Insulin Infusion 0.1 unit/kg/h
- Rate of blood glucose decline - 100 mg/dL/h
- Ketones (+) and anion gap open continue insulin infusion
- Hourly point-of-care blood glucose monitoring



## DKA Insulin Management

- Transitioning patients to subcutaneous (SQ) insulin and sliding scale insulin
  - Stable condition pH >7.3 and bicarb 18 mEq/L
  - Insulin infusion overlaps 1-2 hours prior to stopping
  - N&V - continue D5 1/2 NS and SQ insulin every 4 hours with goal of 100-180mg/dL
  - Established patients return to previous dose of long-acting insulin, if NPH only when eating





## Perioperative Insulin Management

- Surgical patients with DM are at higher risk for infection, myocardial ischemia, death
- Surgery induces a stress response releasing hormones that increase blood glucose
- Perioperative blood glucose targets for surgical patients
  - General Medical/Surgical - <200 mg/dL
  - Cardiac Surgery – <150 mg/dL
  - Critically ill - <150 mg/dL
  - Acute Neuro – 80-140 mg/dL
- Other considerations – give a beta blocker, aseptic technique, and manage fluids



## Perioperative Insulin Management

- Perioperative management of blood glucose varies based on existing insulin regimen, type and duration of surgery
- Monitor blood glucose to prevent hyper- and hypoglycemia
- Reduce nighttime insulin while NPO
- Oral glucose control agents discontinued the day of surgery to prevent hypoglycemia
- Use short-acting insulin sliding scale or continuous infusion during surgery

## Summary

- The number of patients entering the hospital with DM is increasing and RNs are encountering the complicated health care needs of this population
- RNs must have knowledge of the signs and symptoms of hypoglycemia and current DM treatment guidelines to decrease complications and improve outcomes

## Questions



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## CURRICULUM VITAE

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#### KEY

#### ACCOMPLISHMENTS

Improving patient care delivery; increasing patient and employee satisfaction; decreasing turnover; developing and implementing a rapid response team; contributing to organizational awards including ANCC Pathway to Excellence designations in 2015 and 2012, Thomson Reuters Great 100 Hospitals lists in 2012 and 2011, and Texas Award for Performance Excellence in 2012; and coauthoring a publication titled “Application of a Robot for Critical Care Rounding in Small Rural Hospitals.”

#### EXPERIENCE

#### **Aug 2008–Present      Baylor Scott & White, Waxahachie, TX** ***Director of Acute Care Services***

- Responsible for planning, designing, directing, integrating, implementing, coordinating, and improving services for ICU, medical/surgical telemetry nursing units, nursing administration, dialysis, nursing education, and diabetes education services.
- Coaches and mentors leaders and staff to realize the organization's mission, vision, values, and goals, including Press Ganey 90th percentile rank for HCAHPS “Rate” this hospital, NDNQI 75th percentile mean PES, Action O/I 25th percentile or better labor expense, exceeding clinical process measures composite of 98.3, LOS <3.0, retention >93.3.
- Serving as member of healthcare system’s Diversity Council, Research Council, Directors Council, and Glycemic Control Task Force.
- *Accomplishments:* Led key aspects of hospital redesign and campus relocation in December 2014; coordinated dialysis services, wound care, and PCU opening at new location; led the Pathway to Excellence initial application 2012 submission and 2015 redesignation; served as Magnet coordinator.

#### **Jul 1994–Sep 2008      Parkland Health & Hospital System, Dallas, TX**

#### ***Unit Manager III, Cardiopulmonary Intensive Care & Cardiac Rehabilitation (Mar 2006–Sep 2008)***

- Responsible for the daily management, operations, and budget of a 12-bed cardiopulmonary intensive care unit and outpatient cardiac rehabilitation.
- Developed a rapid response team with housewide implementation averaging 120 calls per month. The number of codes outside of the ICU declined significantly.
- Supervised, trained, mentored, evaluated, and led 50 full-time equivalents. Employee satisfaction rates improved to the 77th percentile.
- Improved turnover rates of staff from 19% to less than 10%.
- Increased revenue through increased show rates for Phase II rehabilitation from 3120 to 3692 patient visits. Restructured Phase I consultation and education, resulting in an increase from 2 to an average of 25 Phase I referrals per month.

#### ***Unit Manager II, 9 West Observation/Telemetry (Dec 2002–May 2006)***

- Responsible for the daily management of a 26-bed telemetry/observation unit with 42 full-time equivalents.
- Had fiscal responsibility for the operational budget, equipment, and the direct care area to include space planning, renovations, capital repairs, and acquisitions.
- Provided high-quality patient care through education and development of continuous quality improvement practices. Maintained consistency between institutional and regulatory requirements.

***Associate Unit Manager, Trauma-Surgical/Neurosurgical Intensive Care (Dec 1998–Dec 2002)***

- Assisted unit educator in training and development of the staff.
- Developed, updated, and evaluated unit standards and protocols.
- Evaluated new equipment; conducted research and cost analysis.
- Generated unit productivity reports and tracked quality and service indicators with emphasis on providing quality patient-centered care.
- Facilitated the unit schedule and education and standards committees.
- Conducted employee performance appraisals and interviews; tracked time and attendance and payroll; initiated corrective action.

***Registered Nurse, Trauma-Surgical/Neurosurgical Intensive Care (Jul 1994–Dec 1998)***

- Provided quality nursing care in a trauma, surgical, and neurosurgical critical care environment.

**MILITARY**

**Sep 1982–Aug 1990 United States Air Forces, San Angelo, TX  
*Communications Countermeasures Operator and Instructor***

**EDUCATION**

- **Doctorate in Nursing Practice** – Executive Leadership, May 2016  
*University of Nevada, Las Vegas, NV*
- **Master’s of Business Administration**, Dec 2008  
*Texas Woman’s University, Denton, TX*
- **Bachelor’s of Science in Nursing**, May 1994  
*University of Texas at Arlington, Arlington, TX*
- **BHCS Nurse Executive Fellowship**, April 2009  
*Southern Methodist University, Cox School of Business, Dallas, TX*

**MEMBERSHIPS/  
COMMUNITY  
ACTIVITIES**

- American Nurses Association–Texas Nurses Association, 2015
- Sigma Theta Tau International, HonorSociety.org, inducted 2015
- Texas Organization of Nurse Executives, North Texas Chapter, 2013-present
- People Helping People – renovating homes for the underprivileged
- Meals on Wheels Ellis County

**LICENSURE/  
CERTIFICATIONS**

- Registered Nurse TX (expires 2018)
- Basic Life Support (BLS)
- Advanced Cardiac Life Support (ACLS)
- ANCC Nurse Executive Advanced Board Certified (2016)

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