2018

Development of a Scholarly Educational Intervention to Improve Inpatient Diabetes Care

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This is to certify that the doctoral study by

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Abstract

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MA, New York University 1996

BSN, Adelphi University, 1988

Capstone Proposal Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

Walden University

March 2018

Abstract

Advanced practice providers (APPs), consisting of nurse practitioners and physician assistants, face many challenges in the provision of evidence-based practice in their management of hospitalized adult patients with diabetes. Some of the barriers faced by APPs at a Northeast acute care facility are poor communication between disciplines, lack of confidence in initiating insulin, limited understanding of the management of insulin and the insulin pump, and insufficient treatment of the hospitalized patient with diabetes that aligns with current clinical guidelines for the management of inpatient hyperglycemia. This quality improvement project focused on the development of an evidence-based theory supported educational intervention to improve APPs' knowledge regarding glycemic management. An interdisciplinary team created the educational intervention using the analyze, design, develop, implement, and evaluate (ADDIE) instructional model. A 10-member expert panel validated the program utilizing both a formative and summative evaluation. The results from the formative evaluation was discussed with the interdisciplinary team, corrections were made, and was returned to the expert panel. Once the changes were made to the satisfaction of the expert panel, the program was then validated and submitted to the institution as a completed project to be used by the institution for APPs. This project addresses social change by increasing awareness in the management of inpatients with diabetes therefore decreasing fragmented care delivered by the APPs which will improve quality of care and patient safety.

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Dedication

I dedicate this project to my mother, Ida, along with my close family and friends who have supported me on this journey.

Acknowledgment

First, praise and thanks to my Almighty Lord and Savior. I would also like to say thank you to my Walden University Instructors: Dr. Marisa Wilson, Dr. Dana Leach, Dr. Allison Terry, and Dr. Mary Tilbury. My colleagues from the Endocrine Service were Dr. Alyson Myers, Patricia Garnica, ANP-BC, CDE, and Ann Marie Hasse, RN, CDE. My nursing colleagues were Dr. Seatybul Lee, DNP, Dr. Marissa Persaud, DNP, Dr. Susan Marks, DNP, and Dr. Judy Pine, Ph.D., ANP-BC, as well as the Director of Advanced Practice Providers Marie Giraldo, DNP, and supervisors Peggy McCormack ANP-BC and Dr. Devinand Lackraj, DNP.

Special thanks and praise to my mother, Ida Hasfal, my sisters Veronica, Tonyal, Josephine, my loving niece Clarissa, nephews Avery and Michael, and dearest friend Dr. Deborah Ann Wright, DNP. If it weren't for all of you, this journey would not have been possible. God Bless.

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Section 1: Nature of the Project

Introduction

Diabetes is a complex chronic condition that has affected 25.8 million people in the U.S. It has been estimated there are 7.0 million people who are undiagnosed with diabetes (Centers for Disease Control and Prevention, 2011). Diabetes is considered an epidemic by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO).

Complications experienced by individuals with diabetes includes renal, peripheral, vascular, ocular, neurological and/or cardiovascular problems. Obesity and sedentary lifestyles have also complicated the management of this chronic disease (CDC, 2013). The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK, 2014) reported that for people aged 20 years or older, 7.6% of non-Hispanic whites, 9% of Asians Americans, 12.8% of Hispanics, 13.2% of non-Hispanic blacks, and 15.9% of American Indians/Alaska Natives have a diagnosis of diabetes.

Diabetes, while increasing in prevalence, also increases mortality and morbidity. The International Diabetes Federation has predicted there will be 380 million new cases by the year 2025 (Al-Qazaz et al., 2010). In the United States and internationally, there is a high incidence of diabetes amongst the lower and middle class as well as underserved and rural areas (Al-Qazaz et al., 2010; Colleran et al., 2012). The American Diabetes Association (ADA) and the CDC in 2010 revealed the number of individuals diagnosed with diabetes has increased from 17.5 million to 22.3 million which has increased the cost to the national U.S. economy from $174 billion to $245 billion.

Hospitals have seen an increase in patients with known and undiagnosed diabetes. Health care providers (HCPs) are faced with the challenge of maintaining tight glycemic control during hospitalization due to a lack of understanding by the providers of the patient's target glucose control with the use of insulin therapy. Poor management of hyperglycemia in the hospitalized patient can lead to increase length of stay and costs, as well as an increase in mortality (Beliard et al., 2015; Cook et al., 2009). Advanced practice providers (APPs) consisting of nurse practitioners and physician assistants at a 900-bed acute care institution have encountered the same challenges in addition to lack of familiarity with the guidelines and recommendations by the ADA and the American Association of Clinical Endocrinologists (ACCE) on inpatient glycemic management and increased adverse events, as well as their comfort in using insulin. It was therefore necessary to develop a scholarly educational intervention for the acute care facility for the APPs to increase their knowledge and comfort levels while decreasing barriers in their management of adult inpatients with diabetes.

Background

In 2010, the ADA published the evidence-based *Standards of Medical Care in Diabetes* to assist health care providers in managing patients with diabetes and those at risk for the disease. Some of the recommendations were to perform hemoglobin A1C (HGB A1C) on all patients admitted to the hospital with diabetes or diagnosed with hyperglycemia if was not documented in the previous 2-3 months of the patients' hospital record. Glycemic control (blood glucose) in the critically and noncritically ill should be maintained between 140 – 180 mg/dl. The ADA also mentioned those patients who are in

the intensive care area (the critically ill) requires insulin therapy. It was also recognized in the 2010 ADA Standard of Medical Care the importance of those patients diagnosed with hyperglycemia in the hospital requires appropriate outpatient follow that need to be documented in the patient's discharge records.

In 2016, the ADA published an updated version of the *Standards of Medical Care in Diabetes* for health care providers (ADA, 2016). Some of the changes from 2010 to 2016 was performing HGB A1C on patients with diabetes or admitted with hyperglycemia should be performed every 3 months instead of every 2-3 months if it was not documented in the patient's previous hospital records. Stringent blood glucose has been adjusted from 140-180 mg/dl to 110-140 mg/dl. The recommendation for basal-bolus insulin regimen in the noncritically ill patient with diabetes secondary to the person's illness or infection. A review of hospitals policies on the treatment for hypoglycemia when blood glucose is less than 70 mg/dl; and the importance of transition of care of all inpatients with diabetes and those diagnosed with hyperglycemia from the inpatient to the outpatient setting. Despite the publication of the guidelines, the ADA realized the quality of care provided to the inpatient with diabetes continues to fall short of meeting the standards.

Problem Statement

During my practicum as a DNP student in the Department of Endocrinology, the Endocrinologist, the Diabetes Nurse Practitioner, and myself acknowledged the APPs were lacking knowledge on managing glycemic control of adult inpatients with diabetes. Some of the challenges faced by the APPs at the acute care facility and also supported by the literature review, the practitioners experienced difficulties in managing medical

complexities of diabetes; poor communications between disciplines (physicians, consultants, and the APPs); knowledge of the definition of hyperglycemia with target control; along with the familiarity of the guidelines and recommendations per the ADA/ACCE (Clement, 2016). Managing insulin (including the use of the insulin pump) prior to meals and/or diagnostic tests was not only a challenge to the APPs but also to other HCPs (Mogghisi et al., 2009). In addition to the challenges faced by the APPs the knowledge gap of the providers included delay initiating insulin therapy due to lack of familiarity with the types of insulins and their mechanisms of actions; accurately adjusting insulin with other medications affecting hyperglycemia (i.e. glucosteroids or octreotide); managing blood sugars secondary to changes in a patient's nutritional requirements; and the use of basal-bolus insulin therapy.

There had been an increase in the number of patients with Type 2 diabetes admitted to the institution with insulin pumps. On average, 25 to 30 patients with insulin pumps were admitted monthly to the institution. There are many companies that manufacture insulin pumps. However, while conducting the needs assessment for this project, it was discovered by the Endocrinologist, the Diabetes Nurse Practitioner and myself that the institution's policy on insulin pumps was outdated and there were no guidelines for HCPs when presented with patients on insulin pumps.

There were a significant number of adverse occurrences involving the APPs related to poor management of glycemic events. I had an opportunity to interview the Risk Manager on what were the most common occurrences seen at the hospital by the APPs in their management of patients with diabetes. The most common occurrences were delays

in initiating insulin therapy; withholding Lantus prior to a procedure and/or the operating room; inappropriate dosing of insulin while patients were receiving steroids; and inappropriate administration of basal insulin.

Coordination of tests also presented a challenge for APPs and inpatients with diabetes. The patient with diabetes may need to remain NPO (nothing by mouth) for an extended period due to unknown timing of diagnostic tests or procedures in the operating room. This had led to adverse hyper- or hypoglycemic events. These occurrences were examples of the lack of awareness by the HCPs of the ever-changing evidence-based and fragmented delivery of care affecting the practice behaviors jeopardizing inpatient diabetes management especially with the use of insulin therapy (ADA, 2010; Draznin et al., 2013).

Purpose

The purpose of this project was to develop a validated educational program and a knowledge assessment tool for an acute care facility in the Northeast for APPs who manage inpatients with diabetes. As shown in the literature review, inpatient educational programs have shown to be effective at improving the knowledge of HCPs managing inpatients with diabetes (Desmoine, 2012). A diabetes educational workshop series was created to focus

on inpatient glycemic control included the use of insulin pumps, reinforcement of self-management education, and familiarity with ADA/ACCE guidelines and algorithms was developed for the APPs. This educational intervention addressed the challenges and the knowledge gap faced by the APPs. Education provided will increase knowledge which will improve quality of care and patient safety and decrease the number of glycemic events.

Project Goals and Objectives

The question addressed was: Will an evidence-based theory supported educational intervention improve APPs' knowledge regarding glycemic management, including the use of insulin pumps and insulin therapy, among adult inpatients with diabetes? The goal of the QI project was to develop an evidence-based educational program for the institution utilizing the ADDIE instructional model. ADDIE is an acronym of **A**nalyze, **D**esign, **D**evelop, **I**mplement and **E**valuate. This model has been utilized by the U.S armed forces in the 1970's to develop quality improvement projects in a systematic manner.

The first objective was to create an educational intervention involving six workshops focused on glycemic management including the use of insulin therapy in hospitalized adult patients with diabetes. Five of the six workshops incorporated inpatient glycemic management and emergencies as well as inpatient insulin management. Two workshops discussed types of insulin, pharmokinetics, and management of preoperative patients receiving insulin therapy.

The second objective was to create a sixth workshop dedicated to the management of the insulin pump. The insulin pump workshop is a hand on clinical experience. The APPs will be provided information about the most commonly seen insulin pumps presented to the institution. A return demonstration by the APP to the faculty facilitating the workshop will include obtaining information from insulin device such as the basal rate, the insulin type, the insulin to carb ratio, the insulin sensitivity factor and the blood glucose target. This will ensure their competency with working with the device.

The third objective was to develop and validate a pre/post-test questionnaire for the institution, known as the APPs inpatient diabetes management questionnaire. A modified version of the Mayo Clinic Inpatient Diabetes Survey was used as a blueprint to develop the pre/post-test questionnaire. The interdisciplinary team consisted of the Endocrinologist, the Diabetes NP, the Nurse Practitioner (NP) Supervisor, the diabetes educator, 3 NPs and 3 PAs from the medical and surgical services, as well as myself as a DNP student. The Expert panel consisted of 2 certified Endocrinologist, 5 graduated DNPs, 2 Registered Nurses who were diabetes champions for the institution and 1 PA who was an expert in diabetes management. The interdisciplinary team created the inpatient diabetes questionnaire. The Expert panel completed the formative and summative evaluation to validate the questionnaire which will measure the APPs knowledge in their management of the inpatient with diabetes. The validated pre/post-test questionnaire will be given to the APPs by the institution before and after the completion of six educational workshops.

Significance to Practice

In the 1990's, there has been an increased attention on inpatient glycemic management (Draznin et al., 2013). In 2005, the ADA had conducted a study to assess the management of inpatient care to patient with diabetes by the HCPs. In 2006, the ADA and AACE joined forces to address the inconsistent care provided by HCPs. The ADA (2010) reported that HCPs have been delivering suboptimal care according to guidelines and algorithms. Despite the recommendations from the ADA, AACE, and other reputable medical associations, management of inpatient glycemic events continue to be a concern.

HCPs continue to experience difficulties in managing inpatient glycemic events. A review of literature has indicated that HCPs has expressed a lack of knowledge with insulin therapy and the insulin pump, and barriers as stated earlier have led to fragmented delivery of care for hospitalized adult patients with diabetes (Cook et al., 2007; Cook et al., 2008). The increase in hospitalized patients with known or newly diagnosed diabetes has been associated with increases in length of stay, negative patient outcomes, and increases in mortality (Cook et al., 2008; Cook et al., 2009).

APPs provide direct care that impacts the outcomes of inpatients with diabetes. Development of a diabetes educational program for APPs focused on inpatient management from admission to discharge. Education provided will increase their knowledge about insulin therapy and glycemic management while decreasing fragmented care delivered. It was presumed the educational program will also lead to revisions of the acute care facility's policy and procedures reflecting the ADA and AACE's guidelines and recommendations.

Implication for Social Change

The educational program will increase the APPs knowledge in managing the hospitalized patient with diabetes with the uses of insulin therapy while decreasing the fragmented care presently being delivered. The role of the Doctorate of Nursing Practice (DNP) involved in quality improvement is to apply knowledge to a solution also known as scholarship of nursing practice (Terry, 2015). My role as a DNP student was to formulate and work with an interdisciplinary team) within the acute care facility to develop an educational intervention addressing glycemic management of inpatients with diabetes.

The interdisciplinary team included the Endocrinologist, the Diabetes Nurse Practitioner, the Diabetes Educator, the Nurse Practitioner Supervisor, six Nurse Practitioners and Physician Assistants from the Medicine and Surgical service within the institution. The interdisciplinary team developed the diabetes educational workshop along with the pre and post-test questionnaire to assess APPs' knowledge regarding glycemic management for the acute care institution. I developed an evaluation tool checklist utilizing the ADDIE model to critique the pre/post-test questionnaire, and educational program for the interdisciplinary team. I also developed the formative and summative evaluation utilized by the expert panel to validate the questionnaire and educational program. The expert panel was comprised of two board certified Endocrinologists, two Registered Nurses (RNs) who are part of the Diabetes Champion Team, five DNP practitioners from the medical staff, and one Physician Assistant who has a strong background in diabetes management. The Diabetes Champions at the institution are registered nurses educated by the Department of Endocrinology to be experts in diabetes education for the inpatients and as a diabetes resource for their fellow nurses.

Glycemic management has become a complex task for HCPs to achieve with patients hospitalized with diabetes or hyperglycemia. Aggressive education is needed to understand how inpatient diabetes education can be optimized to ensure quality of care and patient safety for hospitalized patients with diabetes. The link between education and adverse glycemic events will ensure accountability for the care rendered to the inpatient population with diabetes from APPs.

Definitions of Terms

Terminology used throughout this project include:

Advanced practice providers (APPs): APPs, also known as mid-level providers, are nurse practitioners and physician assistants delivering care to patients in an inpatient setting traditionally performed by the physician (Gershengorn, Johnson, & Factor, 2012). APPs provide care to patients in the Department of Medicine and Surgery.

Glycemic Control: Blood glucose between 140 – 180 mg/dl with an effort to prevent uncontrolled hyperglycemia (ADA, 2010). Tightening glycemic control will reduce or prevent further microvascular complications in patients with Type 1 or Type 2 diabetes. Blood glucose too tightly controlled will lead to hypoglycemic events.

Glycemic Events: Also known as adverse glycemic events, these are unintentional medical errors occurring in the hospitalized patient with diabetes. The Institute of Medicine (IOM, 1999) defined medical errors as a failure of an unplanned action that has been deviated from its original aim. Medical errors have been associated with loss of income, decreased productivity, increase in length of stay (LOS), and readmissions associated with physical and psychological disabilities.

Hyperglycemia: Elevated blood glucose which occurs when the body secretes minimal insulin or is unable to use insulin appropriately (ADA, 2014). Hyperglycemia can occur in Type 1 or Type 2 diabetes, stress related illness, or with medications such as steroids, octreotides, diuretics, and antivirals. According to the ADA (2017), hyperglycemia means blood sugars greater than 140 mg/dl. Both critical and non-critically

ill patients in the hospital are to have moderately controlled blood sugars ranging from 140-180 mg/dl once they are receiving insulin therapy.

Hypoglycemia: Serum glucose less than 70 mg/dl. It can occur in hospitalized patients while the HCP are attempting to maintain tight glycemic control (ADA, 2015; ADA, 2017).

Insulin: A medication that mimics the hormone produced by the pancreas. It is extracted from animals (beef or pork), recombinant, or genetically engineered. It is used in the treatment of Type 1 or Type 2 diabetes. The Institute for Safe Medication (ISMP), The Institute for Health Improvement (IHI), and The Joint Commission (TJC) consider insulin one of the top five high risk medications (ISMP, 2015). If used incorrectly, it can cause harm to the individual.

Assumptions and Limitations

The diabetes educational program provided a series of evidence-based topics that included the management of inpatient diabetes and insulin therapy as well as the insulin pump. There were three objectives for the educational program. The first objective was to create a series of evidence-based workshops for the institution focused on glycemic management including the use of insulin therapy. The second objective was to create an insulin pump workshop for the institution for the APPs to manage those patients admitted with an insulin pump. The last objective was to develop and validate a pre/post-test questionnaire to assess the knowledge of the APPs in their management of the hospitalized patient with diabetes.

The assumptions of educational intervention by the Interdisciplinary Team were to increase knowledge and comfort levels while decreasing barriers in the APPs' management of hospitalized patients with diabetes. The literature review as well as the ADA and ACCE indicated that lack of knowledge of insulin therapy and glycemic managment, perceptions by the HCP, and barriers to care has led to fragmented care. Education is the key to changing perceptions and comfort levels of APPs in their management of hospitalized adult patients with diabetes.

A limitation of this project was versatility. This project was developed specifically for the organization located in the Northeast. The problems and concerns specific to this organization may not be applicable to another organization.

Summary

Education provided to the APPs will increase their knowledge, bring empowerment, and provide comfort for the providers in their management of a chronic complex condition (diabetes) during inpatient hospitalization (Colleran et al., 2012). Glycemic control has become a complex task for HCPs to achieve in caring for inpatients with diabetes. Because of their varied knowledge and perceptions and barriers faced by APPs, they are challenged in the quality of care provided to the adult inpatient with diabetes.

This quality improvement project developed a validated educational program and knowledge assessment tool for the APPs employed at an acute care facility in the Northeast who manage adult inpatient with diabetes. The evidence-based educational intervention emphasized the ADA's *Standard in Medical Care in Diabetes* and the AACE/ADA's

Consensus Statement on Inpatient Glycemic Control to highlight the importance of the institution's compliance in managing hyper/hypoglycemia during the inpatient with diabetes' hospitalization. This quality initiative program will increase awareness and change the APPs' perceptions in their management of inpatient glycemic control of this complex patient population.

Section 1 presented an overview of the purpose of the QI project to develop a scholarly educational diabetes program and a pre/post-test questionnaire for APPs that was validated by an expert panel in the field of diabetes. An interdisciplinary team was formulated to create the educational program. A formative and summative evaluation was completed by the expert panel. This QI project utilized the ADDIE Model to approach this educational intervention in a systematic manner. Section 2 will discuss the scholarly review of literature which supported the project as well as the methodology and theoretical framework utilized.

Section 2: Review of Literature and Theoretical and Conceptual Framework

Introduction

This QI project was to develop a scholarly evidence-based and validated educational intervention for the acute care facility to address the knowledge deficit of the APPs in their management of adult inpatients with diabetes. The anticipated goal of the QI project was to increase the knowledge of the APPs in their management of this complex population. A scholarly literature review was used to obtain evidence-based research to develop an educational program to support APPs' knowledge regarding inpatient glycemic management with the use of insulin therapy. The research also supported options for the providers in addressing the complexities of diabetes seen during hospitalization.

Literature Search Strategies

The literature search was conducted from the following databases: CINAHL, PubMed, ProQuest, Cochrane Library, Google Scholar, and Medline. A total of 100 journal /articles were reviewed for this study, but only 34 were selected for the relevance of this topic. The literature inclusion criteria used journal articles focused only on inpatient hyperglycemia management including the use of insulin. The exclusion criteria for articles not selected for this project included outpatient hyperglycemic management, hyperglycemia related to pregnancies, and the use of hypoglycemic oral agents. Terminology used in the search engine were: *nurse practitioners*, *mid-level providers*, *physicians*, *medical residents*, *registered nurses*, *nurses*, *knowledge deficit*, *diabetes*, *inpatient hyperglycemia*, *inpatient diabetes*, *cost of diabetes*, *diabetes education*, *economy and diabetes*, *U.S and diabetes* and *readmission and diabetes.*

Scholarly Evidence

Insulin therapy and inpatient management of diabetes remain a challenge for health care providers. Their misconceptions and comfort initiating insulin therapy may originate in part from a lack of diabetes awareness, and/or a comprehensive impact of the progressive nature of the disease. Insulin-related knowledge deficits amongst health care providers extend beyond the U.S. into Europe and South America (Seng-Lee et al., 2013). Cheekati et al. (2009) identified that inpatient hospital management of diabetes can be complex and chaotic. Seng-Lee et al. (2013) conducted a study in a Singapore hospital with physicians, nurses, and pharmacists to assess differences in insulin-related knowledge among the different professionals. They found physicians gave suboptimal diabetes care secondary to their lack of knowledge. Out of the 375-questionnaire completed, 138 physicians, 209 registered nurses (RNs), and 28 inpatient pharmacists' comfort levels and knowledge were analyzed. Physicians scored poorly with regards to new insulin analog; those with more than 11 years of experience scored low on knowledge of insulin. Physicians did score better than nurses on questions related to characteristics, while nurses scored better on insulin preparation and administration.

The 1999 IOM report *To Err is Human* has enlightened the public, the government, and healthcare industries of errors that have occurred in critical and noncritical units. The report has also alerted the government and public of medical errors resulting in the hospital setting which has led to a rise in medical costs resulting from avoidable errors committed by HCPs. This has led to increased length of hospital stays, increased morbidity and morbidity. The report has called for changes to occur in health care facilities to protect

patients from medical errors. Reporting of sentinel events to the Joint Commission (TJC) and the National Safety Institute (NSI) ensures safe practice is provided to all patients at every delivery level of care (IOM, 1999; TJC, 2016). Insulin is one of four medications that caused the most adverse events for seniors in the U.S. along with warfarin, oral antiplatelet, and oral hypoglycemic agents (Seng-Lee et al., 2013).

In 2004, the ADA and the AACE realized aggressive treatment of inpatient hyperglycemia will produce positive hospital outcomes (Beliard et al., 2015; Cook et al., 2008; Moghissi et al., 2009). They have provided health care professionals evidence on glycemic control for inpatients with hyperglycemia; glycemic target recommendations for various patient populations; safety with medications and treatment of hypo/hyperglycemia; and transition of care from the inpatient to the outpatient setting. The ADA and ACCE have also included in their 2009 report the importance of organizational involvement, cost control and future research topics as it relates to inpatient diabetes management (Moghissi et al., 2009).

Umpierrez and Dungan (2015) reported on recommendations from the ADA to best manage the adult inpatient with diabetes to avoid glycemic events. Practitioners were encouraged to avoid glucose levels greater than 180-240 mg/dl. In 2010, the recommended for HCPs to maintain inpatient blood glucose in the ICU (the critically ill) between 140 and180 mg/dl. In the non-ICU setting, blood glucose goals were to be less than 140mg/dl pre-meals and less than 180 mg/dl for random glucose.

Despite efforts from the ADA, the ACCE as well as other reputable medical agencies in establishing guidelines and statements on inpatient glycemic control, there

remains resistance from healthcare providers and institutions. Providers, many of whom are not familiar with the current guidelines and algorithms, have shown a delay in early initiation of insulin. Health care providers, including the APPs at the acute care facility, continued to show deficiencies in their knowledge of insulin use. Delaying the use of insulin has been reported as a common practice amongst providers (Hu et al., 2012; Seng-Lee et al., 2013).

In addition to the knowledge gap that exists between the patient and the providers, the HCPs are not reaching out to the patient to offer diabetes education nor supportive resources (Akohoe et al, 2015). Bhargava et al. (2014) mentioned physicians may partially be responsible for the lack of education about physical activities, diet consumption and medication management secondary to their comfort. The physicians' knowledge deficiency and the individual's low awareness accounts for 70% non-adherence to medications, decreased trust in the practitioner, and increased non-compliance with diet indicates a "necessity to improve physicians' education and patient involvement" (Bhargava, et.al. 2014). Lack of awareness and familiarity of existing guidelines are the leading cause of deviation from therapy (Furthauer, Flamm, & Sonnichesen, 2013).

Beliard et al. (2015) has shown physicians and nurses still struggle with management of pre-prandial glucose targets, optimal inpatient medication regimens, and the use of the insulin scale in the treatment of hyperglycemia. Coordination of meals, diagnostic tests, and procedures, along with lack of standardization of basal-bolus insulin protocols are systems problems that many institutions find difficult to find a resolution. Cheekati et al. (2009) surveyed medical residents regarding their attitudes, their knowledge

and their comfort with insulin therapy. They concluded that the lack of knowledge about appropriate insulin regimen and its use was the most commonly reported barrier to managing inpatient diabetes.

Desmoine et al. (2012) separated 22 medical residents into two groups: Those who received inpatient diabetes education and those who did not receive the educational program. The result of the study supported the positive effect of inpatient educational programs being effective at improving the knowledge of the residents in managing patients on steroids and hyperglycemia episodes. Shahla et al. (2016) was interested in measuring the knowledge of HCPs in their management of inpatients with Type 2 diabetes amongst physicians and medical students from different subspecialties. The authors developed a survey using the questions from a Johns Hopkins survey to measure the HCP knowledge on the management of the hospitalized patient with Type 2 diabetes. The content of the survey was validated, but the questionnaire was not statistically validated. However, because of the survey, it did support the importance of education to increase the knowledge of fellow HCPs. The study also supported the importance of a "team approach to improve patient outcomes" (Shahla et al., 2016, p. 3).

Studies on knowledge gap of inpatient glycemic management have been conducted from a physician, medical resident and nurses' perspective. Recently there have been articles written on perception and barriers of inpatient diabetes control from the pharmacist and the dietician. However, there is still limited information about the APPs perceptions and barriers to inpatient diabetes glycemic management (Beliard et al., 2015; Draznin et al., 2013; Cheekati et al., 2009; Derr et al., 2007; Cook et al, 2007)

Advanced Practice Providers

APPs consisting of nurse practitioner and physician assistants are sometimes referred to as midlevel providers, physician extenders, or non-physician clinicians. They are both utilized by institutions as an alternate strategy of care delivery to meet the patient care demands (Gershengorn, Johnson, & Factor, 2012). The APPs work in both critical and noncritical areas of the hospital in the department of medicine and surgery.

The APPs at the acute care facility spends a significant amount of time at the patient bedside in the absence of the physician who are either at their office, the operating room, or caring for patients in other areas of the hospital. Hospitals and physicians utilize them to supplement the demands of the hospitalized patients. Although the APPs provide care in various departments, their education and training vary.

Nurse Practitioners (NPs) are registered nurses with a master's degrees providing primary and specialty care. The American Association of Colleges of Nursing (AACN) in 2004 has endorsed the Position Statement on the Practicing Doctorate identifying the DNP as the recommended degree for the advanced practice registered nurse (Gershengorn et. al., 2008; Zaccagnini & White, 2011). There are 151,400 NPs employed in the U.S. The Department of Labor predicts from 2012-2022 there will be a 31% (47,600) increase in employment of the NPs. The NPs scope of practice varies from state to state. They are licensed by their state and are required to have pass a national certification examination.

The Physician Assistants (PAs) provides patient care under the supervision of a physician and surgeon. The PAs follow a medical model. Their education involves both classroom and clinical rotation over a period of 26 months. Their program provides a

bachelor's degree leading to a master's degree. There are 86,700 PAs employed in the U.S. The Department of Labor also predicts a 38% (33,300) increase in employment from 2012-2022. They must pass the Physician Assistant National Certifying Examination. As of 2014, recertification by exam every 10 years.

Although both APPs education and training may differ, they both have shown a lack of comfort as well as knowledge in adjusting insulin of the inpatient with diabetes The APPs are faced with the challenge of time spent with their patients secondary to their workload and responsibilities. Their face-to-face time with their patients is usually brief with an "episodic" window of engagement. (Hu et al., 2012).

The APPs are in a unique position that can be instrumental in coaching and educating the patient with skills and knowledge necessary to manage their diabetes successfully. Awareness of insulin therapy and understanding the complexities of this disease will assist the APPs in providing the information needed to manage inpatient glycemic control. It is important to develop a trusting relationship between the APPs and their patients. This will foster patient centeredness, patient safety and improved patient outcomes. A knowledgeable provider will be confident with the information they will provide to their patients. The APPs will be motivated to incorporate the information learned to their practice (Curran, 2014; McEwen & Wills, 2014).

Challenges faced by the Advanced Practice Providers

During my practicum and research for the QI project I acknowledged some of the challenges faced by the APPs at the acute care facility. A few of the challenges faced by the APPs were their perceived knowledge and comfort in their management of glycemic

control and complexities of this chronic disease. Beliard et al. (2015) summarized the top five barriers related to optimal care by physicians are prolonged NPO status; lack of educational reinforcement to the patient; unpredictable timing of patient procedures; lack of coordination between meals delivery and insulin delivery; and the lack of standardized basal-bolus insulin protocols. Additional barriers documented in the literature and experienced in the acute care setting was dealing with uncontrolled hyperglycemia, the patient's noncompliance with medications, cormorbities and complications of illness and/or infections encountered that has led to an adverse glycemic event, lack of familiarity with the insulin pumps, and restrictions required prior to a test or procedure (Draznin et al., 2013; Cheekati et al., 2009; Moghissi et al., 2009). Comfort with inpatient glycemic management is a concern amongst health care providers including APPs. Adjusting insulin affected by nutritional changes, medication used during hospitalization, or complications associated with the illness or infections presents a challenge to the APPs (Derr et al., 2007; Cook et al., 2007; Cook et al., 2008; Cheekati et al., 2009; Beliard et al., 2015). Cheekati et al. (2009) administered a survey to resident physicians and discovered that 40% reported feeling comfortable treating

glycemic events, but more than 50% were uncomfortable treating these events. Cook (2007) discovered many healthcare professionals are least comfortable with insulin infusions.

The increase in the number of insulin pumps presented to the hospital has presented a problem for the APPs. Over the past two years, there has been an average of 25-30 patients admitted monthly with insulin pumps to the hospital. The number of insulin pumps

continues to increase. The providers were unfamiliar with restrictions of the pumps for a diagnostic procedure and management during inpatient hospitalization (Endocrinologist. Personal Interview, July 2015).

Discharge from the acute care setting also presented a problem. APPs were perplexed in the transition of patient from the inpatient to the outpatient setting. The practitioners were unfamiliar with the cost of hypoglycemic medications, home care service available, and support at home for the patient with diabetes. This was concern for the APPs in order to prevent readmission of the patient to the hospital.

Glycemic Management by the Advanced Practice Providers

There was an increase in the number of adverse events involving the APPs related to diabetes occurring at the acute care facility over the past two years. Many of the occurrences reported were related to poor glycemic management (Risk Management. Personal Interview, July 2015). As stated earlier, there had been a surge in the number of patients admitted with insulin pumps. Several of the APPs were not familiar with insulin pumps or the restrictions of removing the pump prior to a radiologic test. It was discovered during my research, the hospital's policies and protocols did not reflect the guidelines for the type of pumps presented to the institution. Delays were seen in starting insulin therapy on the hospitalized patients especially to those receiving steroids.

Some of the adverse events that were reported from the Risk Manager were withholding Lantus when a patient was NPO for a procedure or for the operating room. APPs from various services held rapid acting insulin prior to meals when the blood sugar was within the normal range despite the person consuming 80% of their meals. Another

common adverse event were APPs working in high risk areas did not adjust insulin appropriately while their patients were receiving steroids oral or intravenous. Since the increase in the number of insulin pumps presented to the institution, the pumps were discontinued during admission without any written insulin orders.

The Diabetes Coordinator had developed a diabetes questionnaire which was administered to the APPs at the acute care facility. A total of 107 APPs responded to the survey. Sixty-nine of the APPs who responded indicated their comfort with diabetes was between neutral to somewhat uncomfortable. Less than 55% of the respondents were comfortable in prescribing insulin. The providers who participated in the survey reported their last training or CME module in diabetes was within the past year (24%); 23% in the last 1-2 years; and 37% in the last 3 years. The information obtained from the survey supported the need to develop an educational intervention focused on inpatient glycemic management at the facility.

Readmission and Diabetes

Diabetes with complications in one of the top 10 conditions with the most 30-day readmissions involving Medicaid patients (Hines et al., 2011). In 2011, there has been approximately 23,700 patients readmitted to the hospitals in the U.S. This accounts for 3.5% of the Medicaid population. The cost of 30 day all cause readmission of patients with diabetes in the U.S. economy is $251 million. It is therefore imperative for health care providers, including the APPs to properly manage the inpatient with diabetes efficiently and discharge safely to decrease the incidences of readmissions to the hospital.

ADDIE Instructional Design Model

ADDIE is an acronym used to describe the systematic approach of the Instructional System Design Model (ISD). The ISD Model has been used by the United States armed forces since the mid-1970's developing regulations and course curriculums for the military (Holden, 2015).

The acronyms of **A**nalyze, **D**esign, **D**evelop, **I**mplement and **E**valuate is an approach that has been utilized for program's development for QI projects (Figure 1). For this project, an evidenced based educational program and questionnaire was analyzed, designed and developed for the organization to later implement for the APPs. A formative evaluation was utilized during the development of this project.

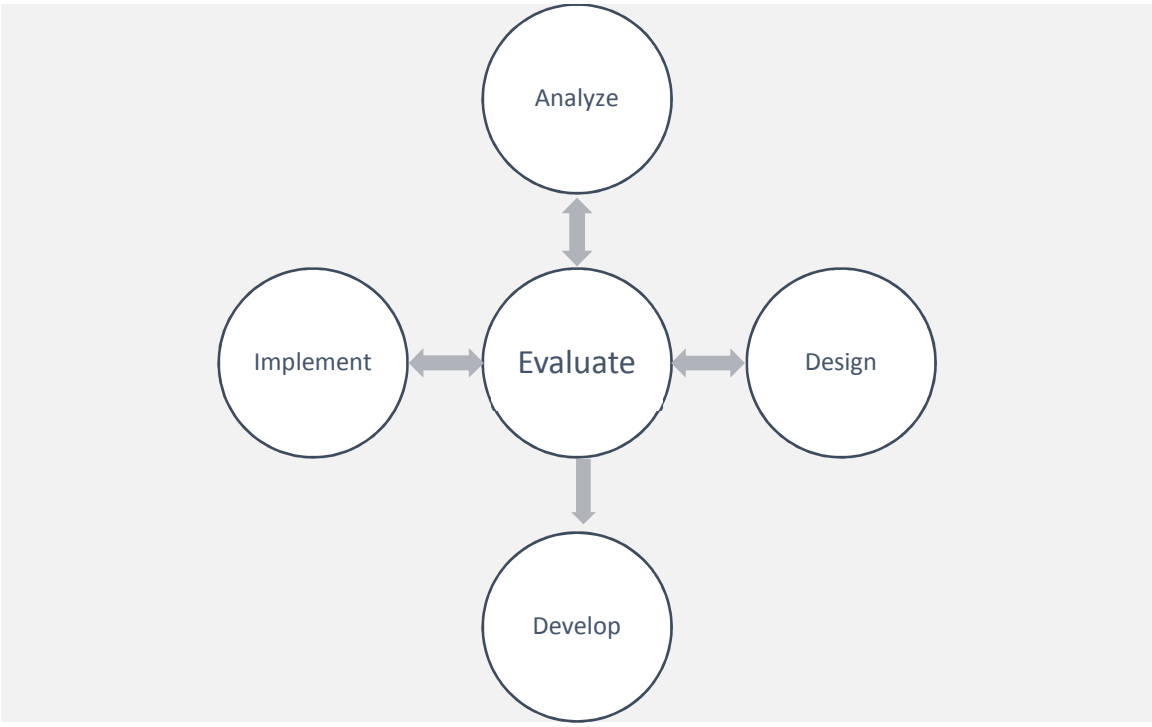

Figure 1. ADDIE model.

Mayo Clinic Diabetes Inpatient Attitude Survey

The Mayo Clinic Inpatient Diabetes Attitude Survey is a tool that assessed the

perceptions, attitudes, and comfort levels of the physician residents and midlevel providers in their management of the hospitalized patient with diabetes. This survey has been utilized and published in 3 research studies: Cook et al, 2007; Cook et al., 2008; and Cheekati et al., 2009.

The original version of the tool assessed the physician residents' perception regarding their attitudes towards the inpatient with diabetes in glycemic management, optimizing glucose control and barriers to treatment of hypo/hyperglycemic events. The second version which was utilized by Cheekati et al. (2009), was utilized as a blueprint in this proposed Capstone Project, which included questions about intravenous insulin as well as the insulin pump. The questions from this survey was divided into 5 categories: importance of the treatment of hyperglycemia; comfort level; familiarity of the treatment of glycemic events and utilization of insulin therapy; glucose goals and initiating IV insulin therapy (Cheekati et al., 2009).

Although the Mayo Clinic Inpatient Diabetes Attitude Survey has been utilized and/or referenced by other authors, the polymetrics was never validated. Therefore, this survey was utilized as a blueprint for the "Advanced Practice Inpatient Diabetes Questionnaire". The interdisciplinary team created a series of questions for the APPs questionnaire. The questionnaire was then validated by the expert panel. The survey will be utilized to assess the APPs knowledge on the education provided, awareness of organizational policy change as it relates to inpatient glycemic management and their comfort with the use of insulin therapy.

Theoretical Framework

In the creation of the QI diabetes educational series for the APP, I incorporated the theoretical framework of Knowles Adult Learning and Kurt Lewin's Force Field Analysis. Two goals were achieved. The first goal was to increase the APPs knowledge in managing the complexities of the inpatient with diabetes. The second goal was to bring awareness of the changes related to insulin therapy and the insulin pump.

Knowles' Adult Learning

Malcolm Knowles was an American educator who was well known for the use of the term andragogy otherwise referred to as adult learning. He believed in creating a positive environment conducive to learning that would provide open communication amongst adults, respective of their knowledge and differences as an adult learner. Knowles identified six assumptions to adult learning: need to know, self-concept, experience, readiness to learn, orientation and motivation (McEwen &Wills, 2014). Self-concept and motivation was incorporated into the model which narrowed his assumptions to four (Figure. 2). The four principles of adult learning are: involvement, experience, relevance and impact to the learner's lives, and problem-centered (Kearney, 2010).

Involvement incorporates the adult learner to be intricate with the learning and the planning of the program. The APP will receive answers as to why there is a need to learn something new especially on a need to know basis. Their experience will not be disregarded but respected. The adverse events and real-life situations will be shared with the group. Once the APP acknowledge the relevance and how it impacts their practice, the

provider will be more motivated to "solve immediate and practical problems" by applying their knowledge immediately (McEwen & Wills, 2013).

Kurt Lewin's Force Field Analysis

Kurt Lewin was a German psychologist who proposed a method of planned change (McEwen & Wills, 2013, p. 370). Lewin's Force Field Analysis (Theory of Change) views change as "a dynamic balance of forces driving and restraining" working in opposites directions within an organization or field. His "Force Field Analysis" when incorporated correctly can moves the individual, a group or an organization towards change.

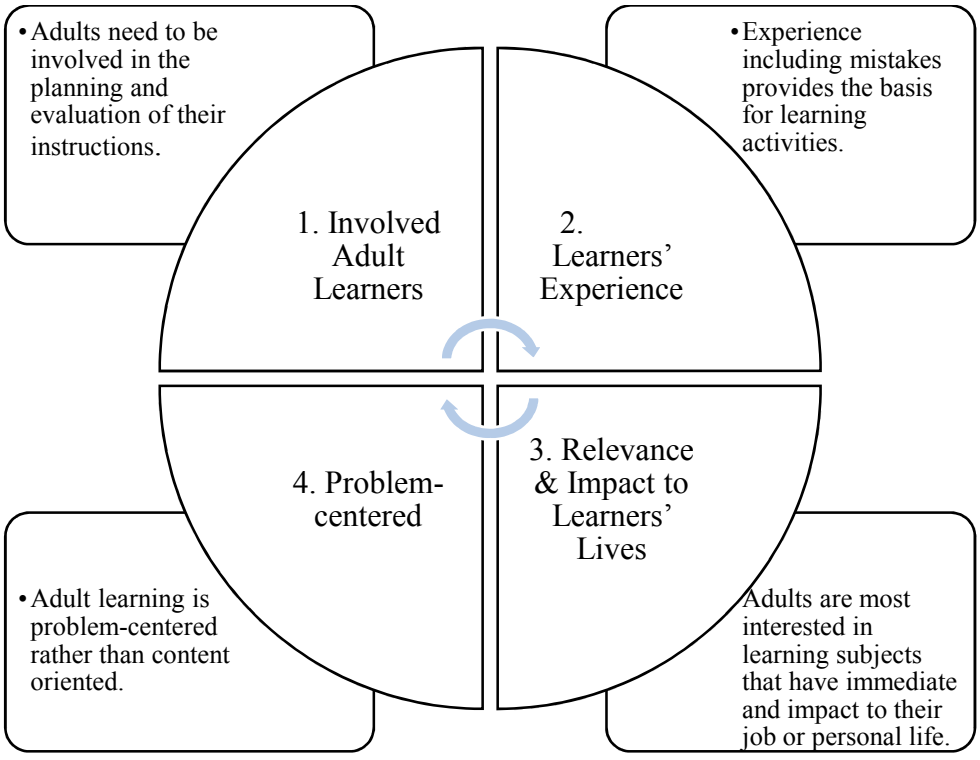

Figure. 2 Knowles 4 Principles of Andragogy

The Theory of Change is divided into three phases: unfreeze, moving or changing, and refreezing (White & Dudley-Brown, 2012; McEwen & Wills, 2013). The first phase

of *unfreezing* the current situation is accomplished by "increasing the driving force or decreasing the restraining force towards change" (White & Dudley-Brown, 2012, p. 51). The APP will be able to identify the issues related to the care provided to the adult inpatient with diabetes. They will be alerted of the adverse events occurring around patients with diabetes within the institution. Education will be a major component in the first phase of change.

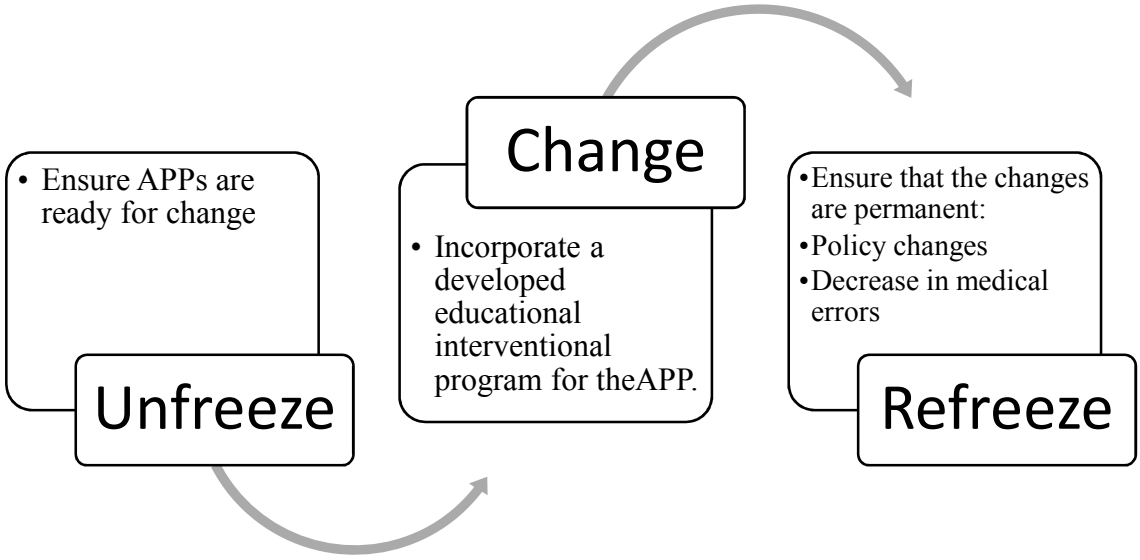

Figure. 3 Lewin's Force Field Analysis

The second phase of Lewin's change model is *moving or change*. Moving involve the APP towards a "new equilibrium of driving and restraining forces." This phase incorporated Knowles Adult Learning principle of immediate application of knowledge into practice. During this phase, the APPs will become aware of the necessary changes set forth by the ADA and the ACCE in their management of the hospitalized patient with

diabetes. As a result of the intervention, the APP will become more knowledgeable on insulin therapy and the insulin pump; bring awareness on the need for medical practice change; and increase awareness in managing and preventing glycemic event in the hospitalized patient with diabetes.

The last phase of Lewin's change model is *refreezing*. Refreezing occurs after change has been implemented. The goal is to sustain the change and become the new norm for the group or the organization. If stabilization is successful, change will be assimilated in the system (McEwen & Wills, 2013, p. 373). The hospitals policy on inpatient hyperglycemic management will reflect the change in practice. The organization will continue to decrease adverse events therefore increasing patient safety.

Summary

Inpatient glycemic control is a challenge for HCPs as well as the APPs at the acute care facility. Poor glycemic management has led to adverse events occurring within the institution along with a deficiency in their knowledge of insulin therapy. The APPs perceived knowledge and level of comfort in managing the inpatients with diabetes presents a concern for the quality of care delivered.

ADDIE ISD Model was the systematic approached utilized in the creation of the diabetes educational intervention. Knowles' Adult Learning and Lewin's Force Field Analysis was the conceptual framework incorporated into the QI project. The educational intervention was developed for the institution to provide the APPs with the necessary information needed to manage inpatient glycemic control and the complexities of the adult inpatient population with diabetes. Section 2 discussed the scholarly literature review

supporting the needs for the QI project. Section 3 will outline the development of the scholarly evidence-based educational workshops and the APP Inpatient Diabetes Questionnaire.

Section 3: Methodology

Introduction

The diabetes educational program was the development of six evidence-based educational workshops as well as the creation of the APP Inpatient Diabetes Questionnaire. The educational intervention was developed for a hospital in the Northeast. The educational intervention and the questionnaire were created by the interdisciplinary team and validated by an expert panel. The question to be addressed was: Will an evidence-based theory supported educational intervention improve APPs' knowledge regarding glycemic management, including the use of insulin pumps and insulin therapy, in adult inpatients with diabetes? The goal of the QI project was to develop an evidence-based educational program for the institution for the APPs utilizing the ADDIE instructional model.

This section will outline the development of this diabetes educational program and the APPs Inpatient Diabetes Questionnaire for the APPs, as well as:

1. Utilize the ADDIE ISD model in the analysis, design, and development of this project for the organization.
2. Formulate an interdisciplinary team to develop an evidence-based program
3. Review the results of the needs assessment for the diabetes educational program with the interdisciplinary team
4. Use the Gantt chart to develop a timeline for the development of the program.

5. Develop the educational program with objectives based on the needs of the APPs and the organization.
6. Develop data collection and a formative and summative evaluation to be utilized by the Expert Panel.
7. Review the hospital's policy on glycemic management as well as the present inpatient diabetes order set with the interdisciplinary team.
8. Develop and implement a formative evaluation throughout the developmental process.

It was necessary to develop a scholarly evidence-based program that will bridge the gap in knowledge and attempt to repair a fragmented delivery of care system.

#	Task	Assigned To	Start	End	Dur
	Development of a Scholarly Educational Intervention to Improve Inpatient Diabetes Care: Winter 2017		6/7/15	3/1/18	713
1	Project Plan		6/7/15	3/1/18	713
2	IRB Approval		5/25/17	7/20/17	40
3	Development of an evidenced based educational workshops		3/1/16	10/25/17	431
4	Development of the APP Inpatient Questionnaire		9/18/16	10/25/17	287
5	Educational Workshop and APP Questionnaire to be presented to the Expert Panel		10/31/17	11/10/17	8
6	Expert Panel Formative Review		11/10/17	11/17/17	5
7	Interdisciplinary Review and Correction to the Expert Panel		11/20/17	12/4/17	10
8	Expert Panel Summative Review		12/6/17	12/13/17	5
9	Submit Project to Walden		4/15/16	2/11/18	476

Figure 4. Ganett Chart with Project Timeline

Developmental Plan for Educational Workshop

The diabetes educational intervention is a series of six educational workshops for APPs. The educational series will increase the knowledge base of APPs in their

management of inpatients with diabetes. Cheekati et al. (2009) and Cook et al. (2007) acknowledged prior to developing an educational program that it is important for me as a coordinator to be insightful regarding the health care providers' (the APPs) perceptions regarding inpatient glycemic management as well as insulin therapy.

A needs assessment was conducted by the Diabetes Coordinator as mentioned in Section 2. The APPs agreed glycemic control is important; however, many were uncomfortable prescribing as well as adjusting insulin. The five top issues faced by the APPs related to insulin therapy were: knowing the types of insulin and how it works; unpredictable timing of procedures; causes of hypoglycemic events; adjusting insulin and changes in a patient's diet or timing of their meals while they are hospitalized (Cook et al.,2007).

Many of the APPs who completed the questionnaire indicated that their comfort level in managing hospitalized patients with diabetes, especially with insulin pumps, was neutral to somewhat uncomfortable. I also interviewed the Risk Manager to review the adverse events involving APPs over the past 24 months. The data collected by the Risk Manager has shown a significant number of adverse events involving the APPs, reflecting the poor management of glycemic events and patients with insulin pumps. The needs assessment as well as the scholarly review of literature justified the importance of developing an evidence-based inpatient diabetes program for the APPs.

The interdisciplinary educational programs team consisted of the Endocrinologist, the Diabetes Nurse Practitioner, the RN Diabetes Nurse Educator, The NP Supervisor from the Department of Advanced Medicine, two APPs, along with myself. Cook et al. (2008)

acknowledged that it is important to have a dedicated multidisciplinary team to establish glycemic order out of glycemic chaos in the hospital setting. Glycemic chaos can be defined as inconsistencies in glycemic management by the HCP. The results of the needs assessment and scholarly review was reviewed by the team. An interdisciplinary approach was taken to create a program that would acknowledge the 2010 and 2016 ADA Standard of Medical Care in Diabetes guidelines as well as the 2009 ADA/ACCE Consensus Statement on Inpatient Glycemic Control. In addition, the educational intervention would increase awareness about the types of insulin and its effect on inpatient glycemic management; increase awareness of insulin pump therapy as it relates to the hospital's safety guidelines and inpatient use. The goal of the interdisciplinary team was to create an educational program for the APPs reflecting the recommendations from the ADA and other reputable medical agencies. As a result of this program, the team also had the opportunity to review and revise the hospital's policies and procedures on glycemic management.

A knowledgeable APP will be empowered to deliver safe and effective quality care to the inpatient with diabetes. A 25-item questionnaire was created to assess APPs' knowledge and attitude towards inpatient insulin therapy. In a future study, the effects of the educational program for the APPs will show an improvement of patient outcomes by decreasing complications associated with diabetes, increasing patient satisfaction, decreasing expenditures to the hospital through decreased length of stay, decrease readmissions as well as reduce adverse glycemic events that are costly to the institution, patient, and the health care system.

Program Design & Method

A one-day educational seminar will be developed by the interdisciplinary project team reflecting the results from the needs assessment. The core curriculum was designed and developed for the educational seminar to address the three objectives of the Capstone Project:

Objective #1: To create a series of evidenced based workshops for the institution focused on glycemic management with the use of insulin therapy on inpatients admitted with diabetes.

Educational Workshop:

- *Know the Difference: Types of diabetes*

  This curriculum focused on the classifications of diabetes; reviewed the prevalence of diabetes; and overview the pathophysiology.

- *Inpatient Management of Diabetes*

  This curriculum focused on the use of insulin therapy. The APPs will be able to identify types of insulin utilized within the institution as well as their pharmokinetics. The insulin order sets were also reviewed in this module.

- *Inpatient Diabetes emergencies*

  This module discussed the causes and management of hyper and hypoglycemic emergencies occurring within the hospital environment.

- *Pre-operative management of the Inpatient with Diabetes*

This module discussed how to manage pre-op insulin therapy; basal-bolus regimen; when and when not to treat hyperglycemia; as well as managing pre-op hypoglycemia.

- *Transition of Care from Inpatient to Outpatient Setting*

  This module discussed with the APPs how to develop a treatment plan for the inpatient with diabetes; how to develop a plan to transition the patient into the community; how to prevent hypo/hyperglycemic events as the patient matriculates back into the community; and introduce the providers of available outpatient resources from home care, the Diabetes Wellness Center as well as inpatient classes available for the patient prior to discharge.

Objective #2: Create an insulin pump workshop for the institution for the APPs to manage admitted patients with insulin pumps.

Educational Workshop:

- *Management of Insulin Pump Workshop*

  This curriculum is a "hands-on" workshop provided for the APPs to familiarize them with the various insulin pump devices presented to the facility. The providers will be able to calculate information from the insulin pump as well as becoming familiar with the institutions policy. A power-point presentation was also being created highlighting the information to be addressed in the "hands-on" workshop.

Each session objectives and goals reflect the complexities in managing the hospitalized patient with diabetes.

Expert speakers (physicians, pharmacists, as well as members from the interdisciplinary team) within the institution was elicited to present on the topics mentioned above. Each speaker will be given 50-60 minutes to present their power point topics. At the end of each topic, time will be designated for questions and answers. Each presenter will present their topics using the technology of Turning Point. This technology will allow the APPs to interact with the speakers, therefore encouraging audience participation. The technology also offers an environment conducive to learning. The power points developed by the speakers will also be used in the I-learn program for those APPs who cannot attend the one-day seminar and those who work off shift. The power-point presentations are evidenced based reflecting the guidelines and recommendations from the ADA and the ACCE.

Developmental Plan for Insulin Pump Education

Nursing Education at the institution has brought clinicians from various diabetes companies to the institution to provide a "hands on" education for the nursing staff about the insulin pump. The Diabetes NP, the Diabetes Nurse Educator, and myself will coordinate the same education for the APPs. The difference from nursing education, the APPs will be taught how to obtain and calculate the information necessary for insulin therapy during the patient's hospitalization.

A class was developed reviewing essential information for the APPs to communicate to the Endocrine Department as well as proper documentation into the order

sets. The workshop will also include "hands-on" education utilizing the common insulin pumps presented to the institution. A select number of APPs will be trained as Super Users for both the day and night shift from departments covering both medical and surgical services. A power-point presentation was created for I-learn for those APPs who are unable to attend the workshop.

Development of the Advanced Practice Inpatient Management Questionnaire

Objective #3: To develop a validated pre/post-test questionnaire for the institution to assess the knowledge of the APPs in their management of the adult inpatient with diabetes.

The interdisciplinary team developed a series of questions reflecting the objectives from the educational workshop. The Mayo Clinic Inpatient Diabetes Management Survey had been used to assess the knowledge, the perception and the comfort level of the health care provider in their management of the hospitalized patient with diabetes. The tool was developed by endocrinologists and physicians from Mayo Clinic. Although the survey has been utilized as a source to measure the health care provider's perception towards diabetes, the tool was never validated as a reliable instrument. The Mayo Clinic Inpatient Diabetes Survey was modified to develop the "APPs Inpatient Diabetes Questionnaire". However, the questions will mirror the guidelines from the ADA 2010 and 2016 *Standards of Medical Care* in Diabetes as well as the ACCE 2009 inpatient diabetes recommendations.

Anticipated Population and Sampling

The formative evaluation utilized a purposeful sample of experts who reviewed and provided scholarly feedback on the developed process, educational materials and pre/post-test. The Endocrinologist and myself formally approach the selected members identified by the interdisciplinary team to serve as the expert panelist. The anticipated population to participate in this project was a panel consisting of 2 board certified endocrinologists; 5 doctorate of nurse practitioners from the medicine service; 2 registered nurses from the diabetes champion committee; and 1 physician assistant who had a strong interest and knowledge in managing inpatients with diabetes.

The expert panel received an official invite via email to attend a 60-minute meeting to discuss the project's purpose, the intervention and the questionnaire. The panel formatively evaluated the developed materials, the process and the long-term evaluation tool for this DNP project. They also validated the program on its consistencies with the guidelines and recommendations from the ADA and the ACCE, as well as the program support of the stated objectives.

Protection of Human Rights

An application was submitted to Walden University Institutional Review Board (IRB) for approval. The IRB approval number for this study is 08-25-17-0391315. Participants for the expert panel was assured their participation is voluntary and their identity will be confidential. The Confidentiality Consent was obtained from Walden. A "thank you" note along with a small gift was funded by the myself as compensation for their time spent on this project. Once the requirements were accepted and ratified, the

inpatient diabetes educational program and the "APP Inpatient Diabetes Questionnaire" will be implemented and evaluated by the supporting acute care facility.

Data Collection and Analysis

After the initial meeting, the expert panel was sent an evaluation tool using a 5-point Likert Scale utilizing the ADDIE methodology (Appendix C) to critique the lesson plan, the power point presentation as well as the APPs Inpatient Diabetes Questionnaire. The evaluation tool utilized an anonymous coding (i.e.: 1A, 2A, etc.) to protect their identities from the interdisciplinary panel. They were given 2 weeks to review the materials.

I collected the formative evaluation from the expert panel 1 weeks later. The data was compiled and analyzed by the Endocrinologist and myself using descriptive statistics. The critiques and the statistical data was then discussed with the interdisciplinary team to make corrections if necessary. Once the corrections were made, the lesson plan and questionnaire were then returned to the expert panel, utilizing and anonymous coding (i.e. 2A, 2B, etc.) for a summative evaluation. Once the changes were made to the satisfaction of the expert panel, the program was then validated and submitted to the institution as a completed project to be utilized by the institution for the APPs

Evaluation Plan

Education is an integral part of the APPs behavioral, perception and knowledge change in their management of the inpatient with diabetes (Singh et al., 2013). It is important to evaluate any educational intervention for its effectiveness with the learner. Evaluation is done continuously throughout the program's inception. Evaluation provides

feedback, continuous monitoring, and necessary modification of the program if needed to support the desired outcomes established by the program planner.

Formative evaluation is an evaluation that was be done prior to the implementation of the diabetes educational intervention (Holden, 2015). This evaluation will be done throughout the development of the course curriculum and questionnaire for the institution. It will provide continuous assessment and feedback of the diabetes educational intervention amongst the Interdisciplinary Team and experts in the field of diabetes.

The ADDIE Inpatient Diabetes Evaluation Worksheet (Appendix B) was developed and utilized by the Interdisciplinary Team. During the development of the curriculum and questionnaire, the evaluation worksheet addressed the knowledge gap identified from the needs assessment; addressed the guidelines and recommendations from the ADA and ACCE; and provided information relevant to the APPs management of inpatient diabetes. The expert panel was given the ADDIE Inpatient Diabetes Evaluation Form (Appendix C) to critique and provide validation of the diabetes inpatient program for consistencies with the ADA and ACCE guidelines and recommendations as well as the desired outcomes of the program. As previously mentioned, the tool was given anonymously using a coding system.

Summary

Development of a scholarly evidence-based educational intervention for the institution addressed the knowledge deficit of the APPs in their management of the adult inpatient with diabetes. The anticipated goal of the Capstone Project was to create a series

of workshops focusing on glycemic management control with the use of insulin therapy and the insulin pump; as well as the inpatient management of the complexities of diabetes. The project also developed a validated pre/post-test questionnaire known as the "APP Inpatient Diabetes Questionnaire" created by the interdisciplinary team and validated by an expert Panel to measure the knowledge of the APPs. Knowledge will empower our providers, therefore providing a positive and safe environment for our patients. Section 3 outlined the development of the diabetes inpatient educational intervention. Section 4 will discuss the findings and implications from the Expert Panel.

Section 4:

Findings, Discussion, and Implications

Introduction

Challenges faced by APPs at an acute care facility in the Northeast are related to the evidence-based practice of their management of inpatients with diabetes. These challenges are the results of poor communication among the disciplines, lack of confidence in initiating insulin therapy, a limited understanding of patients on an insulin pump, and lack of treatment of the hospitalized patient with diabetes that aligns with ADA and the ACCE guidelines and recommendations for the management of hyperglycemia. This QI project addressed the question: Will an evidence-based theory supported educational intervention improve APPs' knowledge regarding glycemic management, including the use of insulin pumps and insulin therapy in adult inpatients with diabetes? The goal of this QI project was to develop a validated evidenced based educational program for APPs utilizing the ADDIE instructional model. The implication for social change will bridge the gap of knowledge in their management of the hospitalized adult with diabetes and decrease the fragmented care delivered by the APPs which will improve quality of care and patient safety.

The scholarly literature review supports the importance of bringing awareness to HCPs in managing inpatient diabetes. However, there was limited information about APPs' perceptions and barriers to glycemic management of the inpatient with diabetes. The results of the diabetes need assessment revealed 64% of APPs (69 out of 107 who

responded to the questionnaire) indicated they were between neutral to somewhat uncomfortable with their knowledge in managing inpatient diabetes.

As a result of the literature review and the needs assessment, an educational intervention along with a 25-item questionnaire was developed by the interdisciplinary team and myself utilizing the ADDIE instructional model. The program also incorporated Knowles' adult learning principles to enhance APPs' knowledge regarding glycemic management for adult inpatients with diabetes. An expert panel consisting of two endocrinologists, five DNP graduates, one physician assistant diabetes specialist, and two RN diabetes champions were selected to critique and validate the educational intervention for the institution for APPs.

Findings and Implications

Experts were emailed a formative evaluation to critique the six PowerPoint presentations and the lesson plan along with the 25 item pre/post-test questionnaire. All 10 of the expert panelists completed the evaluation and returned the results within a week. The results of the formative evaluation were reviewed by the Endocrinologist and myself. Corrections were made by the interdisciplinary team. A summative evaluation along with a formative evaluation was returned to the expert panel via email to verify the changes that were suggested.

Each PowerPoint presentation was rated on the following categories: Purpose, objectives, content, and presentation. A 5-point Likert scale was used to determine if the panel strongly disagreed or strongly agreed with each presentation. 100% of the panel felt the program was appropriate for the APPs. 20% of the panel felt the presentation required

additional citations to validate the program as evidence-based. The panel agreed an overview of diabetes was important to reiterate to the APPs. In the presentations Know the Difference, Diabetes Emergencies, and Inpatient Management of Diabetes provided an opportunity to introduce the guidelines of the ADA and the ACCE as well as familiarize the group with the hospital's policy on managing glycemic events.

Table 1. Know the Difference

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Purpose	Is the purpose clear and concise	0	0	0	0	10
Objectives	Is the information clear and concise?	0	0	0	0	10
Content	a. Is it clear and concise?	0	0	0	0	10
	b. Does the workshop provide progression of information?	0	0	0	0	10
Power-point Presentation	a. Is it visually appropriate?	0	0	0	0	10
	b. Is the wording in the Power-point… (Circle your response)?	Too much	Appropriate = 10	Too little		
	c. Are evidence-based citations included in the program to verify credibility of its resources	0	0	0	1	9

Table 2. Diabetes Emergencies

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Purpose	Is the purpose clear and concise?	0	0	0	0	10
Objective	a. Is the information clear and concise?	0	0	0	0	10
	b. Do the objectives support the content of the program?	0	0	0	0	10
Content	a. Is it clear and concise?	0	0	0	0	10
	b. Does the workshop provide progression of information?	0	0	0	0	10
PowerPoint Presentation	a. Is it visually appropriate?	0	0	0	0	10
	b. Is the wording in the power-point… (*Circle your response)*?	Too Much	Appropriate =10	Too Little		
	c. Are evidence-based citations included in the program to verify credibility of its resources?	0	0	0	0	10

Table 3. Inpatient Management of Diabetes: Case Presentations

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Purpose	Is the purpose clear and concise?	0	0	0	0	10
Objective	c. Is the information clear and concise?	0	0	0	0	10
	d. Do the objectives support the content of the program?	0	0	0	0	10
Content	c. Is it clear and concise?	0	0	0	0	10
	d. Does the workshop provide progression of information?	0	0	0	0	10

Power-point Presentation	d.	Is it visually appropriate?	0	0	0	1	9
	e.	Is the wording in the power-point… (*Circle your response)*?	Too Much	Appropriate =10	Too Little		
	f.	Are evidence-based citations included in the program to verify credibility of its resources?	0	0	0	1	9

Management of the Insulin Pump introduced the APPs to various and most common types of insulin pumps seen on patients with diabetes admitted to the hospital. The interdisciplinary team felt it was important to include insulin pumps into the curriculum since there has been a recent influx in the number of patients presented to the hospital through the Emergency Room with insulin pumps. Included in the presentation was the introduction of the Attestation Form. The Attestation Form identifies those patient that can manage their own insulin pump in accordance to the hospital's policy. Guidelines for the insulin pump was created by the interdisciplinary team and validated by the expert panel. As a result of the formative evaluation, the hospital's policy on insulin pumps was reviewed and revised.

Table 4. Management of Insulin Pumps

			Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Purpose	Is the purpose clear and concise?		0	0	0	0	10
Objective	e.	Is the information clear and concise?	0	0	0	0	10
	f.	Do the objectives support the content of the program?	0	0	0	0	10
Content	e.	Is it clear and concise?	0	0	0	0	10

	f.	Does the workshop provide progression of information?	0	0	0	0	10
Power-point Presentation	g.	Is it visually appropriate?	0	0	0	0	10
	h.	Is the wording in the power-point? (*Circle your response)*.	Too Much	Appropriate =10	Too Little		
	i.	Are evidence-based citations included in the program to verify credibility of its resources?	0	0	0	1	9

The presentation that received the most criticism was the "Peri-operative Management of the Inpatient with Diabetes". The expert panel felt the slides had too much wording along with abbreviations that should have been spelled out (i.e.: CAG; the pneumonic for PONV). After reviewing the formative evaluation from the expert panel, the interdisciplinary team re-consulted with the surgeons from Pre-Surgical Testing as well as Risk Management to correct the Pre-operative presentation. The information that was imperative to stress to the APPs was the importance of communication with the Surgeons and/or those on the surgical team and adjustment of the basal insulin prior to surgery.

Table 5. Peri-operative Management of the Inpatient with Diabetes

			Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Purpose	Is the purpose clear and concise?		0	0	0	0	10
Objective	g.	Is the information clear and concise?	0	0	0	0	10
	h.	Do the objectives support the content of the program?	0	0	0	0	10
Content	g.	Is it clear and concise?	0	0	0	3	7

	h.	Does the workshop provide progression of information?	0	0	0	0	10
Power-point Presentation	j.	Is it visually appropriate?	0	0	0	3	7
	k.	Is the wording in the power-point? (*Circle your response)*.	Too Much	Appropriate=10	Too Little		
	l.	Are evidence-based citations included in the program to verify credibility of its resources?	0	0	0	4	6

It is important for patient to take ownership of their health and well- being. In preparation for discharge, the APPs can ensure that the patient with diabetes have the appropriate follow-up care either with their own endocrinologist, primary care physician or with the hospital's diabetes clinic. Immediately after discharge ongoing patient education and resources are provided to the patient with diabetes. Education on Transition of Care is extremely important to prevent and/or decrease re-admission to the hospital. The APPs are in the position to assist the patient with diabetes to become more knowledgeable about their diabetes and support them in their health care goals.

Table 6. Transition of Care: From the Inpatient to the Outpatient Setting

			Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Purpose	Is the purpose clear and concise?		0	0	0	0	10
Objective	i.	Is the information clear and concise?	0	0	0	0	10
	j.	Do the objectives support the content of the program?	0	0	0	0	10
Content	i.	Is it clear and concise?	0	0	0	1	9

	j.	Does the workshop provide progression of information?	0	0	0	0	10
Power-point Presentation	m.	Is it visually appropriate?	0	0	0	0	10
	n.	Is the wording in the power-point:(*Circle your response)*?	Too Much	Appropriate 10	Too Little		
	o.	Are evidence-based citations included in the program to verify credibility of its resources?	0	0	0	1	9

A formative and summative evaluation of the "APPs Inpatient Diabetes Questionnaire" was also completed. The questionnaire reflected the information from the power point presentations. It also assessed the comfort level and the perception of the APPs management of the hospitalized patient with diabetes. The expert panel referenced how the survey reflects the revised policy regarding the insulin pump and the updated definition on hyperglycemia.

Implications

Because of this project along with the findings from the expert panel, standardizing the care and decreasing the knowledge gap amongst our APPs are important and it is a beginning. The knowledge gap, as supported by the literature review, is not only amongst the APPs but also amongst our hospitalists (physicians) and the health care team who are closely involved in providing direct care to the inpatient with diabetes. It is therefore important to share this information within the institution. There are situations as providers we can control medical practice such as initiating early insulin therapy, providing early and continuous education to our patients, being more knowledgeable about the insulin pump

and completing the necessary documents according to the institution's policy. It is important to emphasize the healthcare team role and responsibility to our patients with diabetes to be involved with the transition from the inpatient to the outpatient setting to provide continued information to the outpatient physician; home care support to those who are newly diagnose with diabetes in the hospital; and to ensure the patient can afford their medications and supplies to prevent complications and readmission to the hospital setting.

Strengths and Limitations

This project was implemented based on the creation of an evidenced based educational intervention as well as the expert panel critiquing and validating the program. The comments from the panel has identified the strengths of the program providing a standardized education with the purpose of adhering to the guidelines recommended by the ADA and the ACCE as well as other reputable medical organizations. The intervention also addressed issues identified in the needs assessment done by the Diabetes Educator prior to the inception of this project. The educational intervention can be utilized not only by the APPs but also the hospitalists (physicians) and residents at the institution as a quick reference especially in their management of patients with insulin pumps and those in preparation for surgery. However, since this project has only addressed the issues found at the institution in the Northeast, it is important to emphasize the information is limited and applicable to the institution. There were no outside experts participating in the evaluation and validation process.

While working on this project, the Endocrinologist and myself are interested in developing a validated diabetes survey that could be utilized nationally. The ADDIE ISD Model would be utilized to organize the process. Also publishing the results of the institutions finding once the educational intervention has been implemented and completed is another project of interest.

Summary

The educational program created by the interdisciplinary team was submitted to the expert panel for a formative evaluation to critique the appropriateness of the intervention for the APPs in their management of the hospitalized patient with diabetes. The expert panel completed the formative evaluation and returned their findings to the Endocrinologist and myself. The overall program received positive reviews. Corrections were made by the interdisciplinary team and returned to the expert panel for its summative review. The expert panel of 10 completed the summative evaluation and validated the educational intervention. The panel concluded the evidenced-based, theory supported educational program was appropriate and addressed the knowledge gap of the APPs in their management of the inpatient with diabetes.

The program will be submitted to the institution to be implemented and evaluated as an evidenced based intervention for the APPs in the management of the inpatient with diabetes. The intervention has satisfied the goal of developing an evidenced based educational intervention utilizing the ADDIE Instructional Model as well as incorporating the principles of Knowles Adult Learning. Section 4 discussed the findings and

implications from the expert panel. Section 5 will discuss the completion of the scholarly project.

Section 5

Scholarly Product

Introduction

The diabetes educational program involved the development of six evidence-based educational workshops as well as the creation of a 25 item pre/post-test questionnaire. The educational intervention was developed for the organization in the Northeast. The educational intervention and the questionnaire was created by the interdisciplinary team and validated by an expert panel using the ADDIE instructional model and incorporating Knowles' Adult Learning principles. The question was: Will an evidence-based theory supported educational intervention improve APPs' knowledge regarding glycemic management, including the use of insulin pumps and insulin therapy, in the adult inpatient with diabetes? The goal of the QI project was achieved through developing an evidence-based educational program for the institution for the APPs by utilizing the ADDIE ISD model. This program will be submitted to the institution to implement and evaluate regarding the effectiveness of the intervention.

Dissemination Plan

The completed educational intervention will be submitted to the Department of Endocrinology. The educational intervention will be placed on I-learn (Internet educational learning) for the APPs at the institution. I will apply for continuing education credits through the facility's credentialing agency, the American Association of Physician Assistants. On I-learn, the program will be available and mandatory for all APPs on both

the day and night shift for them to complete. The 25 item pre/post-test questionnaire will be offered prior to accessing the PowerPoint presentations.

I also plan to submit an abstract to the New York State Nurse Practitioner Association. The abstract will be presented in poster form during their annual conference in October 2018. I would also like to present my project during grand rounds for the APPs.

Analysis of Self

This project has been a challenging experience. I appreciated the wealth of knowledge that was obtained during the literature review and the development of the educational curriculum. It is a privilege to work for an organization that supports doctoral and PhD students on providing change in our medical practice that is evidenced-based and promotes patient safety. A change in medical practice will not only affect our acute care facility but also other facilities that is a part of the hospital's health system affected by the same problem.

Inpatient diabetes management, as per the ADA and from my own personal experience during the execution of this project, is not a simple problem that can be fixed overnight. APPs must commit to protecting patients by decreasing the gap in miscommunications amongst colleagues and be cognizant in initiating early insulin therapy. Even though diabetes may not be the initial diagnosis when a patient has been admitted, is it a disease that must be acknowledged and controlled during the person's hospitalization.

Conclusion

Inpatient diabetes management is not only a problem within my institution but an issue amongst many APPs and other HCPs practicing in the hospital setting. An evidenced based educational intervention was created by the Interdisciplinary Team utilizing the ADDIE ISD Model. The purpose of this educational intervention was to bring awareness to the APPs at an acute care facility in the northeast on inpatient glycemic management in accordance to the recommendations from the ADA, the ACCE and other reputable medical agencies. This was also an opportunity to familiarize the group on the hospital's policies on glycemic control. As a result, a formative and summative evaluation was completed by an Expert Panel. The Expert Panel validated the program and addressed the project question that the information provided in the evidenced based, theory supported educational intervention will improve the knowledge of the APPs on glycemic management including the use of insulin pumps and insulin therapy in the adult patient with diabetes. Increased knowledge through education will provide the APPs to make a difference one patient at a time. Small steps can make a world of difference towards the steps to change.

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Appendix A

IRB Approval

IRB<IRB.mail@Walden.edu

8/25/17 @ 7:25 pm

Dear Ms. Hasfal,

This email is to notify you that the Institutional Review Board (IRB) confirms that your study entitled, "Development of a Scholarly Educational Intervention to Improve Inpatient Diabetes Management," meets Walden University's ethical standards. Our records indicate that you will be analyzing data provided to you by North Shore University Hospital as collected under its oversight. Since this study will serve as a Walden doctoral capstone, the Walden IRB will oversee your capstone data analysis and results reporting. **The IRB approval number for this study is 08-25-17-0391315.**

This confirmation is contingent upon your adherence to the exact procedures described in the final version of the documents that have been submitted to IRB@mail.waldenu.edu as of this date. This includes maintaining your status with the university and the oversight relationship is only valid while you are an actively enrolled student at Walden University. If you need to take a leave of absence or are otherwise unable to remain actively enrolled, this is suspended.

If you need to make any changes to your research staff or procedures, you must obtain IRB approval by submitting the IRB Request for Change in Procedures Form. You will receive confirmation with a status update of the request within 1 week of submitting the change request form and are not permitted to implement changes prior to receiving approval. Please note that Walden University does not accept responsibility or liability for research activities conducted without the IRB's approval, and the University will not accept or grant credit for student work that fails to comply with the policies and procedures related to ethical standards in research.

When you submitted your IRB materials, you made a commitment to communicate both discrete adverse events and general problems to the IRB within 1 week of their occurrence/realization. Failure to do so may result in invalidation of data, loss of academic credit, and/or loss of legal protections otherwise available to the researcher.

Both the Adverse Event Reporting form and Request for Change in Procedures form can be obtained at the IRB section of the Walden website: http://academicguides.waldenu.edu/researchcenter/orec

Researchers are expected to keep detailed records of their research activities (i.e., participant log sheets, completed consent forms, etc.) for the same period they retain the

original data. If, in the future, you require copies of the originally submitted IRB materials, you may request them from Institutional Review Board.

Both students and faculty are invited to provide feedback on this IRB experience at the link below:

http://www.surveymonkey.com/s.aspx?sm=qHBJzkJMUx43pZegKlmdiQ_3d_3d

Sincerely,
Libby Munson
Research Ethics Support Specialist
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Information about the Walden University Institutional Review Board, including instructions for application, may be found at this link:http://academicguides.waldenu.edu/researchcenter/orec

Appendix B

ADDIE Inpatient Diabetes Worksheet

1. Are we addressing the needs of the APPs identified in the needs assessment survey?

   __ Yes

   __ No

Comments:

2. Address the correct terminology to be used for the diagnosis of diabetes.

   __ Yes

   __ No

Comments:

3. Importance of when to obtain the HBGAIC.

   __ Yes

   __ No

Comments:

4. Address Prediabetes.

__ Yes

__ No

Comments:

5. Address the types of diabetes.

__ Yes

__ No

Comments:

6. Do the workshops provide a clear rationale for treating hypo/hyperglycemic events?

__ Yes

__ No

Comments:

7. Treatment for hyperglycemia has been addressed.

__ Yes

__ No

Comments:

8. Treatment for hypoglycemia has been addressed.

__ Yes

__ No

Comments:

9. Address when to trigger House Endocrinology.

__ Yes

__ No

Comments:

10. Address the effects of diabetes and nutrition.

__ Yes

__ No

Comments:

11. Identify the types of insulin used by the facility.

__ Yes

__ No

Comments:

12. Address managing pre-meal and basal insulin in the event of a glycemic event.

__ Yes

__ No

Comments:

13. Does the workshop educate the APPs on insulin use during hospitalization?

__ Yes

__ No

Comments:

14. Addressing the use of basal-bolus insulin.

__ Yes

__ No

Comments:

15. How to calculate the Total Daily Dose (TDD).

__ Yes

__ No

Comments:

16. Address the effects of diabetes and certain medications.

__ Yes

__ No

Comments:

17. Questions to be answered when a patient is admitted with an insulin pump.

__ Yes

__ No

Comments:

18. Address which documents must be included in the chart when a patient is admitted with an insulin pump.

__ Yes

__ No

Comments:

19. Address insulin management during pre-op.

__ Yes

__ No

Comments:

20. Address optimal intra-operative blood glucose levels.

__ Yes

__ No

Comments:

21. Address management of patient pending late surgical procedures.

__ Yes

__ No

Comments:

22. Address transition of care when a patient is about to be discharged from the hospital.

_-Yes

__ No

Comments:

23. Address handling socioeconomic issues (i.e.: expense of medications) prior to discharge.

__ Yes

__ No

Comments:

24. Do the workshops involve a multidisciplinary approach in managing the inpatient with diabetes?

__ Yes

__ No

Comments:

25. Does the workshop reflect the hospital's policy and order sets for the treatment of glycemic events and the use of the insulin pump?

__ Yes

__ No

Comments:

Appendix C

Expert Panel Evaluation Form

ADDIE Inpatient Diabetes Evaluation Form: Code: 1A

Topic: Know the Difference: Types of Diabetes (Lesson Plan and Power-point presentation)

Instruction: Please complete the following statements by circling the number that describes your rating. The rating scale ranges from 1 to 5 where:

1= strongly disagree 2= disagree 3= neutral 4= agree 5= strongly agree.

Please provide constructive criticism in the comment section. Thank you for your participation in the evaluation of this program.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Purpose	Is the purpose clear and concise?	1	2	3	4	5
Objective	k. Is the information clear and concise?	1	2	3	4	5
	l. Do the objectives support the content of the program?	1	2	3	4	5
Content	k. Is it clear and concise?	1	2	3	4	5
	l. Does the workshop provide progression of information?	1	2	3	4	5
Power-point Presentation	p. Is it visually appropriate?	1	2	3	4	5
	q. Are the wording in the power-point… (*Circle your response)*?	Too Much	Appropriate	Too Little		
	r. Are evidence-based citations included in the program to verify	1	2	3	4	5

	credibility of its resources?					

Comments:

Expert Panel Evaluation Form

ADDIE Inpatient Diabetes Evaluation Form: Code: 1A

Topic: Inpatient Management of Diabetes (Lesson Plan and Power-point presentation)

Instruction: Please complete the following statements by circling the number that describes your rating. The rating scale ranges from 1 to 5 where:

1= strongly disagree 2= disagree 3= neutral 4= agree 5= strongly agree.

Please provide constructive criticism in the comment section. Thank you for your participation in the evaluation of this program.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Purpose	Is the purpose clear and concise?	1	2	3	4	5
Objective	m. Is the information clear and concise?	1	2	3	4	5
	n. Do the objectives support the content of the program?	1	2	3	4	5
Content	m. Is it clear and concise?	1	2	3	4	5
	n. Does the workshop provide progression of information?	1	2	3	4	5
Power-point Presentation	s. Is it visually appropriate?	1	2	3	4	5
	t. Are the wording in the power-point… (*Circle your response)*?	Too Much	Appropriate-ate	Too Little		

	u. Are evidence-based citations included in the program to verify credibility of its resources?	1	2	3	4	5

Comments:

Expert Panel Evaluation Form

ADDIE Inpatient Diabetes Evaluation Form: Code: 1A

Topic: Inpatient Diabetes Emergencies (Lesson Plan and Power-point presentation)

Instruction: Please complete the following statements by circling the number that describes your rating. The rating scale ranges from 1 to 5 where:

1= strongly disagree 2= disagree 3= neutral 4= agree 5= strongly agree.

Please provide constructive criticism in the comment section. Thank you for your participation in the evaluation of this program.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Purpose	Is the purpose clear and concise?	1	2	3	4	5
Objective	o. Is the information clear and concise?	1	2	3	4	5
	p. Do the objectives support the content of the program?	1	2	3	4	5
Content	o. Is it clear and concise?	1	2	3	4	5
	p. Does the workshop provide progression of information?	1	2	3	4	5
Power-point Presentation	v. Is it visually appropriate?	1	2	3	4	5

	w. Are the wording in the power-point… (*Circle your response)*?	Too Much	Appropri ate-ate	Too Little		
	x. Are evidence-based citations included in the program to verify credibility of its resources?	1	2	3	4	5

Comments:

Expert Panel Evaluation Form

ADDIE Inpatient Diabetes Evaluation Form: Code: 1A

Topic: Pre-operative Management of the Inpatient with Diabetes (Lesson Plan and Power-point presentation)

Instruction: Please complete the following statements by circling the number that describes your rating. The rating scale ranges from 1 to 5 where:

1= strongly disagree 2= disagree 3= neutral 4= agree 5= strongly agree.

Please provide constructive criticism in the comment section. Thank you for your participation in the evaluation of this program.

		Strongly Disagree	Disagree	Neutra l	Agree	Strongly Agree
Purpose	Is the purpose clear and concise?	1	2	3	4	5
Objective	q. Is the information clear and concise?	1	2	3	4	5
	r. Do the objectives support the content of the program?	1	2	3	4	5
Content	q. Is it clear and concise?	1	2	3	4	5
	r. Does the workshop provide	1	2	3	4	5

	progression of information?					
Power-point Presentation	y. Is it visually appropriate?	1	2	3	4	5
	z. Are the wording in the power-point… (*Circle your response)*?	Too Much	Appropri ate-ate	Too Little		
	aa. Are evidence-based citations included in the program to verify credibility of its resources?	1	2	3	4	5

Comments:

Expert Panel Evaluation Form

ADDIE Inpatient Diabetes Evaluation Form: Code: 1A

Topic: Transition of Care from Inpatient to Outpatient Setting (Lesson Plan and Power-point presentation)

Instruction: Please complete the following statements by circling the number that describes your rating. The rating scale ranges from 1 to 5 where:

1= strongly disagree 2= disagree 3= neutral 4= agree 5= strongly agree.

Please provide constructive criticism in the comment section. Thank you for your participation in the evaluation of this program.

		Strongly Disagree	Disagree	Neutra l	Agree	Strongly Agree
Purpose	Is the purpose clear and concise?	1	2	3	4	5
Objective	s. Is the information clear and concise?	1	2	3	4	5
	t. Do the objectives support the content of the program?	1	2	3	4	5
Content	s. Is it clear and concise?	1	2	3	4	5

	t. Does the workshop provide progression of information?	1	2	3	4	5
Power-point Presentation	bb. Is it visually appropriate?	1	2	3	4	5
	cc. Are the wording in the power-point… (*Circle your response)*?	Too Much	Appropri ate-ate	Too Little		
	dd. Are evidence-based citations included in the program to verify credibility of its resources?	1	2	3	4	5

Comments:

Expert Panel Evaluation Form

ADDIE Inpatient Diabetes Evaluation Form: Code: 1A

Topic: Management of Insulin Pumps (Lesson Plan and Power-point presentation)

Instruction: Please complete the following statements by circling the number that describes your rating. The rating scale ranges from 1 to 5 where:

1= strongly disagree 2= disagree 3= neutral 4= agree 5= strongly agree.

Please provide constructive criticism in the comment section. Thank you for your participation in the evaluation of this program.

		Strongly Disagree	Disagree	Neutra l	Agree	Strongly Agree
Purpose	Is the purpose clear and concise?	1	2	3	4	5
Objective	u. Is the information clear and concise?	1	2	3	4	5
	v. Do the objectives support the content of the program?	1	2	3	4	5

Content	u. Is it clear and concise?	1	2	3	4	5
	v. Does the workshop provide progression of information?	1	2	3	4	5
Power-point Presentation	ee. Is it visually appropriate?	1	2	3	4	5
	ff. Are the wording in the power-point… (*Circle your response)*?	Too Much	Appropri ate-ate	Too Little		
	gg. Are evidence-based citations included in the program to verify credibility of its resources?	1	2	3	4	5

Comments:

Appendix D

Expert Statements

Formative Evaluation	**Summative Evaluation**
Could use more citations to validate the information.	Improvement in the additional citations added to the presentations.
More resources for data statements	
EBP. Major epidemic	
Overall program looks good. Define hyperglycemia by research or other organization. What range are you referring to?	Hyperglycemia has been defined and included in the program the ranges.
Case Studies very appropriate and interactive.	An interactive case presentation is a great approach to providing the information to your constituents.
Appropriate pictures utilized in the presentations.	
Power-point presentation nicely presented.	
For the Pre-op discussion—include explanation of "CAG" for readers. Write out "PONV" pneumonic.	Corrections are now satisfactory.
Pre- op presentation – Too much wording on the slides.	Pre-op presentation: still wordy however have seen the corrections made to the slides.
Management of the insulin pumps-It was visually appropriate.	
The overall program was very good, relevant, and put together nicely.	
Add some of the new basal insulin agents in the market to the presentation.	The new basal insulins mentioned in the presentation are appropriate.
For the Transition in Care include a few of the outpatient support offered by the organization.	
Adjust the lesion plan for Management of Insulin pump.	Corrections are now satisfactory.
Questionnaire is very appropriate.	

Appendix E:

PowerPoint Presentations with Lesson Plans

Northwell Health

Know The Difference:
Diabetes Classifications

Marie Frazzitta DNP, FNP-c, CDE,MBA
Sharon Hasfal ANP-BC
Northwell Health System

North Shore LIJ

Objectives:

- Provide an overview of different classifications of diabetes

North Shore LIJ

1) HT an African American 46 year old female with a BMI of 29 and family history of type 2 diabetes was told that she had a HbA1c result of 6.2%. Based on her HbA1c what would her diagnosis be?
a) Her HbA1c is within normal range
b) Pre diabetes
c)Type 2 diabetes
d)Type1 diabetes

2) TJ, a 33 year old female is admitted to the ICU with a blood glucose of 585mg/dl and a pH of 7.1. What further testing is needed to determine if TJ has Type 1 or Type 2 diabetes?
a)HbA1c
b)Antibodies
c)insulin resistant screening
d)Thyroid screening

3) RD a 54 year old Hispanic man presented to his doctors office complaining of waking up during the night to urinate, constant drinking and increased hunger. He has a family history of diabetes. He has a BMI of 28.
All of the following are RD's risk factors for type 2 diabetes except?
a)Increased urination and thirst
b)Hispanic Ethnic background
c)Family History of type 2 diabetes
d)Increased BMI of 28
•

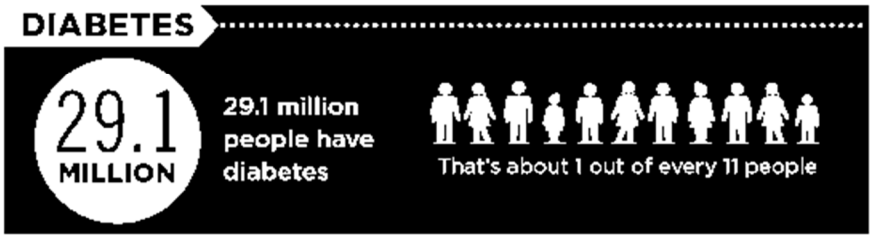
North Shore LIJ

Topics

- Prevalence of Diabetes
- Overview of Pathophysiology
- Diabetes Classifications

North Shore LIJ

The Epidemic of Diabetes



Diabetes Epidemic

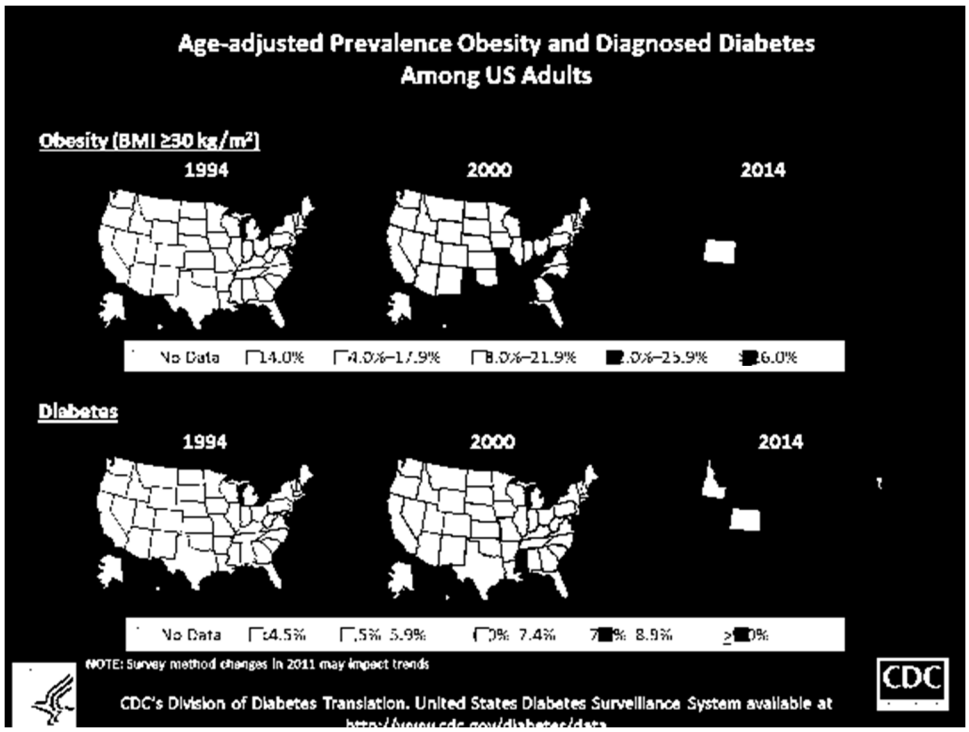
Epidemic of Diabetes

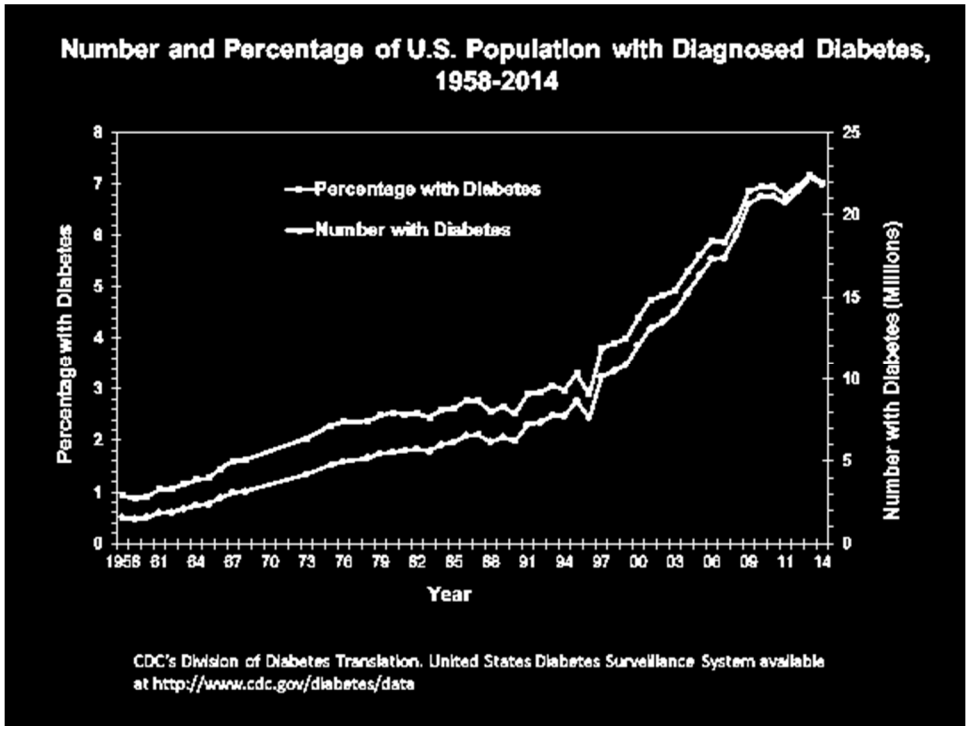
Reported by the CDC

Topic	2011	2014
Affects	25.8 million 8.3% of US Population	29.1 million 9.3% of US Population
Diagnosed	18.8 million	21.1 million
Undiagnosed	7.1 million	8.1 million
65 and older	10.9 million	11.2 million
Newly diagnosed (Aged 20 yrs & older)	1.9 million	1.7 million

Global Epidemic

- Every 10 seconds
  - 1 person dies from diabetes
  - 2 people develop diabetes
- Every Year
  - 3 millions deaths
  - 6 million new cases
- In the year 2050 1 in 3 Americans may have diabetes


Age-adjusted Prevalence Obesity and Diagnosed Diabetes Among US Adults
Obesity (BMI ≥30 kg/m²)
1994
2000
2014
No Data
Diabetes
1994
2000
2014
No Data
NOTE: Survey method changes in 2011 may impact trends
CDC's Division of Diabetes Translation. United States Diabetes Surveillance System available at
CDC

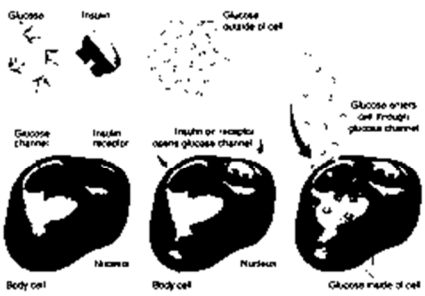

Number and Percentage of U.S. Population with Diagnosed Diabetes, 1958-2014
Percentage with Diabetes
Number with Diabetes
Percentage with Diabetes
Number with Diabetes (Millions)
Year
1958 61 64 67 70 73 76 79 82 85 88 91 94 97 00 03 06 09 11 14
CDC's Division of Diabetes Translation. United States Diabetes Surveillance System available at http://www.cdc.gov/diabetes/data

Cost of Diabetes

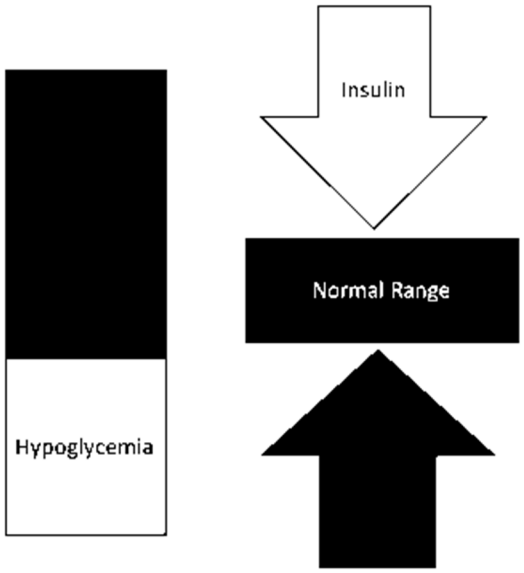
- One in every five health care dollars is spent on care needed for someone with diabetes
- 2012 the total annual economic cost of diabetes in medical expenditures and lost productivity was estimated to be $245 billion, a 40% increase since 2007
- The 2012 per capita annual costs of health care for people with diabetes is $13,700 per year of which $7,900 (57%) is attributed to diabetes
- Medical expenditures are approximately 2.3 times higher then those without diabetes

Normal Glucose Metabolism

- Insulin is produced by beta cells in the pancreas
- Insulin binds to its receptor on the target cell to allow for glucose entry into the cells



Glucose Regulation



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Diabetes Educational Services

Diabetes is a metabolic disease

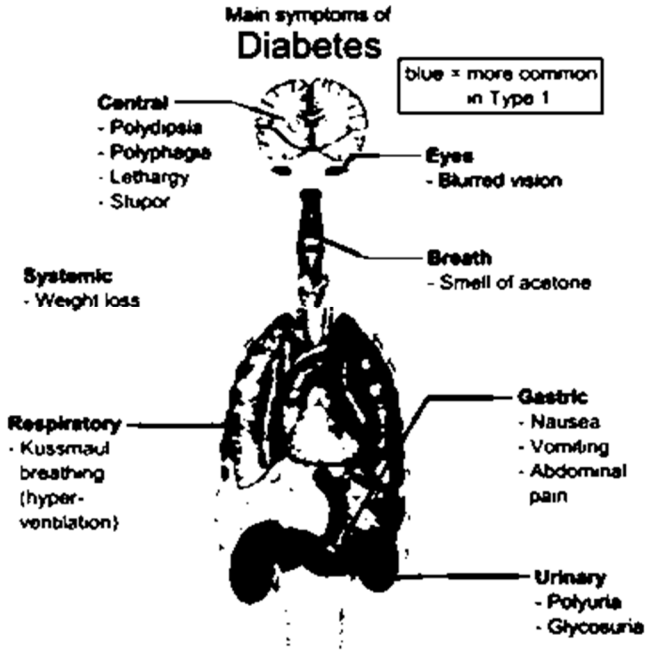
- In which the body **can not make insulin**
  - **Beta Cell Failure Type 1 Diabetes**
- Is **unable to utilize the insulin** it makes
  - **Insulin Resistance Type 2 Diabetes**
- Or both
  - Beta Cell Dysfunction and Insulin Resistance **Type 2 Diabetes**

North Shore LIJ

Types of Diabetes

~~Insulin dependent vs. Non-Insulin Dependent~~

- Prediabetes
- Type 1 DM
- Type 2 DM
- LADA (Latent Autoimmune Disease of Adulthood)
- Gestational Diabetes



Diagnostic Criteria

Types	Fasting blood glucose	Hemoglobin A1C
Diabetes	**≥126 mg/dl**	**≥ 6.5%**
Pre-diabetes	**≥100mg/dl & ≤125mg/dl**	**5.7% - 6.4%**
Normal	**≤99mg/dl**	**≤5.6%***

If normal, but at risk, reevaluate in 3 years

American Diabetes Association Clinical Practice Recommendations. Standards of medical care 2014

Case Study 1

HT an African American 46 year old female with a BMI of 29 and family history of type 2 diabetes was told that she had a HbA1c result of 6.2%.

North Shore LIJ

Pre-Diabetes

B) Pre diabetes- HbA1c 5.7%-6.4%

Recommendations would be:

-5-7% weight loss

-150 minutes of exercise a week

- Metformin (Glucophage)

Case Study 2

TJ, a 33 year old female is admitted to the ICU with a blood glucose of 585mg/dl and a pH of 7.1. What further testing is needed to determine if TJ has Type 1 or Type 2 diabetes?

A) HbA1c

B) Antibodies

C) Insulin resistant screening

D) Thyroid screening

Characteristics	Usually Present for type 1 diabetes
Family history (FH) of diabetes	No
FH of autoimmune disease	yes
Body Type	Thin Frame and/or recent weight loss
Insulin Resistance	No: Usually Insulin Sensitive
History of Diabetes Ketone Acidosis (DKA)	Usually presents this way
(+) Antibodies: GAD-65, insulin auto antibodies(ICA, IA2 &IAA), ZnT8 (Zinc transporter)	Yes
C-peptide	Low Levels
Co-Morbid immune conditions: Thyroid disease, Celiac disease, Addison's disease	Yes

Type 1 Diabetes

- Type 1: 5-10% of cases of diabetes
  - Autoimmune destruction of β-cells in the pancreas
- 23% rise in Type 1 from 2001-2009
- Usually seen in the pediatric population but can develop later in life
- Combo of genes and disease susceptibility
- Risk factors
  - Autoimmunity in families, higher rates in non breastfed infants, Viral triggers: Congenital rubella, coxsackie virus B, cytomegalovirus, adenovirus and mumps

North Shore LIJ

Treatment

INSULIN: Can't live without it!

North Shore LIJ

Treatment Continued

- Blood glucose monitoring
- Medical Nutritional Therapy (Carbohydrate counting)
- Exercise

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Type 1 Summary

- Autoimmune disease
- Complete pancreatic dysfunction
- Needs insulin: Insulin Dependent
- Insulin sensitive
- Glucagon sensitivity decreases over time
- Often first presents in Diabetes Keto Acidosis (DKA)

North Shore LIJ

Case 3

RD a 54 year old Hispanic man presented to his doctors office complaining of waking up during the night to urinate, constant drinking and increased hunger. He has a family history of diabetes. He has a BMI of 28.

North Shore LIJ

All of the following are RD's risk factors for type 2 diabetes except?

A) Increased urination and thirst
B) Hispanic Ethnic background
C) Family History of type 2 diabetes
D) Increased BMI of 28

North Shore LIJ

Risk Factors for Type 2 Diabetes

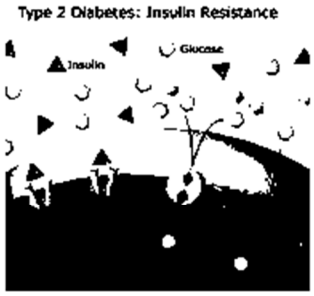
- Pre Diabetes
- First-degree relative with diabetes
- Age over 45
- Gestational Diabetes or a baby weighing ≥ 9lbs.
- Acanthosis nigricans
- Metabolic Syndrome
- Medications such as steroids, tacrolimus and antipsychotics
- Member of a high risk racial or ethnic group
- Sedentary life style
- Obesity, especially central

North Shore LIJ

Characteristics	Usually Present for type 2 diabetes
Family history (FH) of diabetes	Yes
FH of autoimmune disease	No
Body type	Usually increase BMI with central obesity
Insulin Resistance	Yes
History of Diabetes Ketone Acidosis (DKA)	No
(+) Antibodies: GAD-65, insulin auto antibodies(ICA, IA2 &IAA), ZnT8 (Zinc transporter)	No
C-peptide	Normal- High
Co-Morbid immune conditions: Thyroid disease, Celiac disease, Addison's disease	No

Insulin Resistance

- When the signaling of the of insulin receptor prevents opening of the glucose channel -> insulin resistance



www.themedicalpark.com

Underlying cause of Type 2 Diabetes

North Shore LIJ

Metabolic Syndrome

- Excess weight around the middle
  - Waist measures greater than
    - 40 inches for men
    - 35 inches for women
- Triglycerides >150
- HDL <35
  - Below
    - 40mg/dL for men
    - 50mg/dL for women
- High Blood Pressure (greater than 140/90)
- High Fasting Blood Glucose level (NIDDK)

Treatment

- Weight Loss if BMI >25
- Exercise (recommended 150 minutes a week)
- Oral Medications/ insulin
- Blood Glucose Monitoring

Summary Type 2 Diabetes

- Complex metabolic disorder
- Progressive disease and often patients will eventually need insulin
- Healthy body weight and exercise is the foundation of achieving and maintaining good glycemic control (HbA1c $\leq$ 7%).

Case 4

JP was DX with type 2 diabetes 5 years ago. BMI at the time of DX was 28. He has been able to maintain an HbA1c of <7% through utilization of lifestyle changes and Januvia / Metformin. He comes into his PCP office complaining of a 20lb weight loss over the past two months, polyuria and fatigue. HbA1c 9% random glucose 283mg/dl, urine ketones 3+.

Latent Autoimmunity Diabetes in Adults (LADA)

- (+) Antibodies, Low C-peptide
- Sometimes called diabetes 1.5
- May account for as many as 10% of adult Type 1 cases
- Slow, progressive Type 1 diabetes
- Often confused with Type 2
- Insulin dependent
- Beta cell destruction typically slower

Diabetes Types
Key characteristics of type 1, LADA, and type 2

	Type 1	LADA	Type 2
Typical age of onset	Youth or Adult	Adult	Youth or Adult
Progression to insulin dependence	Immediate	Latent (months/years)	Slow
Presence of autoantibodies	Yes	Yes	No
Insulin dependence	Yes/ at diagnosis	Yes	Over time, if at all
Insulin resistance	No	Possible	Yes

Thank you for your time

How Many Steps did you walk today?
10,000 Steps a Day Prevents Diabetes and Promotes Weight Loss

Resources

- CDC National Diabetes Fact Sheet, 2011 (www.cdc.gov)
- CDC National Diabetes Fact Sheet, 2014 (www.cdc.gov)
- American Diabetes Association (2016) *Standards in Medical Care*. Diabetes Care; 39(1):S99-S104.
- American Diabetes Association (2014). *Standards in Medical Care: Clinical Practice Recommendations*. Diabetes Care;

Diabetes Emergencies

Alyson Myers, MD
Attending Endocrinologist, NS/LIJ Health System
Assistant Professor, Hofstra School of Medicine
Northwell Health System

Disclosures

None

"I think diabetes is affecting my eyesight. I have trouble seeing the consequences of poor food choices."

North Shore LIJ

Objectives

*To discuss the pathophysiology of diabetes

*To describe the pharmokinetics of insulin

*To illustrate the causes and management of hyperglycemia

*To review the causes and management of hypoglycemia

North Shore LIJ

Ms. P is a 25 year old female with T1DM who presents to the ED with a serum glucose of HIGH. There is concern for DKA. All of the following are true about the management of DKA except:

a) Volume replacement is important
b) Regular insulin IVP can be used as the sole insulin to manage DKA
c) Patients should be NPO until the bicarbonate is at least 18 and the gap is closing
d) Untreated DKA can be fatal

North Shore LIJ

Mr. X has T1.5DM managed at home with metformin and glyburide. He was admitted to NSUH three days ago with DKA. He should be discharged on:
a) Metformin and glyburide
b) Metformin alone
c) Metformin and Glargine (Lantus®)
d) Glargine (Lantus®) and Lispro (Humalog®)

North Shore LIJ

Ms. G is a 60 year old female with T2DM treated with glipizide XL 10mg po bid who was admitted with hypoglycemia. Which is the likely cause of her hypoglycemia?
A) Poor PO Intake
B) Acute Renal Failure
C) A and B
D) Insulinoma

North Shore LIJ

What is diabetes mellitus???

- Greek for a *honey channel*
  - Insufficient insulin
  - Cells resistant to insulin
  - Type 1 vs. 12 not NIDDM vs. IDDM

North Shore LIJ

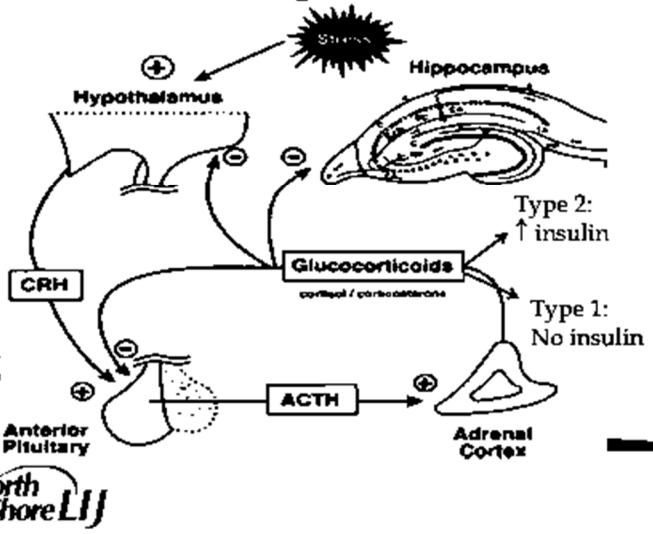
Normal Glucose Metabolism

- Insulin is produced by beta cells in the pancreas
- Insulin binds to its receptor on the target cell to allow for glucose entry into the cells
- Fasting bs: less than 100 mg/dL

www.humanillnesses.com

North Shore LIJ

What happens to diabetes during the stress of being in the hospital??



North Shore LIJ

Miller DB, O'Callaghan JP. Metabolism 51: 5, 10, 2002

Management of Diabetes

- Type 1 DM
  - Cannot use oral hypoglycemics, only symlin or insulin
  - Insulin requirement of 0.2 units/kg
- Type 2 DM
  - Can be managed with oral hypoglycemics, insulin sensitizers or insulin
  - Insulin requirement of 0.4-0.8 units/kg or greater

North Shore LIJ

Insulin Requirements in DM

- Basal
  - Long-acting insulin to cover for fasting blood sugars
  - 50% of the total daily dose (TDD)
  - Lantus, detemir or NPH
- Nutritional
  - 50% of the TDD
  - Pre-meal short acting insulin
  - Decreases the post-prandial hyperglycemic excursions
- Correctional
  - Treatment of elevated blood sugars based on a patient's sensitivity

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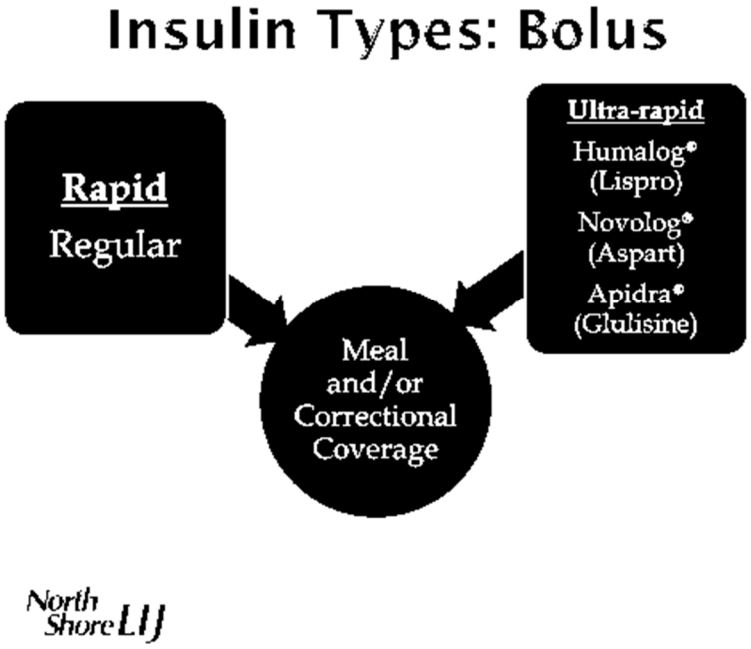
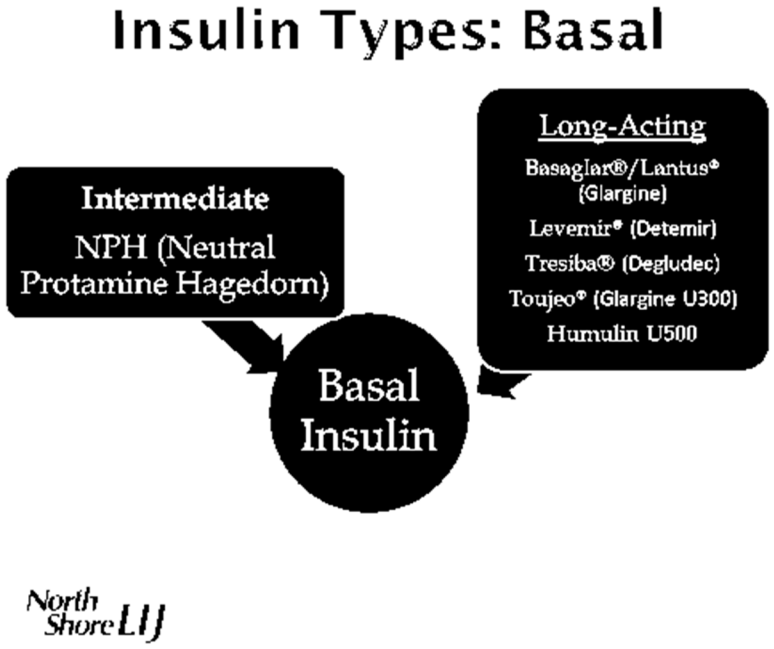
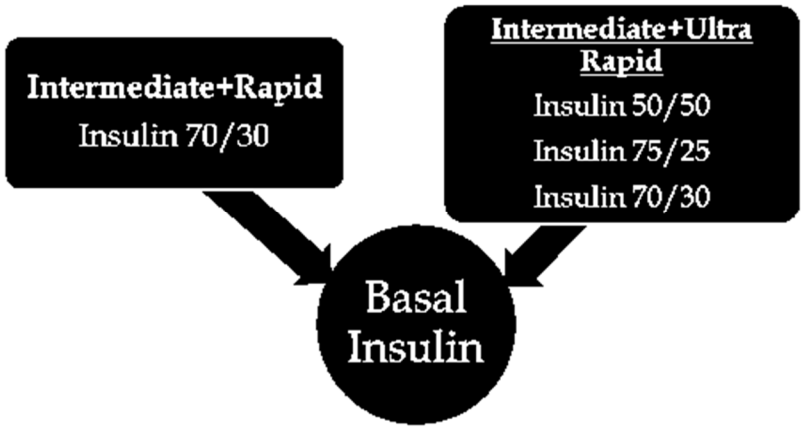

Insulin Types: Bolus
Rapid
Regular
Ultra-rapid
Humalog® (Lispro)
Novolog® (Aspart)
Apidra® (Glulisine)
Meal and/or Correctional Coverage
North Shore LIJ


Insulin Types: Basal
Intermediate
NPH (Neutral Protamine Hagedorn)
Long-Acting
Basaglar®/Lantus® (Glargine)
Levemir® (Determir)
Tresiba® (Degludec)
Toujeo® (Glargine U300)
Humulin U500
Basal Insulin
North Shore LIJ

Insulin Types: Pre-Mixed



North Shore LIJ

Onset of Action

Table 2 - Types of insulin and their actions

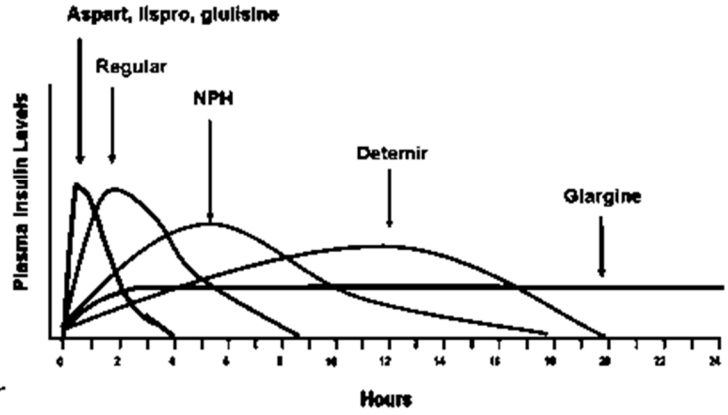
Type of insulin	Onset of action	Peak of action	Total duration
Short and rapid action			
Regular	30-60 minutes	2-4 h	6-9 h
Aspart, lispro, glulisine	10-15 minutes	30-90 minutes	3-4 h
Intermediate action			
NPH	1-2 h	3-8 h	12-15 h
Basal insulin			
Glargine	1-2 h	no peak	24 h
Detemir	1-2 h	no peak	24 h
Premixed insulin			
70/30 NPH/regular	30-60 minutes	3-8 h	12-15 h
75/25 NPH/lispro	10 -15 minutes	30 min-8 h	12-15 h

NPH = neutral protamine Hagedorn.[a]

Schmid H. J Pediatr 83: S146-154, 2007.

North Shore LIJ

Action of Insulin



Hirsch IB. Skyla[illegible]. Chapter 17. The Management of Type 1 Diabetes. http://www.endotext.org/diabetes/diabetes17/diabetesframe17.htm

Hyperglycemia

- Pancreas
  - T1DM/T1.5DM
  - Acute Inflammation
  - Cancer
  - Secondary Causes
- Human
  - Poor insulin absorption
  - Poor administrative technique
  - Eating too many carbs
  - Taking too little Insulin
  - Infection/Cancer

"...I was hoping you'd let me know how much more insulin I need to take if I decide to 'super-size' my order."

© 2004 Diabetes Health

Case 1

Ms. G is a 53 yo female with hx of T1DM (A1C 7.7%) for 25 years with retinopathy, pvd s/p L BKA, gastroparesis and cad s/p CABG who presents with 2 days of R LE edema and erythema consistent with cellulitis. On presentation to the ED her vitals are as such: T-98.5, P-108, BP-111/72, R-18, PO 98% on RA. Physical Exam is normal except R LE erythema and edema associated with tenderness to touch. Labs are as noted:

Sodium, Serum		134
Potassium, Serum	↓	3.4
Chloride, Serum	↓	93
Carbon Dioxide, Serum		23
Anion Gap, Serum	↑	18
Blood Urea Nitrogen, Serum		15
Creatinine, Serum		0.98
Glucose, Serum	↑	273
Calcium, Total Serum		9.0
eGFR if Non African American		66
eGFR if African American		76

WBC Count	↑	12.0
RBC Count		4.42
Hemoglobin		12.8
Hematocrit		39.2
Mean Cell Volume		88.6
Mean Cell Hemoglobin		29.1
Mean Cell Hemoglobin Conc		32.8
Red Cell Distrib Width		14.0
Platelet Count - Automated		303

North Shore LIJ

What are the possible causes of her hyperglycemia?
What other labs would you like to know?

Case 1

The following morning Ms. G is admitted to the floor at 4am. She has been treated only with IVPB clindamycin.

WBC Count		10.5
RBC Count		3.91
Hemoglobin	↓	11.4
Hematocrit		35.1
Mean Cell Volume		89.6
Mean Cell Hemoglobin		29.2
Mean Cell Hemoglobin Conc		32.6
Red Cell Distrib Width		14.2
Platelet Count - Automated		294

Sodium, Serum		132
Potassium, Serum		3.5
Chloride, Serum	↓	93
Carbon Dioxide, Serum	↓	20
Anion Gap, Serum	↑	19
Blood Urea Nitrogen, Serum		17
Creatinine, Serum		0.99
Glucose, Serum	↑	355
Calcium, Total Serum		8.9
eGFR if Non African American		65
eGFR if African American		75
Lactate, Serum	1.2	

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What are the possible causes of her early morning hyperglycemia?
What other labs would you like to know?

Case 1

On night #2, the patient received Lantus 10 units sq and the following day her labs are thus:

Sodium, Serum		135		133
Potassium, Serum		4.4		4.2
Chloride, Serum	↓	95	↓	93
Carbon Dioxide, Serum	↓	21	↓	21
Anion Gap, Serum	↑	19	↑	19
Blood Urea Nitrogen, Serum		22		19
Creatinine, Serum		0.92		0.89
Glucose, Serum	* ↑↑	538	↑↑	460
Calcium, Total Serum		8.6		8.6
eGFR if Non African American	*	71	*	74
eGFR if African American		82		86
Ammonia, Serum				
Acetone, Serum	1	Moderate		

What is the diagnosis?
How should Ms. G be managed?

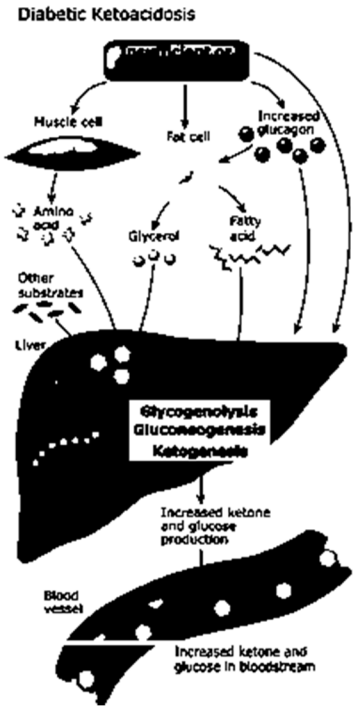
DIABETES EMERGENCY!!!
NPO, Insulin and IVF stat!

DKA:
- PH <7.3
- HCO3 <18
- +ketones in the urine
- Glucose > 200

Hyperosmolar Hyperglycemia:
- PH > 7.4
- HCO3: Normal
- Trace Ketones
- Glucose >600

3x greater mortality with HHS than DKA!!!!

http://dtc.ucsf.edu/living-with-diabetes/complications/diabetic-ketoacidosis



Ms. G Continued

Ms. G is made NPO and treated with 250cc of IVF as well as 20 units NPH and 10 units regular insulin. A BMP is repeated in 2 hours. At that time her gap has closed and her serum glucose is in the 300s so at her request she gets 20 units more of regular insulin. That night she is treated with Lantus 55 units and awakens at 179 the following morning.

All patients with T1DM require basal insulin every day!

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Ms. P is a 25 year old female with T1DM who presents to the ED with a serum glucose of HIGH. There is concern for DKA. All of the following are true about the management of DKA except:

a) Volume replacement is important
b) Regular insulin IVP can be used as the sole insulin to manage DKA
c) Patients should be NPO until the bicarbonate is at least 18 and the gap is closing
d) Untreated DKA can be fatal

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Case 2

Mr. B is a 38 yo male with no PMH who presents with 3 hours of 10/10 burning pain in his epigastrium associated with L arm numbness. On presentation to the ED his vitals are as such: T-99.1, P-119, BP-117/69, R-20, PO 95% on RA. Physical Exam is normal except epigastric tenderness. Labs are as noted:

WBC Count	↑	15.9
RBC Count	* ↓	3.63
Hemoglobin	↓	12.2
Hematocrit	↓	33.2
Mean Cell Volume		91.3
Mean Cell Hemoglobin		33.6
Mean Cell Hemoglobin Conc	↑	36.8
Red Cell Distrib Width	↑	15.5
Platelet Count - Automated		218

Sodium, Serum	*	135
Potassium, Serum	*	3.7
Chloride, Serum	↓	91
Carbon Dioxide, Serum		22
Anion Gap, Serum	↑	22
Blood Urea Nitrogen, Serum	↓	2
Creatinine, Serum		0.73
Glucose, Serum	↑	378
Calcium, Total Serum		8.8
eGFR if Non African American	*	118
Lipase, Serum	↑	1107

What are the possible causes of his hyperglycemia?
What other labs/imaging would you like?
What are the diagnoses?

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Case 2

The ED orders a CT abd/pelvis which shows:

IMPRESSION: 1. Findings compatible with acute pancreatitis. No drainable peripancreatic fluid collection. No intrahepatic or extrahepatic biliary dilatation.
2. Mildly dilated, prominent distal duodenum, duodenojejunal junction and proximal jejunum, likely reactive or ileus given adjacent inflamed pancreas. No bowel obstruction.
3. Enlarged, fatty liver.

How would you further manage this patient with pancreatitis and DKA?

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Transitioning from Insulin Infusions

Transitioning from IV insulin drip

- Look at the hourly rate for the past 4-6 hours. Take the average and multiply by 24.
- Add up the requirement for the past 24 hours and give about 80% of the total.

- Ex: Mr. B is getting 2-3u/hr the past 6 hours, so 2.5 x 24 is 60. 80% of 60 is 48.
- 50% of 48 is basal and 50% of 48 is bolus.
- Give 24 units of lantus and stop the gtt 2 hours later. Also order lispro (Humalog) 6 units tid-ac if he is eating and moderate correctional scale.

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Discharge of the Patient with T1.5 Diabetes

- Formerly known as Flatbush diabetes, Ketosis-Prone T2DM or Type 1B
- Patients temporarily lose their insulin-production capabilities -> DKA
- Patients are often African descent, obese and or FH
- MUST discharge with basal/bolus insulin -> can resume oral agents after 2-3 months

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HEALTH SCIENCE CENTER AT BROOKLYN · STATE UNIVERSITY OF NEW YORK ·

Umpierrez GE. Diabetes Care 28: 2755-2757

Mr. X has T1.5DM managed at home with metformin and glyburide. He was admitted to NSUH three days ago with DKA. He should be discharged on:

a) Metformin and glyburide
b) Metformin alone
c) Metformin and Glargine
d) Glargine (Lantus®) and Lispro (Humalog®)

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Case 3

Chief Complaint/Reason for Admission:
Chief Complaint/Reason for Admission Abscess and rash

History of Present Illness:
HPI
This is a 46 y/o male with primary history of HTN, Diabetes type 2 (insulin Dependent) presents to Ed complaining of severe swelling and pain at the right side of abdomen that onset a week ago. Pt reports that he has been using the same insulin syringe for the past year Pt states the pain is 5/10 and constant using numeric scale. He denies any chest pain , headaches, sob , fever or chills. He reports that he had no sick contact or recent travel.

Allergies/Medications:
Allergies:
No Known Allergies

Home Medications:
"Incomplete Medication History as of 25-Apr-2015 16:29 documented in Prescription Writer
- **Insulin: , once a day**

PMH/PSH/FH/SH:
Past Medical History:
Diabetes mellitus
Hypertension.

Family History:
No pertinent family history in first degree relatives.

Problem/Plan . 2:
- Problem. 2. Diabetes mellitus. Plan Fs Ac/HS
Corrective sliding scale
HgbA1c
Low carb diet
DM Pt education

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Case 3 continued

Column Date/Time	Blood Glucose Puncture Site(1,3)	Blood Glucose (mG/dL)	(70-99) Bio	WOL	Cell Comment	ObsSummaryLin
27-Apr-2015 12:37	Fingertip	363		No		
27-Apr-2015 08:13	Fingertip	325		No		
26-Apr-2015 21:43	Fingertip	353		No		
26-Apr-2015 17:07	Fingertip	349		No		
26-Apr-2015 12:33		368		No		
26-Apr-2015 08:46		332		No		
25-Apr-2015 23:55	Fingertip	311		No		

The patient had no problem articulating that his outpatient regimen is:

~~Detemir (Levemir®) 70 units sq bid~~

~~Lispro (Humalog®) 15 units tid ac~~

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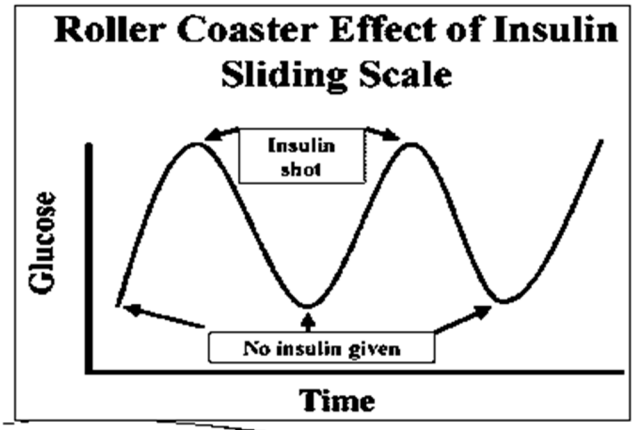

North Shore LIJ

Schaeffer A, Weinberg M, Rushakoff RJ. Endotext.web. Chapter 19. Management of the Hospitalized Diabetic Patient. http://www.endotext.org/diabetes/diabetes19/diabetes19.htm

Case 4

- 67 y.o. male with hx of T2DM for 15 years and ESRD on HD T/Th/Sat after having a R/L nephrectomy for renal cell ca. He is currently being treated with lantus 12 units sq qhs and humalog 3 units tid-ac with a small sliding scale. His blood sugars are:

	Breakfast	Lunch	Dinner	Bedtime

- Why was his sugar low at breakfast?
- What happened at lunchtime?

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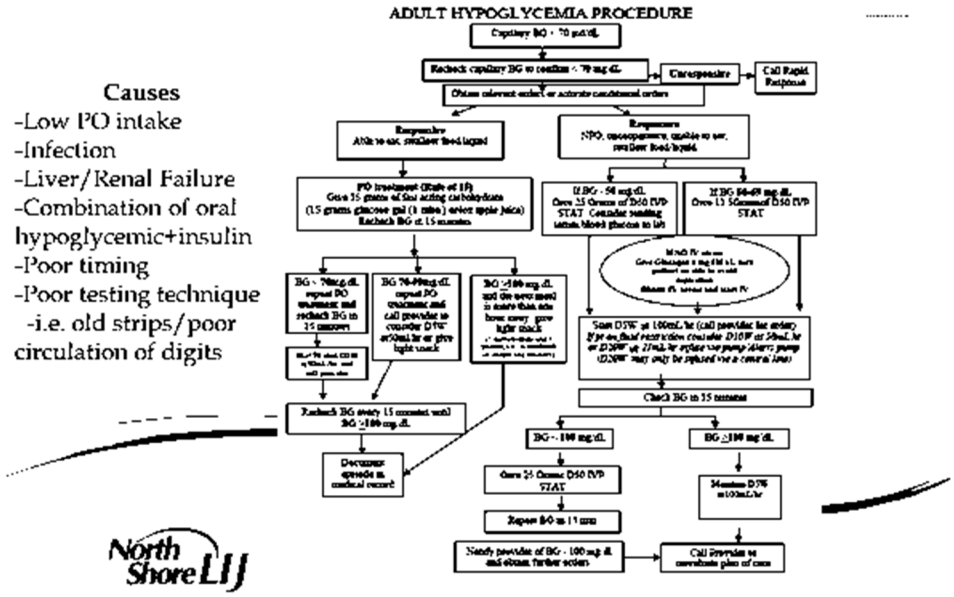
Management of Hypoglcyemia

Causes

-Low PO intake
-Infection
-Liver/Renal Failure
-Combination of oral hypoglycemic+insulin
-Poor timing
-Poor testing technique
-i.e. old strips/poor circulation of digits



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Association between CKD and hypoglycemia

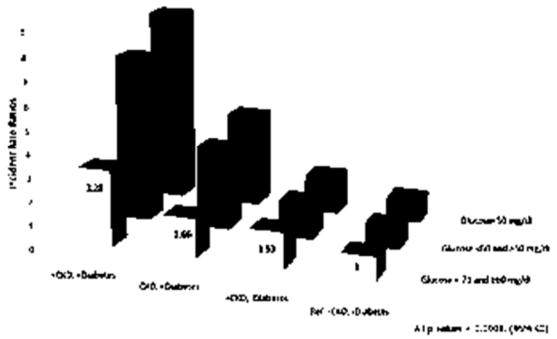

Figure 1. Risk for hypoglycemia of varying severity and expressed as an adjusted incidence rate ratio in veterans classified by presence or absence of chronic kidney disease (CKD) and diabetes. Reference group are veterans without CKD or diabetes. Rates adjusted for race, gender, age, Charlson comorbidity index, cancer, diabetes, and cardiovascular disease (all rate ratios P < 0.0001).

Zhan M, Hsu VD, Walker LD. Frequency of Hypoglycemia and its Significance in Chronic Kidney Disease. Clinical Journal of the American Society of Nephrology. 1121-1127. 2009

Ms. G is a 60 year old female with T2DM treated with glipizide XL 10mg po bid who was admitted with hypoglycemia. Which is the likely cause of her hypoglycemia?

A) Poor PO Intake
B) Acute Renal Failure
C) A and B
D) Insulinoma

Conclusions

- The preferred treatment for patients is to provide them with bolus, pre-meal and correctional dose insulin.
- Assessment of po intake, medications, and renal function are all important in determining how to manage blood sugars.
- Both hyper and hypoglycemia need to be addressed immediately to ensure patient safety.

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Resources

- North Shore Inpatient Diabetes Team
  - Alyson Myers, MD (516) 975-0578, 9am-6pm
  - Patricia Garnica, NP/CDE (516) 975-1920, M-W,F 8am-6pm
  - Anne-Marie Hasse, RN/CDE (516) 975-1196, 7am-3pm
  - After hours/weekends: HealthPort for Endo Fellow On Call
- Diabetes Champions at NS/LIJ
- Registered Dieticians
- Inpatient Diabetes Classes: 1st and 2nd Tuesday and 3rd and 4th Thursday at 1030AM, 4 Monti
- Outpatient Wellness Classes: 855-36-GOALS
- Shared Point
- American Diabetes Association Website

North Shore LIJ

Sources

- Alish CJ, Timothy Garvey W, Maki KC, Sacks GS, Hustead DS, Hegazi RA, Mustad VA. 2010. A Diabetes-Specific Enteral Formula Improves Glycemic Variability in Patients with Type 2 Diabetes. Diabetes Technology & Therapeutics, 12: 419–425.
- Hirsch IB, Sylar JB. Endotext.web. The Management of Type 1 Diabetes. Available at: http://www.endotext.org/diabetes/diabetes17/diabetesframe17.htm Accessibility verified November 7, 2012.
- Larsen J, Gardner. 2011. Approach to the Hospitalized Patient with
- Severe Insulin Resistance. J Clin Endocrinol Metab, 96:2652–2662
- Miller DB, O'Callaghan JP 2002. Neuroendocrine Aspects of the Response to Stress. Metabolism 51: 5-10.
- Moen MF, Zhan M, Hsu VD, Walker LD. 2009. Frequency of Hypoglycemia and its Significance in Chronic Kidney Disease. Clinical Journal of the American Society of Nephrology. 1121-1127.
- Oakes EE, Cole L. Diabetic Ketoacidosis Resource Folder. Available at: http://intensivecare.hsnet.nsw.gov.au/wp-content/doc/education_packages/nepean/nepean_guide_DKA_2007.pdf. Accessibility verified February 2, 2013.

Sources

Schaeffer A, Weinberg M, Rushakoff RJ. Endotext.web. Management of the Hospitalized Diabetic Patient. Available at: http://www.endotext.org/diabetes/diabetes19/diabetes19.htm. Accessibility verified November 2, 2012.

Schmid H 2007. New Options in Insulin Therapy. J Pediatr 83:S146-154.

Tridgell DM, Tridgell AH, Hirsch IB . 2010. Inpatient Management of Adults and Children with Type 1 Diabetes. Endocrinology and Metabolism Clinics. 39.

Umpierrez GE, Hellman R, Korytkowski MT, Kosiborod M, et al 2012. Management of Hyperglycemia in Hospitalized Patients in Non-Critical Care Setting: An Endocrine Society Clinical Practice Guideline. JCEM 97: 16-18.

Umpierrez GE. Ketosis-Prone Type 2 Diabetes Time to revise the classification of diabetes 2006. Diabetes Care 29: 2755-2757.

Verspohl EJ. Novel Pharmacological Approaches to the Treatment of Type 2 Diabetes 2012. Pharmacological Reviews 64: 188-237.

Any questions?

North Shore LIJ

Perioperative Management of Patients with Diabetes

Steven Herling, DO

Medical Director, Pre-Surgical Testing

North Shore University Hospital

Objectives

- Management of pre-op patient on oral and non oral hypoglycemic agents.
- Management of pre-op patient on insulin.
- Optimal intraoperative glucose levels.

- A patient typically wakes up in the morning with a blood glucose of 150 mg/dl. They do not report having symptomatic hypoglycemia. They take 40 units of Lantus® at bedtime. On the night before surgery, the patient should take how much Lantus®?

a) 40 units
b) 20 units
c) 0 units
d) 60 units

- A patient with Type 2 diabetes arrives to the hospital for their carpal tunnel release surgery. The fingerstick on admission is 320 mg/dl. Do you cancel the case?

a) Yes, Cancel the surgery.
b) No, Move forward with the surgery as scheduled.
c) Not enough information provided to make a decision.

- The preferred method of treating hyperglycemia in the peri-op period is:

a) Humalog subcutaneous.
b) Regular insulin subcutaneous.
c) Regular insulin drip.
d) Humalog IV push.

Hyperglycemia

- Dehydration
- Fluid shifts
- Electrolyte abnormalities
- Predisposition to infection
- Impaired wound healing
- Ketoacidosis
- Hyperosmolar states

American Association of Clinical Endocrinologists (AACE) and American Diabetes Association (ADA)

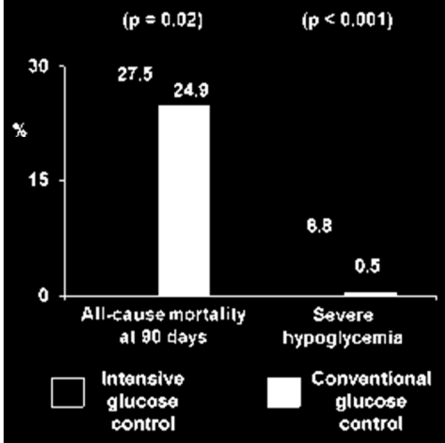
Clinical Recommendations:

- Hospitalized
- Critically ill

Did not address ambulatory procedures or elective surgery

NICE-SUGAR

Trial design: Patients admitted to the ICU were randomized to intensive glucose control (81-108 mg/dl; n = 3,054) vs. conventional glucose control (<180 mg/dl, n = 3,050). Insulin was given intravenously and nutrition was given enterally.



- All-cause mortality at 90 days: 27.5% for intensive group vs 24.9% for conventional group (p = 0.02)
- All-cause mortality at 28 days: 22.3% vs. 20.8% (p = 0.17), respectively
- Severe hypoglycemia: 6.8% vs. 0.5% (p < 0.001), respectively

- Among patients admitted to the ICU, intensive glucose control increased mortality an absolute 2.6% at 90 days
- Severe hypoglycemia was more common in the intensive control group

NICE-SUGAR Investigators. N Engl J Med 2009;360:1283-97

Society of Ambulatory Anesthesia

Joshi, Girish P., et al. "Society for Ambulatory Anesthesia Consensus Statement on Perioperative Blood Glucose Management in Diabetic Patients undergoing Ambulatory Surgery." *Anesthesia & Analgesia* 111.6 (2010) 1378-1387

Primary Goals of Consensus Statement

- Avoidance of hypoglycemia
- Maintain adequate glucose control

Preoperative Information

- HbA1c

A1C	eAG	
%	mg/dl	mmol/l
6	126	7.0
6.5	140	7.8
7	154	8.6
7.5	169	9.4
8	183	10.1
8.5	197	10.9
9	212	11.8
9.5	226	12.6
10	240	13.4

Formula: 28.7 X A1C – 46.7 = eAG

Preoperative Information

Type and dose of antidiabetic therapy-

- Oral
- Insulin

➢ Occurrence and frequency of hypoglycemia

➢ Manifestations of hypoglycemia

➢ Blood glucose level at which symptoms occur

➢ Ability to reliably test and understand and manage Diabetes

How do we manage Preoperative Oral Antidiabetic & non-insulin injectable therapy?

- Hypoglycemia rarely occurs
- No evidence metformin associated with increased risk of perioperative lactic acidosis
  - Renal dysfunction
  - IV contrast
- May not be necessary to discontinue oral antidiabetics before the day of surgery
- Hold on a day of surgery until normal food intake resumed

How do we manage preoperative Insulin Therapy?

- Basal-bolus regimen
- Minimal alteration in basal component unless
  - Hypoglycemia
    - At night
    - In morning
    - With missed meals
  - Possibly diet restriction e.g. bowel prep
  - Insulin in combination with oral antidiabetics
  - Intermediate- acting insulins with peak effect (NPH)
    - May experience hypoglycemia if meal omitted

Preoperative Management- continued

Plan should consider:

- Preop glycemic control – fasting and HbA1c
  - Tight control
  - Wide range in daily values
  - Complex regimens
  - Patients ability to check blood glucose & follow instructions
  - Timing of surgery and expected time to resumption of regular diet

Insulin Regimen	Day Before Surgery	Day of Surgery
Insulin pump	no change	No change
Long acting, peakless insulins	No change	75-100% morning dose
Intermediate-acting insulins	No change in daytime dose 75% evening dose	50-75% morning dose
Fixed combination insulins	No change	50- 75% morning dose of intermediate component
Short and rapid acting insulin	No change	Hold the dose
Non insulin injectables	No change	Hold the dose

Is there a specific blood glucose level above which one should postpone elective surgery?

- Insufficient data for specific level
- Preop hyperglycemia commonly due to
  - Inappropriate discontinuation of antidiabetic therapy
  - Preop stress response

- Proceed in patient with preoperative hyperglycemia but adequate long term control
- Chronically poorly controlled diabetes
  - Consider comorbidities
  - Potential risks of surgical complications
    - Delayed wound healing
    - Wound infection

What is optimal intraoperative blood glucose level?

No evidence any particular blood glucose is beneficial or harmful for patients undergoing ambulatory surgical procedures.

- AACE/ADA consensus statements
- Society of Thoracic Surgeons
  - Well controlled patients
    - Intraoperative blood sugar target ~ 180
    - Higher is acceptable if short procedure, expected to resume oral intake and antidiabetic therapy

What is optimal intraoperative blood glucose level?

- Poorly controlled patients
  - Maintain BS near preoperative baseline
    - Threshold for experiencing symptoms and organ impairment dynamic
    - Altered counter regulatory response
    - May increase oxidative stress response
    - May increase perioperative morbidity and mortality

How do we maintain optimal blood glucose level?

Type of insulin

- SQ rapid-acting insulin analogs preferred over regular insulin
  - (superior pharmacokinetics)

- Route (IV vs. SQ)
  - IV bolus not recommended
    - Short duration of action
    - Significant fluctuations in BS

- Umpierrez, Guillermo E., et al. "Randomized study of basal-bolus insulin therapy in the inpatient management of patients with type 2 diabetes undergoing general surgery (RABBIT 2 surgery)." *Diabetes care* 34.2 (2011): 256-261.

SQ vs. IV infusion

- SQ route recommended for non-critically ill patients
- IV infusion requires frequent monitoring
- IV infusion not practical for outpatient setting
- SQ provides similar control to IV infusion
- Beware of "stacking"

V infusion, need to run D5W

Dosing Schedule

Basal-bolus preferred over SSI

- Umpierrez, Guillermo E., et al. "Randomized study of basal-bolus insulin therapy in the inpatient management of patients with type 2 diabetes undergoing general surgery (RABBIT 2 surgery)." *Diabetes care* 34.2 (2011).
-

The Journal of Clinical Endocrinology & Metabolism 2012 97:1

"Rule of 1800" or "Rule of 1500"

Divide by the total daily dose of insulin

Example: TDD = 60 units

Each unit will lower blood glucose 25-30 mg/dl

Other Considerations

- First case, if possible
- Adequate preoperative hydration
  - Water until 2 hours preop
- Adequate intraoperative hydration
  - 20- 40cc/kg
- Aggressive PONV prophylaxis
- Allows early resumption of oral intake
- Dexamethasone 4mg
  - Less increase in blood glucose
  - Similar PONV prophylaxis

Lykre MB, Mannion PH. Hyperglycemia in patients administered dexamethasone for craniotomy. Anesth Analg 2005; 100:1228–33

Optimal perioperative blood glucose monitoring interval?

- All patients: blood glucose on arrival and before discharge
- No intraop testing if procedure less than 2 hours
- Point of care monitors overestimate BS during hypoglycemia – higher level as alert

How should we manage perioperative hypoglycemia?

- Maintain high index of suspicion
- Low HbA1c
- Tightest glycemic control
- Labile control
- History of frequent hypoglycemia
- Geriatric patients experience less hypoglycemic symptoms

- Use of peakless basal insulin analogs or insulin pumps result in fewer episodes of hypoglycemia
- *Gough, Stephen C.L. A review of human and analogue insulin trials. Diabetes Research and Clinical Practice , Volume 77, Issue 1 , 1 - 15*

Hypoglycemia Symptoms

- Sweating
- Palpitations
- Weakness
- Fatigue
- Confusion
- Behavior changes
- Seizure
- Loss of consciousness
- Death

Hypoglycemia Unawareness

- Long standing Diabetes
- Repeated episodes of hypoglycemia
- Autonomic dysfunction
- Impairment or loss of warning symptoms
- Much more common in Type 1 Diabetes

Hypoglycemia Treatment

Awake- 10-25 grams glucose

- clear liquid

  juice, soda, sugary drink

-if unable to ingest

  glucagon 1 mg SQ

IV access – 20-50 ml D50%

Treatment related hyperglycemia may be transient

PACU Discharge Criteria

Need to exclude possibility of hypoglycemia from perioperative Insulin administration

SQ Rapid Acting	*1.5 hours*
SQ regular insulin	*3-4 hours*

- A patient typically wakes up in the morning with a blood glucose of 150 mg/dl. They do not report having symptomatic hypoglycemia. They take 40 units of Lantus® at bedtime. On the night before surgery, the patient should take how much Lantus®?

a) 40 units

- A patient with Type 2 diabetes arrives to the hospital for their carpal tunnel release surgery. The fingerstick on admission is 320 mg/dl. Do you cancel the case?

b) No, Move forward with the surgery as scheduled.

- The preferred method of treating hyperglycemia in the peri-op period is:

a) Humalog subcutaneous.

Resources

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Insulin Pumps

Inpatient Policy and Procedure

Patricia Garnica ANP-BC, CDE

Sharon Hasfal ANP-BC

Objectives

- To ensure patient's safe self-administration of insulin via a personal insulin pump while in the hospital
- To provide guidelines to staff regarding the appropriate process for a patient to ***self manage*** their diabetes while using their personal insulin pump.

Insulin Pump

An insulin pump is a Continuous Subcutaneous Insulin Infusion (CSII) device.

Basic Concepts Of Insulin Pump Therapy

- Part of care in patients (of all ages) with Type 1, Type 2 and Gestational Diabetes
- Patient driven
- Aims to mimic the body's insulin secretion lowering the risk of hypoglycemia
- An insulin pump **ONLY** uses rapid acting insulin (Humalog, Novolog, Apidra) or short acting insulin (Regular U-100 or U-500)
- Insulin is delivered in two ways:
  - **Basal:** Continuous insulin delivery through out the day
  - **Bolus:** Delivery of insulin required with meals and/or to correct hyperglycemia.

Insulin Pumps Facts

- Battery-powered device
- Delivers programmed basal insulin automatically
- Programmed for bolus delivery by patient
- A Teflon catheter has an introducer needle that is withdrawn when the catheter is in place.
- The insertion site is changed every 2days (Apidra insulin) or 3 days (all other rapid or short acting insulins)

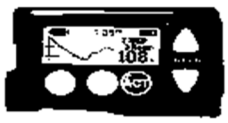
Types of Insulin Pumps

With tubing

Without tubing

Brands of Insulin Pumps

- Medtronic



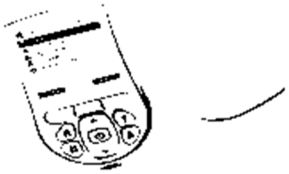
- Animas

- Roche Accu-Chek Spirit Combo

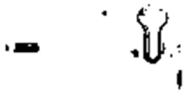
Brands of Insulin Pumps

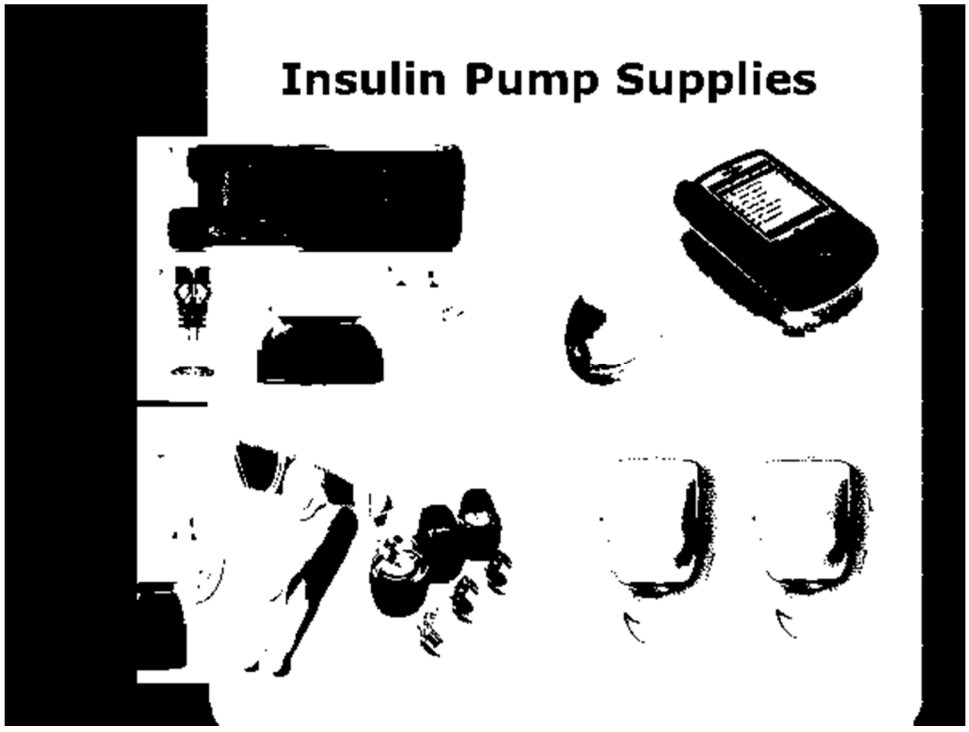
- Tandem

- OmniPod



- V-Go

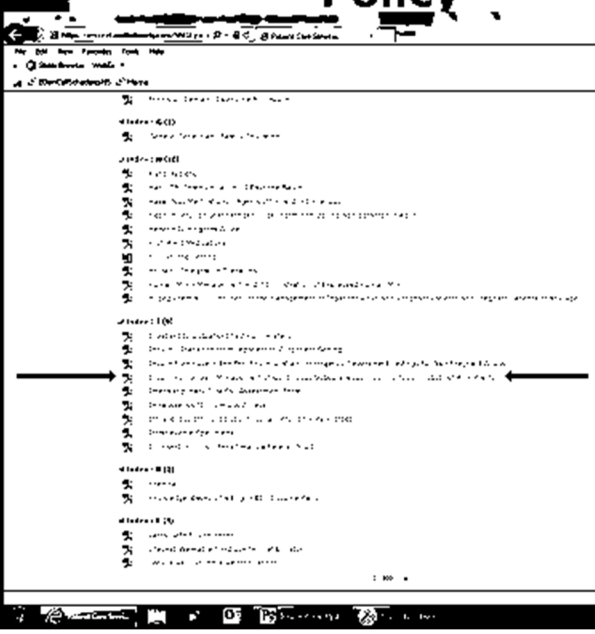



Insulin Pump Supplies

You have a patient with an insulin pump: What next...

- Call endocrine consult on ALL patients with an insulin pump: Contact number in health port (Endocrine: 516 708 2540 at NSUH)
- Patient needs to complete the insulin pump attestation form and the insulin pump adult assessment form (found in forms on demand under letter "I")
- Check the insertion site and document it in the H&P and whenever assessing the patient
- Discontinue any orders for SQ insulin unless patient needs to come off the pump

here to find the Insulin Pump Policy



Endocrine Consult

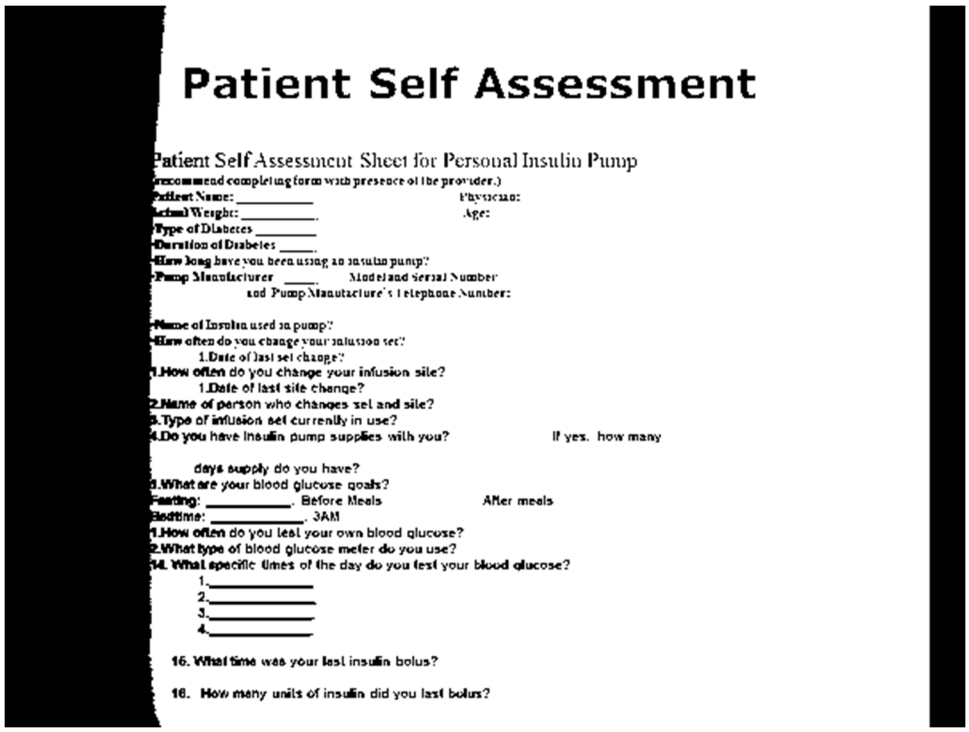
- ALL patients with an insulin pump require an endocrine consult within the first 24 hours of admission
- The contact number for inpatient endocrine consult is found in health port (516-708-2540 at NSUH)
- When calling provide the following information:

1. Patient's name and location
2. Diabetes Type (T1DM, T2DM, Gestational DM)
3. Blood glucose level
4. Insulin pump brand
5. Name of outpatient endocrinologist

Patient Attestation Form

- Patients, significant others, parents and legal guardians are required to sign an attestation consenting to self manage their personal insulin pump. A provider MUST sign this attestation
- If they refuse to sign the attestation the pump will need to be discontinued and the insulin administered in an alternative route

Attestation for Adult Patient Significant Other Emancipated Minor Self Management of Personal Insulin Pump: Continuous Subcutaneous Insulin (CSII)



Patient Self Assessment

Patient Self Assessment Sheet for Personal Insulin Pump

(I recommend completing form with presence of the provider.)

Patient Name: _____ Physician:

Actual Weight: _____. Age:

Type of Diabetes _____

Duration of Diabetes _____.

How long have you been using an insulin pump?

Pump Manufacturer _____. Model and Serial Number

and Pump Manufacturer's Telephone Number:

Name of Insulin used in pump?

How often do you change your infusion set?

1.Date of last set change?

1.How often do you change your infusion site?

1.Date of last site change?

2.Name of person who changes set and site?

3.Type of infusion set currently in use?

4.Do you have insulin pump supplies with you? If yes, how many

days supply do you have?

5.What are your blood glucose goals?

Fasting: _____. Before Meals After meals

Bedtime: _____. 3AM

1.How often do you test your own blood glucose?

2.What type of blood glucose meter do you use?

14. What specific times of the day do you test your blood glucose?

1._____

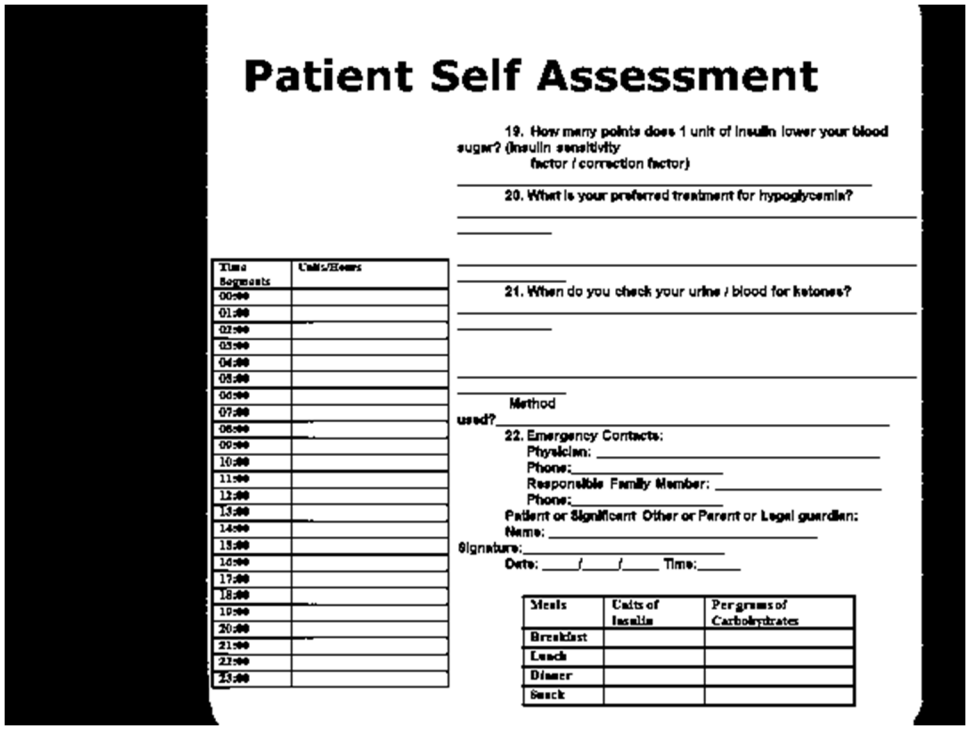
2._____

3._____

4._____

16. What time was your last insulin bolus?

16. How many units of insulin did you last bolus?



Patient Self Assessment

19. How many points does 1 unit of insulin lower your blood sugar? (Insulin sensitivity factor / correction factor)

_____

20. What is your preferred treatment for hypoglycemia?

_____

_____

21. When do you check your urine / blood for ketones?

_____

_____

_____

_____

Method used?_____

22. Emergency Contacts:

Physician: _____

Phone:_____

Responsible Family Member: _____

Phone:_____

Patient or Significant Other or Parent or Legal guardian:

Name: _____

Signature:_____

Date: ____/____/____ Time:_____

Time Segments	Units/Hours
00:00	
01:00	
02:00	
03:00	
04:00	
05:00	
06:00	
07:00	
08:00	
09:00	
10:00	
11:00	
12:00	
13:00	
14:00	
15:00	
16:00	
17:00	
18:00	
19:00	
20:00	
21:00	
22:00	
23:00	

Meals	Units of Insulin	Per grams of Carbohydrates
Breakfast		
Lunch		
Dinner		
Snack		

Providers Responsibilities

Assess patient's ability and competency for using the personal insulin pump

Call Endocrine consult (House endocrine team or private endocrinologist if he/she follows inpatient insulin pumps)

Make sure the attestation and assessment forms are filled out, signed and placed in patient's chart

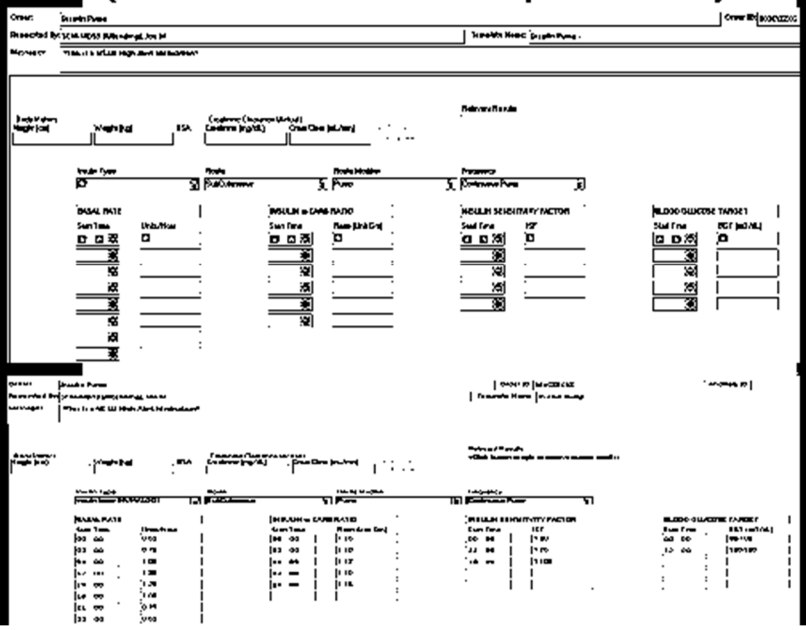
Consult for Nutrition, Clinical Pharmacist, and/or Certified Diabetes Educator (CDE) as needed

Surgical patients need approval from Anesthesia for OR setting

Providers Responsibilities

- Write order that patient, significant other, parent or legal guardian may self manage insulin pump
- Enter insulin orders in Sunrise including type of insulin to be used (Novolog, Humalog, Apidra, Regular insulin (U-100 or U-500)
- Basal, bolus, correction factor rates and blood glucose goals
- Verbal orders are not accepted. Contact endocrine team for assistance as needed.

Entering insulin pump orders in sunrise (Call endocrine team for help if needed!!)



Providers Responsibilities

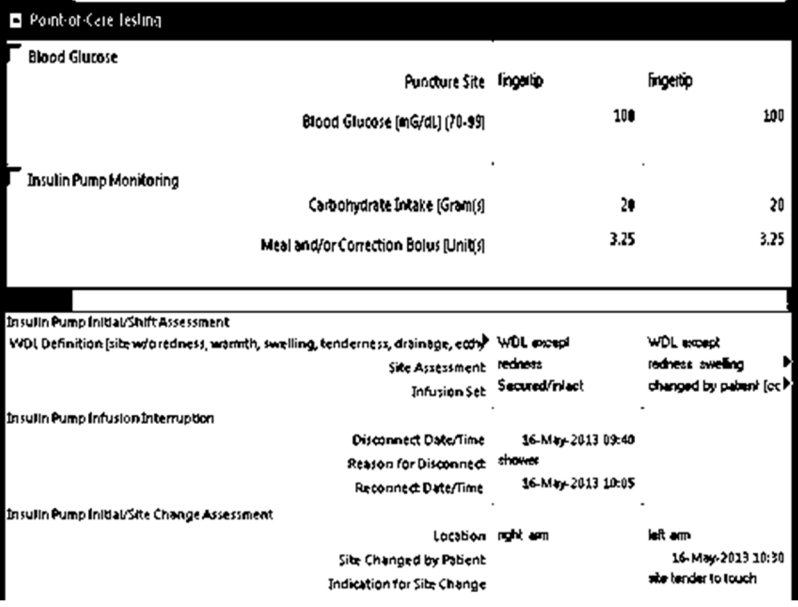
Write orders for:

- Frequency of blood glucose monitoring
- Blood glucose notification parameters or the default of < 70 or >then 250 will be instituted
- Removal of the personal insulin pump prior for any radiological procedures
- Temporary insulin orders if patient is disconnected or removed from the personal insulin pump

Patient, Significant Other, Parent, or Legal Guardian Responsibilities

- Sign the attestation form and complete the self assessment form
- Use hospital glucose meter and insulin
- Have 3 spare sets of insulin pump supplies
- Report carbohydrate intake and insulin boluses to the nurse
- If the pump is being managed by a significant other, parent or legal guardian, **they must stay with the patient at all times during the hospitalization.**

...rise assessment parameters specific to insulin pumps (RN Responsibilities)



Contraindications for patient use of insulin pump in the hospital

Change in patient status resulting in ability to self manage pump

- Altered state of consciousness
- Critical condition
- Risk for suicide
- Emotional and behavioral issues

Patient and or parent/legal guardian does not have the capacity to manage the pump

Patient and/or parent/legal guardian declines using pump in the hospital

Other circumstances identified by health care provider

Temporary Disconnection of Insulin Pump

Do not expose the insulin pump to

- MRI
- CT Scan
- X-Rays
- Fluoroscopy

Insulin pumps with tubing MUST be disconnected

Insulin pumps without tubing (OmniPod) MUST be removed.

Reconnect or replace insulin pump RIGHT AFTER procedure.

Pt may need temporary insulin orders and blood glucose monitoring when disconnected from insulin pump

Summary
The ABC's of Insulin Pump Policy

Assess and document the presence of an insulin pump upon admission and as needed

Be sure that **ALL** orders are entered in the system including pump settings, blood glucose monitoring, and temporary disconnect or removal of insulin pump.

Contact endocrine team about **ANY** patient with an insulin pump and make sure the patient has no contraindications for its use while in the hospital (if patient unable or not willing to continue using insulin pump subcutaneous insulin MUST be started prior to removal of insulin pump).

RESOURCES

- Hospital's endocrine team: Go to Intranet> Endocrine on call info.
- Endocrine Service Phone Number: 516 708 2540 (24/7)
- Insulin Pump Super Users: Go to NP supervisors (Day/Night Shifts) for available staff

Transition of Care: From the Inpatient to the Outpatient Setting

Patricia Garnica ANP-BC, CDE

Objectives:

- The participant will be able to develop a treatment plan for the inpatient with diabetes.
- The participant will be able to develop a treatment plan for the patient who is discharged into the community.

QUESTION # 1:
Ms. T is a 54 y/o admitted with pyelonephritis and elevated glucose levels. She is diagnosed with type 2 diabetes.
Which of the following is not a survival skill that Ms. T needs to learn prior to discharge?

a. Name, dose and frequency of medications.
b. Glucose monitoring frequency.
c. Healthy eating with emphasis in carbohydrate count
d. Hypoglycemia prevention, detection and treatment
e. None of the above (She needs to learn all the above skills).

Question # 2
Ms. G is a 79 y/o with history of HTN, HLD, recurrent CHF, and T2DM on Metformin 1000 mg bid at home. Her A1C is 7.5%. She was admitted with CHF and has been on low dose correction scale with BGs 100 to 180s.
She is ready to go home. Which of the following is the <u>safest</u> discharge plan?

a. Continue Metformin and add Januvia.
b. Discontinue Metformin and start Januvia.
c. Discontinue Metformin and start glimepiride.
d. Continue lispro correction scale ac meals.

Question # 3
Ms. O is an 86 y/o with type 2 diabetes on Glyburide 10 mg qam at home. Her A1C is 6.5% and the reports 1-2 hypoglycemic episodes per week at home. Pt was admitted with PNA and is ready to be discharged to home.
What is your discharge plan for Ms. O?

a. **Decrease Glyburide to 5 mg q am.**

b. **Split Glyburide dose to 5 mg bid.**

c. **Stop Glyburide.**

d. **Switch to Glipizide XL 2.5 mg daily.**

Question # 4
Mr. J is a 45 y/o undocumented, unemployed and uninsured patient with new diagnosis of Type 1 diabetes. He was admitted on DKA and his blood glucose has improved while on glargine/lispro insulins. He is ready to go home.
Which of the following insulins will you discharge Mr. J on?

a. **Continue glargine and lispro insulins.**

b. **Switch to Novolog 70/30 insulin before breakfast and dinner.**

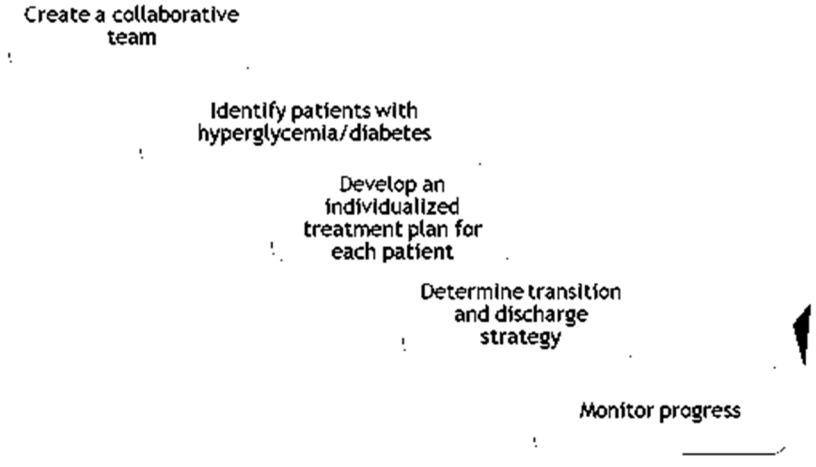
c. **Switch to Novolin 70/30 insulin before breakfast and bedtime.**

c. **Switch to Novolog 70/30 insulin before breakfast and bedtime.**

e. **Switch to Novolin 70/30 insulin before breakfast and dinner.**

Transition of Care Importance

- Pressures to discharge patient early / Shorter hospital stays / Hospital reimbursement
- Patients characteristics (Access to health care, physical/mental/social limitations)
- System barriers (fragmented care is consider one of the main barriers to transition of care)
- Readmission



Moghissi E, et al. *Endocr Pract*. 2009;15:353-369.

Transition From Hospital to Outpatient Care

- Preparation for transition to the outpatient setting should begin at the time of hospital admission
- Multidisciplinary team
  - MDs, NPs, PAs.
  - Bedside nurse
  - Clinical pharmacist
  - Registered dietitian
  - Case manager/Social worker
- Clear communication with outpatient providers is critical for ensuring safe and successful transition to outpatient management

npierrez GE, et al. *J Clin Endocrinol Metab.* 2012;97:16-38.

Patient Factors to Be Considered in Transition of Care

- Physical/self-care factors: Physical limitations (blindness, stroke, amputation, dexterity).
- Socioeconomic factors: insurance coverage, family support, access to food/medications, follow up appointments
- Psychological factors: Understanding of the disease, self care behaviors, mental problems, attitudes toward diabetes and health care.
- Disease related factors: Glycemic control prior to admission and severity of hyperglycemia while in hospital, diabetes complications, comorbidities, age, length of the disease.
- Learning factors: language, cognition, competence related diabetes self-management

Predischarge Checklist

- Treatment goals (A1C, BG levels). Consider all care factors.
- Survival skills training
- Prescriptions for diabetes medications, and diabetes supplies (insulin pen, vials pen needles or syringes, Glucose meter with strips/lancets and Glucose tablets/gel, Medi-alert bracelet).
- Contact phone numbers. PCP, Endocrinologist, Wellness program

Survival Skills to Be Taught Before Discharge

- How, how much and when to take oral medication/insulin
  - Effects of medication
- How/when to test blood glucose (SMBG)
  - Target glucose levels
- Meal planning basics
- How to prevent, detect and treat hypoglycemia
- Sick-day management plan
- Date/time of follow-up visits
  - Including diabetes education
- When and whom to call on the healthcare team
  - Available community resources

ghissi ES, et al. *Endocr Pract.* 2009;15:353-369

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c. Healthy eating with emphasis in carbohydrate count
d. Hypoglycemia prevention, detection and treatment
e. None of the above (She needs to learn all the above skills).

Patients Newly Diagnosed With Diabetes During Hospitalization

- Develop a diabetes education plan prior to hospital discharge that addresses the following:
  - Understanding of the diagnosis of diabetes
  - SMBG and explanation of home blood glucose goals
  - Definition, recognition, treatment, and prevention of hyperglycemia and hypoglycemia
  - Identification of healthcare provider who will provide diabetes care after discharge
  - Information on consistent eating patterns
  - When and how to take medication, including proper disposal of needles and syringes
  - Sick-day management

A. *Diabetes Care*. 2013;36(suppl 1):S11-S66.
delsman Y, et al. *Endocr Pract*. 2011;17(suppl 2):1-53.

Patients With Previously Diagnosed Diabetes

A1C	Indication
6.5%-7.5%	Options: • Increase dose of home noninsulin agents • Add third agent • Add basal insulin at bedtime
7.6%-9.0%	• If already on 2 noninsulin agents, add once daily basal insulin at bedtime
≥9%	• Discharge home on basal and bolus insulin regimen ▪ May use amount of basal insulin required in hospital as once daily glargine/detemir or twice daily NPH dose ▪ Continue multiple daily doses as started in the hospital if appropriate ▪ Twice daily premixed insulin may be considered for less complex insulin regimens, particularly in elderly patients and/or patients without insurance

Handelsman Y, et al. *Endocr Pract*. 2011;17(suppl 2):1-53.
Rodbard HW, et al. *Endocr Pract*. 2009;15:540-559.

What about PO meds pt was taking prior to admission?

- Can we continue?
- Should we adjust doses?
- Should we change or discontinue orals?

Factors to consider:

1. Age, Clinical condition. Co-morbidities, DM complications, new meds.
2. Blood glucose levels and A1C levels
3. Orals meds actions, side effects and contraindications.

Oral Meds considerations

Biguanides: metformin (Glucophage)

- Decrease hepatic glucose output.
- First line med at diagnosis of type 2.

Side effects: nausea, bloating, diarrhea (Use XR to minimize).

Lactic acidosis precaution: avoid in pts with creat >1.4 women, 1.5 men, during illness or surgery. ETOH abuse, CHF, EF<30.

Benefits: decreased cholesterol, no weight gain or hypoglycemia.

Lowers A1c 1.0% - 2.0%

Question # 2
Ms. G is a 79 y/o with history of HTN, HLD, recurrent CHF, and T2DM on Metformin 1000 mg bid at home. Her A1C is 7.5%. She was admitted with CHF and has been on low dose correction scale with BGs 100 to 180s.
She is ready to go home. Which of the following is the <u>safest</u> discharge plan?

a. **Continue Metformin and add Januvia.**

b. **Discontinue Metformin and start Januvia.**

c. **Discontinue Metformin and start glimepiride.**

d. **Continue lispro correction scale ac meals.**

Oral Meds considerations

Sulfonylureas:

glyburide:(Micronase, Diabeta), (Glynase), glipizide:(Glucotrol),(Glucotrol XL), glimepiride (Amaryl)

- Stimulates sustained insulin release.

Can take once or twice daily.

Side effects: hypoglycemia and weight gain.

<u>Eliminated via kidney. Caution on kidney disease, elderly>especially Glyburide!!</u>

Must eat 3 meals a day!!!

Lowers A1c 1.0%-2.0%.

Question # 3
Ms. O is an 86 y/o with type 2 diabetes on Glyburide 10 mg qam at home. Her A1C is 6.5% and the reports 1-2 hypoglycemic episodes per week at home. Pt was admitted with PNA and is ready to be discharged to home.
What is your discharge plan for Ms. O?

a. **Decrease Glyburide to 5 mg q am.**

b. **Split Glyburide dose to 5 mg bid.**

c. **Stop Glyburide.**

d. **Switch to Glipizide XL 2.5 mg daily.**

Oral Meds Considerations

▶ **Meglitinides**

repaglinide (Prandin)

nateglinide (Starlix)

- Stimulates rapid insulin burst.

Take before meals.

Side effects: hypoglycemia and weight gain.

wers A1c 1.0%-2.0%.

Oral Meds Considerations

- **Meglitinides**

repaglinide (Prandin)

nateglinide (Starlix)

- Stimulates rapid insulin burst.

Take before meals.

Side effects: hypoglycemia and weight gain.

[redacted]wers A1c 1.0%-2.0%.

Oral Meds Considerations

- **Thiazolidinediones "TZDs"**

pioglitazone (Actos)

rosiglitazone (Avandia)

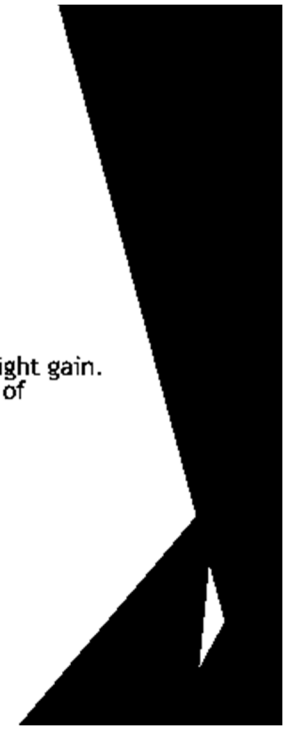
- Increase insulin sensitivity.

Black Box Warning:

TZDs may cause or worsen CHF. Monitor for edema and weight gain. Increased peripheral fracture risk. Actos may increase risk of bladder cancer.

Benefits: No hypoglycemia.

[redacted]**wers A1c 0.5%-1.0%**



Oral Meds considerations

DPP - 4 Inhibitors

sitagliptin (Januvia) (eliminated via kidney dosing adjustment).

saxagliptin (Onglyza) (eliminated via kidney dosing adjustment).

linagliptin (Tradjenta)

alogliptin (Nesina)

- "Incretin Enhancers" Prolongs action of gut hormones
- Increase insulin secretion, delayed gastric emptying.

Benefits: Neutral/no wt gain, no hypoglycemia.

Side effects: include nasopharyngitis, headache and upper-respiratory tract infection. Report signs of pancreatitis(abdominal pain, nausea, vomiting).

wers A1c 0.6%-0.8%.

Oral Meds Considerations

- **SGLT2 Inhibitors:**

Canagliflozin (Invokana)

Dapagliflozin (Farxiga)

Empagliflozin (Jardiance)

- Decrease glucose reabsorption in kidneys
- "glucoretic."

Caution: monitor B/P, K+ and renal function. If GFR<60, stop Farxiga. If GFR<45, stop Invokana. Do not start pts w/ GFR<60 on Jardiance.

Side effects: hypotension, UTIs, increased urination, genital infections. Avoid Farxiga in pts. w/bladder cancer.

enefits: Neutral or weight lost 2-3 lbs.

wers A1c 0.7% -1.5%

Case study

- 62 year old female with DM, HTN, HL, here with chest pain. Found to have STEMI. Going for card cath tomorrow in am.
- What else do you need to know about her DM?
- What labs do you order?

DM data

- T2DM x 12 years.
- A1C: 12.5%
- BG at time of assessment was 345.
- BMI: 31. Weight 90kg
- On metformin 500mg bid PTA
- Creat 0.8 at admission
- Doesn't test BG at home. Glucose meter broke
- No ophtho eval x2 years > was told having "diabetes" in her eyes.
- Denies any other DM complications
- Has no insurance. No PCP.
- NPO for card cath next day.

Next steps

- Complete H&P DM hx. Uncontrolled T2DM c/b retinopathy, add obesity to diagnosis list.
- Enter metformin 500mg bid on medication reconciliation
- Start BG monitoring ac and hs if eating and q6h once NPO.
- Think about discharge planning...
- What DM meds would you order?

Hospital Course

- Patient had cardiac cath with 2 stents placed.
- Patient developed CHF during hospitalization.
- Creatinine increased after cardiac cath from 0.9 to 1.8 improving to 1.6.
- BGs remain at goal (100s to 180s) while on glargine (Lantus) insulin 14 units at HS and Lispro (Humalog) 5 units before meals.
- Pt will be discharged home the next day.
- What to do now?

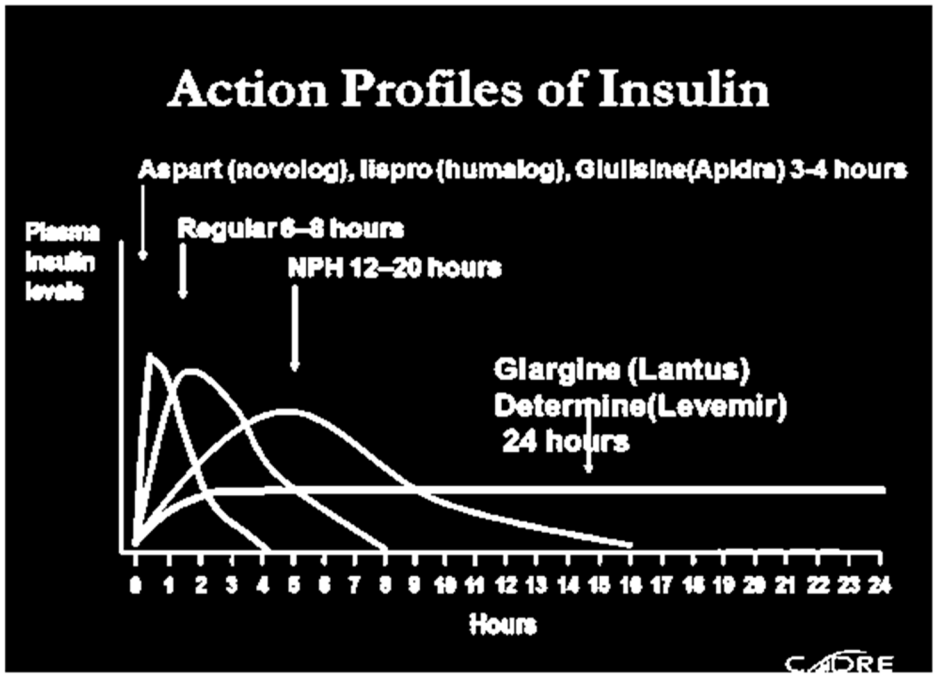
Re-assess info available

- A1C -12.5%
- On metformin PTA
- On insulin while in hospital with improved glycemic control.
- Creat improved but not at base line (0.9 to 1.6)

NO INSURANCE!!!

What next.....

- Discharge on metformin?
- Discharge on basal insulin and metformin?
- Discharge on insulin only?
- If on insulin >which insulin and how much?
- What about DM supplies?
- What about follow up care?
- What about DM education?
- What about VNS services?



Discharge diabetes plan

- Discontinue metformin
- Start HUMULIN or NOVOLIN 70/30 insulin.
- What type of insulin is HUMULIN or NOVOLIN 70/30 insulin?
- Give 70% of total daily dose. Why?
- Give 70% of total calculated dose ac breakfa and 30% ac dinner

Insulin doses

- Look at last 24 hours total insulin received.
- 14 Glargine plus average 5 units lispro ac meals (15 total/day)=TDD is 29 units/day (100%)
- 70% of 29 units=20 TDD of 70/30 insulin.

70% ac breakfast = 14 units and 30% ac dinner = 6 units

Question # 4

Mr. J is a 45 y/o undocumented, unemployed and uninsured patient with new diagnosis of Type 1 diabetes. He was admitted on DKA and his blood glucose has improved while on glargine/lispro insulins. He is ready to go home.

Which of the following insulins will you discharge Mr. J on?

a. Continue glargine and lispro insulins.
b. Switch to Novolog 70/30 insulin before breakfast and dinner.
c. Switch to Novolin 70/30 insulin before breakfast and bedtime.
d. Switch to Novolog 70/30 insulin before breakfast and bedtime.
e. Switch to Novolin 70/30 insulin before breakfast and dinner.

Diabetes discharge plan

Write RXs for:

- Glucose meter # 1
- Glucose meter strips # 100
- Glucose meter lancets # 100
- Glucose tabs 4g #30 OR Glucose Gel #10 (use as directed).
- Novolin/Humulin70/30 insulin # 1month supply.

Insulin Syringes (1/3 cc) #100

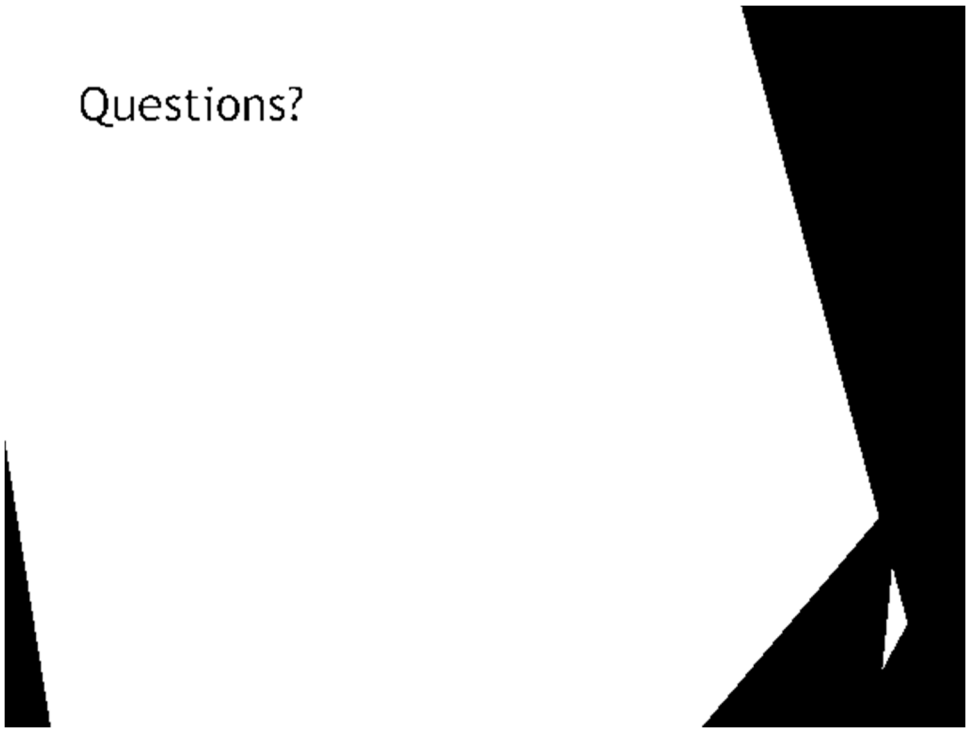
Where to get above and for how much?

Diabetes discharge plan

- Diabetes education
- Social worker to assess if possible Medicaid candidate.
- Social worker to arrange VNS services.
- Follow up care at out patient clinic.
- Refer to wellness program

Needs optho eval as out pt.

Questions?



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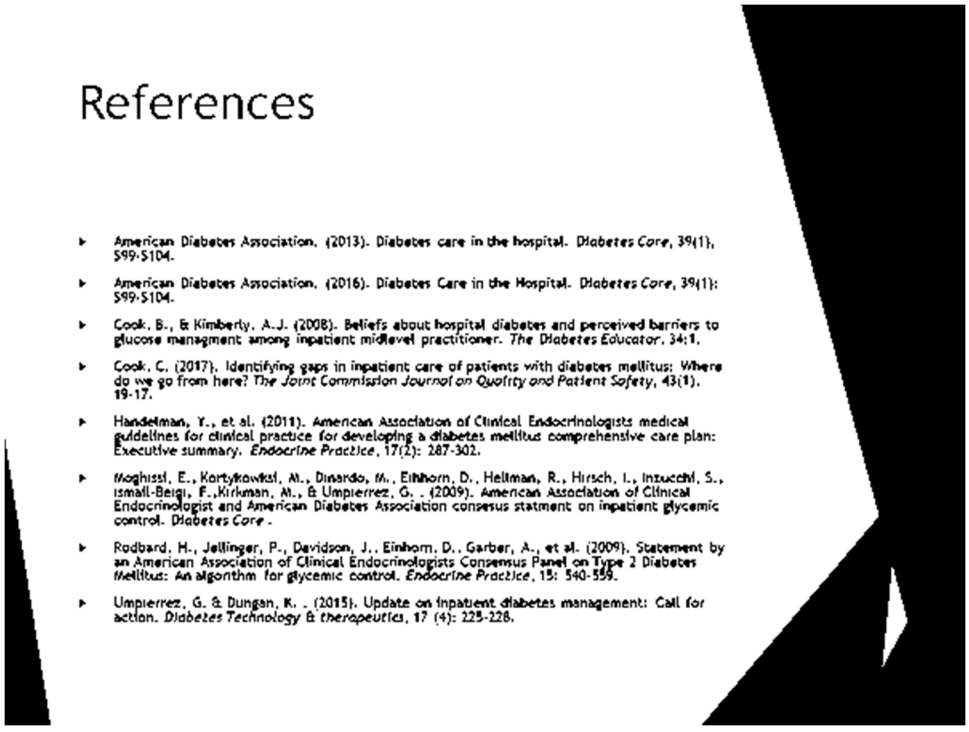


INPATIENT MANAGEMENT OF DIABETES: CASE STUDY APPROACH

BY SHARON HASFAL ANP-BC

OBJECTIVES

Manage	Manage hypoglycemic events per hospital protocol.
Understand	Understand their role in managing patients with an insulin pump.
Manage	Manage newly diagnosed patient on insulin from admission to discharge.

CASE STUDY 1

- 63 YEAR OLD MALE WITH PMHX OF TYPE 2 DM, HTN SCHEDULED TO HAVE SURGERY. HE HAS BEEN NPO SINCE MIDNIGHT. PT IS ON LANTUS 30 UNITS ALONG WITH HUMALOG 5 UNITS PREMEALS. HE IS APPROXIMATELY 200 LBS.

CASE STUDY 1

- THE NURSE REPORTS TO THE PRACTITIONER, PT'S BLOOD SUGAR AT 0800 WAS 42 MG/DL. THE REPEAT BLOOD SUGAR WAS 45 MG/DL. THE PRACTITIONER ORDERED FOR 1 AMP OF D50 (25 G) TO BE GIVEN. 30 MINUTES LATER THE BLOOD SUGAR INCREASED TO 65 MG/DL. THE PRACTITIONER GAVE AN ADDITIONAL 12.5 G OF D50 (1/2 AMP) AND STARTED THE PATIENT ON D5W AT 50 CC/HR. THE REPEAT BLOOD SUGAR 30 MINUTES LATER INCREASED TO 117 MG/DL. APPROXIMATELY AT 1700, THE PATIENT'S SURGERY WAS CANCELLED WITH NO DATE OF WHEN IT WILL BE RESCHEDULED.

WHAT IS THE BEST TREATMENT PLAN?

a. WHAT IS THE BEST TREATMENT PLAN?
b. 1 AMP OF D50
c. ½ AMP OF D50
d. 1 UNIT OF GLUCAGON
e. 1 GLUCOSE GEL
f. 4 OZ OF APPLE OR CRANBERRY JUICE?

- CORRECT ANSWER: A

HOW MUCH SHOULD THE PATIENT'S BLOOD SUGAR INCREASE BY? (APPROXIMATELY)

a. 15 MG/DL
b. 25 MG/DL
c. 30 MG/DL
d. 45 MG/DL
e. 60 MG/DL

- CORRECT ANSWER: D

IS IT APPROPRIATE TO START IVF WHILE NPO?

a. YES

b. NO

- CORRECT ANSWER: A

CASE STUDY 1

- THE FOLLOWING MORNING THE NURSE REPORTED TO THE PRACTITIONER, THE PT'S BLOOD SUGAR AT 0830 WAS 59 MG/DL. THE PT ONCE AGAIN WAS MADE NPO AT 12 MIDNIGHT BY THE SURGICAL TEAM. THE PT HAD ALREADY RECEIVED HIS EVENING DOSE OF LANTUS. THE PT IS AWAKE AND ALERT. NO COMPLAINTS OF FEELING DIZZY NOR LIGHTHEADED. NO IV FLUIDS WAS INFUSING. PT WAS GIVEN ½ AMP OF D50. 30 MINUTES LATER THE PATIENT BLOOD SUGAR INCREASED TO 89 MG/DL. PT WAS THEN STARTED ON IV FLUID D5W AT 50 CC/HR WHILE FOLLOWING THE NPO PROTOCOL FOR DIABETICS. AT 1500, THE PRACTITIONER CALLED THE PHYSICIAN AND THE OR, SURGERY WAS POSTPONED UNTIL THE FOLLOWING DAY.

CASE STUDY 1

- LATER IN THE EVENING THE PRACTITIONER DID NOT WANT A REPEAT EVENT OF HYPOGLYCEMIA TO OCCUR. SO THE PRACTITIONER REDUCED THE INSULIN BY 50%. WROTE A PROVIDER TO RN TO ONLY ADMINISTER ½ OF THE INSULIN DOSE ALONG WITH STARTING IVF AT 0500 AT 50 ML/HR UNTIL HE GOES TO THE OR. THE PRACTITIONER ALSO WROTE A SINGLE ORDER FOR LANTUS 15 UNITS TO BE GIVEN INSTEAD OF LANTUS 30 UNITS AT 2200 PM. THE PRACTITIONER THOUGHT SHE COVERED ALL OF HER BASES.

CASE STUDY 1

THE FOLLOWING MORNING, THE AM BLOOD SUGAR AT 0800 WAS 84 MG/DL. NO TREATMENT WAS GIVEN. HOWEVER, THE NIGHT NURSE ADMINISTERED THE FULL DOSE OF INSULIN.

WHAT WENT WRONG?

CORRECTIVE ACTION:

a. SHOULD HAVE DISCONTINUED THE LANTUS 30 UNITS.

b. WRITE A SINGLE ORDER FOR LANTUS 15 UNITS

c. COMMUNICATE TO THE RN

d. STILL WRITE A PROVIDER TO RN TO GIVEN LANTUS 15 UNITS.

e. ALL OF THE ABOVE.

CORRECT ANSWER: ALL OF THE ABOVE.

WHY?

1- THE NURSE DID NOT CHECK HER ALERTS.

2- THE PRACTITIONER DID NOT DISCONTINUE THE ORIGINAL LANTUS ORDER DESPITE THE "PROVIDER TO RN" ORDER EXPLICITLY WRITTEN "ADMINISTER 15 UNITS OF LANTUS AND DO NOT GIVE THE 30 UNITS". THERE ALSO WAS AN ORDER WRITTEN FOR LANTUS 15 UNITS TO BE GIVEN AT 2200. (THE NURSE DID NOT QUESTION THE ORDER. THANK GOODNESS SHE DID NOT GIVE THE EXTRA LANTUS.

3- THE PROVIDER ALSO DID NOT COMMUNICATE DIRECTLY WITH THE NURSE NOT TO GIVE THE 30 UNITS OF LANTUS.

MORAL OF THE STORY

COMMUNICATION

DOT YOUR I'S AND CROSS YOUR T'S.

TREATMENT OF HYPOGLYCEMIA GLUCOSE < 70 MG/DL

- GIVE 15-20 GRAMS OF A SIMPLE SUGAR OR GLUCOSE. SUCH AS:
  - 1 AMP OF D50 (25 GRAM)
  - ½ AMP OF D50 (12.5 GRAM)
  - GLUCOSE GEL (15 GRAM)
  - GLUCOSE TAB (4 GRAM OF CARB PER TAB)
  - GLUCAGON IV 1 UNIT/ML (12MG/ML)

HYPOGLYCEMIA TREATMENT

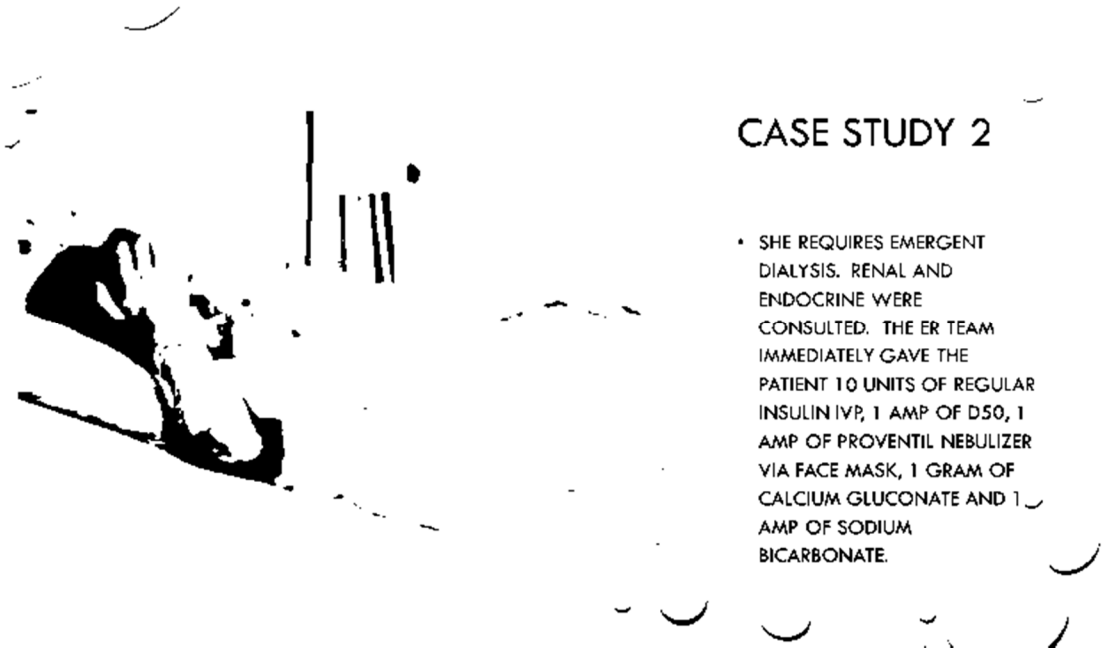
- 1 GRAM OF GLUCOSE WILL INCREASE THE SERUM BLOOD SUGARS BY 3,4,5 POINTS FOR BODY WEIGHTS OF 200 LBS, 150LBS, AND 100 LBS.
- GOAL GLUCOSE: ≥ 100 MG/DL.

CASE STUDY 2

- 35 Y/O FEMALE WITH HISTORY OF TYPE 2 DM, ANXIETY, ESRD (ON HD MWF), DM NEUROPATHY, AND S/P RIGHT AKA. PT PRESENTS TO THE ER WITH HER MOTHER WITH COMPLAINTS OF VOMITING, DEHYDRATION AND LETHARGY.

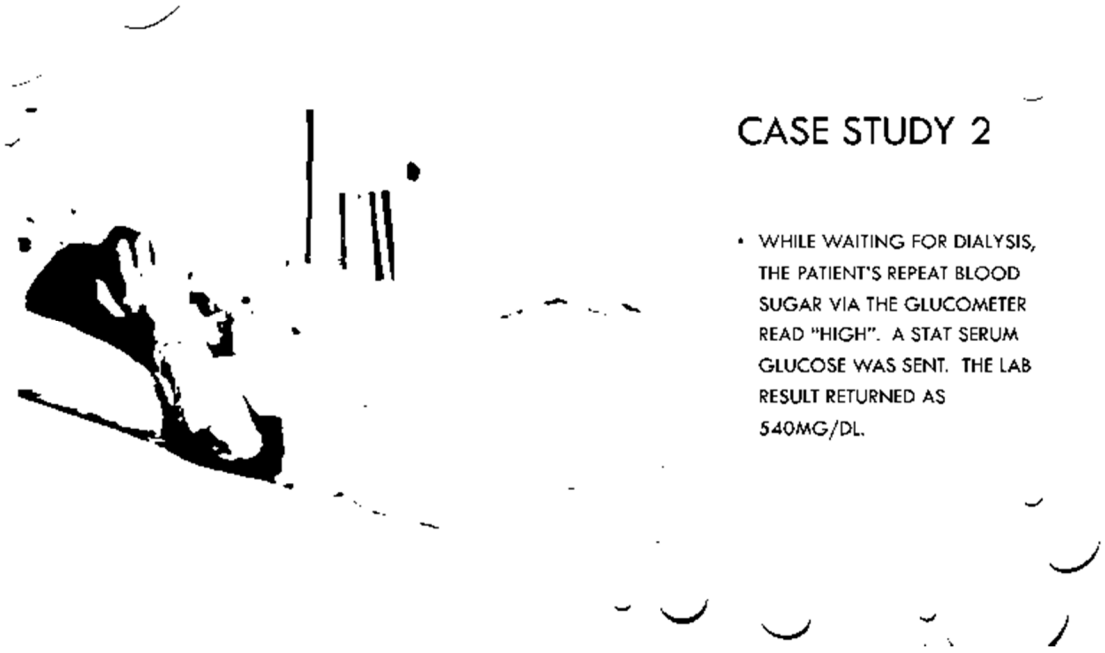
CASE STUDY 2

- IN THE ER HER BLOOD SUGAR WAS 635 MG/DL, SERUM POTASSIUM: 8.0 MEQ/DL AND HER CRE: 15.



CASE STUDY 2

- SHE REQUIRES EMERGENT DIALYSIS. RENAL AND ENDOCRINE WERE CONSULTED. THE ER TEAM IMMEDIATELY GAVE THE PATIENT 10 UNITS OF REGULAR INSULIN IVP, 1 AMP OF D50, 1 AMP OF PROVENTIL NEBULIZER VIA FACE MASK, 1 GRAM OF CALCIUM GLUCONATE AND 1 AMP OF SODIUM BICARBONATE.



CASE STUDY 2

- WHILE WAITING FOR DIALYSIS, THE PATIENT'S REPEAT BLOOD SUGAR VIA THE GLUCOMETER READ "HIGH". A STAT SERUM GLUCOSE WAS SENT. THE LAB RESULT RETURNED AS 540MG/DL.

WHAT IS YOUR TREATMENT PLAN?

a. 10 UNITS OF INSULIN
b. REPEAT THE SAME COCKTAIL OF: REGULAR INSULIN, D50, CALCIUM GLUCONATE, AND ALBUTEROL
c. IVF: ½ NS AT 200 CC/HR.
d. NONE OF THE ABOVE.

CORRECT ANSWER: A.

CASE STUDY 2

45 MINUTES LATER THE REPEAT BLOOD SUGAR WAS 396 MG/DL. THE PATIENT RECEIVED ANOTHER 10 UNITS OF REGULAR INSULIN.

WHAT DO WE NEED TO BE CAREFUL OF?

INSULIN STACKING.

CASE STUDY 2

- THE PATIENT THEN RECEIVED 500 ML OF NORMAL SALINE IN THE ER AND SHORTLY WAS SENT TO HEMODIALYSIS. WHILE IN DIALYSIS, THE PATIENTS BLOOD SUGAR WAS 295 MG/DL. THE PATIENT'S MOTHER WAS CHECKING HER DAUGHTER. SHE THEN DISCOVERED HER DAUGHTER'S OMNIPOD WAS OFF HER BODY. THE MOTHER THEN POLITELY PLACED THE OMNIPOD ON THE DAUGHTER, BUT DID NOT TELL THE NURSE NOR THE PRACTITIONER OF WHAT SHE DONE.

CASE STUDY 2

- APPROXIMATELY 2 HOURS INTO DIALYSIS, THE PATIENT COMPLAINED OF FEELING NAUSEOUS. SHE THEN RECEIVED ZOFRAN 4 MG IV X 1 WITH RELIEF NOTED.

CASE STUDY 2

- AT 2330, THE PRACTITIONER RECEIVED A CALL FROM THE DIALYSIS NURSE, THE PT'S BLOOD SUGAR WAS 32 MG/DL. THE REPEAT BLOOD SUGAR WAS 35 MG/DL. PT WAS DIAPHORETIC AND LETHARGIC.

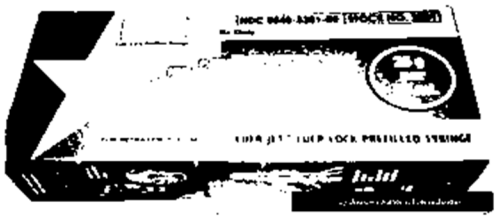
HOW WOULD YOU TREAT THE PATIENT?

a. 1 AMP OF D50
b. ½ AMP OF D50
c. 1 GLUCOSE GEL
d. 4 OZ OF APPLE JUICE
e. 1 UNIT OF GLUCAGON IV/IM

CORRECT ANSWER: A

- AFTER TREATMENT, THE REPEAT BLOOD SUGAR WAS 59 MG/DL. ½ AMP OF D50 WAS GIVEN. THE REPEAT BLOOD SUGAR WAS 124 MG/DL. THE PATIENT WAS THEN RETURNED TO THE ER. THE PRACTITIONER IN THE ER THEN REMOVED THE OMNIPOD PUMP.

CASE STUDY 2



WHY?

THE PATIENT WAS NOT EATING AND SHE WAS STILL LETHARGIC.

THE MOTHER OBVIOUSLY COULD NOT BE TRUSTED IN MANAGING THE OMNIPOD PUMP.

CASE STUDY 2

- REPEAT LABS WERE SENT WHILE THE PATIENT WAS IN THE ER. REPEAT POTASSIUM WAS: **4.8** MEQ/DL
- PH: 7.30. THE NP THEN ASKED THE RN IN THE HOLDING AREA TO REPEAT THE BLOOD SUGARS EVERY 1 HOUR AND START D5W AT 50 ML/HR.

BLOOD SUGAR AT:

0100: 96 mg/dl.

- 0200: 86 mg/dl
- 0300: 73 mg/dl
- 0400: 82 mg/dl (Pt awake and very alert)
- 0500: 94 mg/dl
- 0600: 122 mg/dl
- 0700: 139 mg/dl

CASE STUDY 2

- PT AT 0700 IS AWAKE AND VERBALLY ABUSIVE. ENDOCRINE TEAM CAME BACK TO SEE THE PATIENT OF WHO WAS VERY WELL KNOWN TO THEIR SERVICE. FINGERSTICKS WAS THEN CHANGED TO Q6HOURS. THE PATIENT THEN DEMANDED FOR THE OMNIPOD TO BE PUT BACK ON HER. AT 1000, PT WANT TO GO HOME. HER BLOOD SUGAR WAS 180 MG/DL.
- PT SIGNED OUT AMA AND WALKED OUT WITH HER PROSTHESIS.

WHAT COULD BE CORRECTED?

- INITIAL ASSESSMENT IN THE ER (IE: REVIEW OF MEDICATION LIST; HOW DOES SHE RECEIVE HER INSULIN).
- PT'S MOTHER WAS NOT FORTHCOMING WITH THE INFORMATION RE: THE OMNIPOD.
- BODY ASSESSMENT TO SEE IF THERE WAS ANY OBVIOUS SIGN OF INFECTION – CHECK THE ABDOMEN, THE LEGS AND FEET.

WHAT OTHER PROBLEMS OCCURRED WITH THIS PATIENT DURING WHILE SHE WAS IN THE HOSPITAL?

- MOTHER SHOULD HAVE TOLD THE NURSE AND/OR THE PRACTITIONER SHE HAD PLACED THE OMNIPOD ON HER DAUGHTER WHEN SHE DISCOVERED IT WAS OFF.
- THE PRACTITIONER ALSO NEED TO REALIZE THE PATIENT WAS NOT EATING, WHILE IN DIALYSIS THE BLOOD SUGAR SHOULD HAVE BEEN CHECKED FREQUENTLY.

DURING THE INITIAL TREATMENT IN THE ER, PT RECEIVED A TOTAL OF 30 UNITS OF REGULAR INSULIN IN THE ER IN LESS THAN A 3 HOUR PERIOD. WAS THIS TOO MUCH INSULIN?

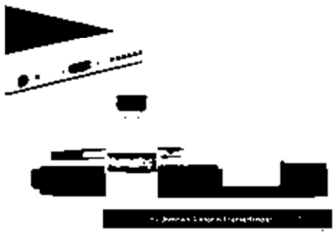
a. YES

b. NO

c. MAYBE, DEPENDS ON THE BODY WEIGHT/MASS OF THE PATIENT.

CORRECT ANSWER: C

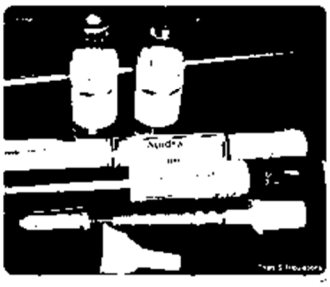
INSULIN FACT



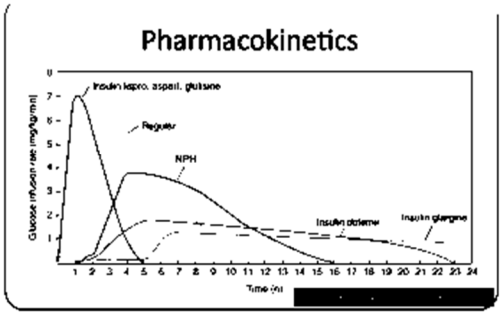
- HUMALOG AND NOVOLOG DECREASES BLOOD SUGARS **20** MINUTES AFTER INJECTION.

INSULIN FACT

- **LENTE, NPH, ULTRALENTE** AND LANTUS HAS NO AFFECT ON BLOOD SUGARS FOR 90-120 MINUTES.
- HOWEVER IF THE BASAL DOSE IS DECREASED, THE ORIGINAL DOSE WILL CONTINUE TO AFFECT THE BLOOD SUGARS UP TO 14-24 HOUR LATER.



INSULIN FACT



CASE STUDY 3

- 51-YEAR-OLD OBESE FEMALE COMES INTO THE ER WITH COMPLAINTS OF CHEST PAIN. PT HAVE A PMHX OF DMT2 AND HTN. PT APPROXIMATELY WEIGHS 248LBS. PT TAKES METFORMIN 1000 MG BID AND GLIMEPIRIDE 4 MG DAILY.

CASE STUDY 3

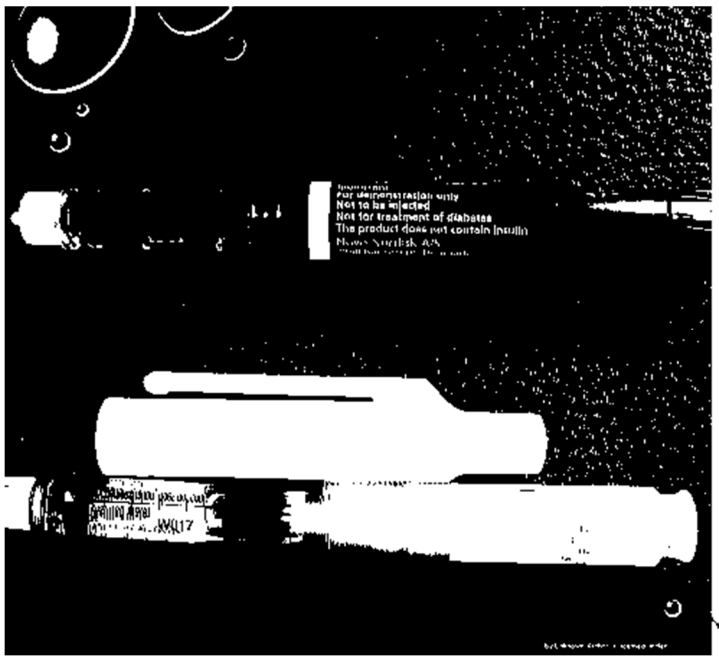
- WHEN SHE CAME TO THE ER SHE WAS EXPERIENCING MIDSTERNAL CHEST PAIN RADIATING DOWN HER LEFT ARM ALONG WITH BEING DIAPHORETIC. SHE WAS ALSO SHORT OF BREATH X 2 DAYS PRIOR TO COMING TO THE HOSPITAL. LABS WERE SENT OF WHICH REVEALED HER TROPONINS WERE ELEVATED X 2.

CASE STUDY 3

DIAGNOSIS: NSTEMI

TYPE **2** DIABETES

PT WAS SEEN BY CARDIOLOGY. DES X **2** WAS PLACED TO THE MLAD AND PLAD.



CASE STUDY 3

- THE PRACTITIONER ALSO REALIZED THE PATIENT HAD AN ELEVATED HGB A1C: 14.6%. ENDOCRINE CONSULTS WERE CALLED.
- ENDOCRINE CAME TO SEE THE PATIENT AND STARTED HER ON LANTUS 20 UNITS DAILY AT BEDTIME IN ADDITION TO HUMALOG 5 UNITS PREMEAL TID. INSULIN IS NEW FOR THE PATIENT.

AS A PRACTITIONER, WHAT IS THE **MOST IMPORTANT** FACTOR RE: HER CARE NOW?

a. IF PATIENT CAN ADMINISTER INSULIN ON HER OWN.

b. CAN SHE AFFORD THE INSULIN?

c. COMPLIANCE FOLLOWING UP WITH HER ENDOCRINOLOGIST.

d. ANSWER A ONLY.

e. ALL THE ABOVE.

CORRECT ANSWER: A.

EVEN THOUGH PATIENT IS A KNOWN DIABETIC, DO NOT TAKE FOR GRANTED WHAT SHE KNOWS. **WHO IS RESPONSIBLE** TO FIND OUT HOW MUCH THE PATIENT KNOWS ABOUT HER DIABETES AND TO REINFORCE EDUCATION?

a. THE UNIT DIABETES CHAMPION
b. THE PRACTITIONER
c. THE BEDSIDE RN
d. THE DIABETES NURSE EDUCATOR
e. ANSWERS A, B, & C
f. ALL THE ABOVE

CORRECT ANSWER: E

DISCHARGE PLAN

- IT'S TIME FOR THE PATIENT TO BE DISCHARGED TO HOME.
- ENDOCRINE PHYSICIAN WILL CONTINUE THE PATIENT ON THE SAME MEDICATION LANTUS 20 UNITS AND HUMALOG 5 UNITS PREMEAL TO BE HER HOME REGIMEN.
- CASE MANAGER WILL SET UP HOME CARE FOR THE PATIENT TO HAVE A NURSE REINFORCE HER DIABETES TEACHING AND MAKE SURE SHE IS ADMINISTERING HER INSULIN CORRECTLY.

DISCHARGE PLAN

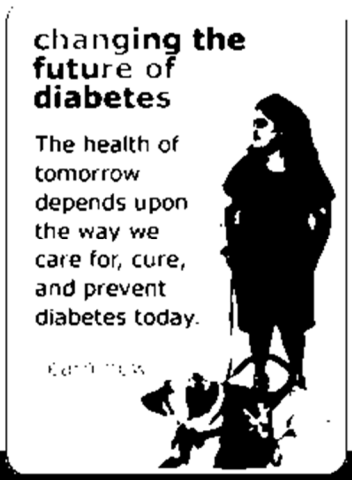
- THE DIETICIAN HAD SEEN THE PATIENT WHILE SHE WAS IN THE UNIT. AT DISCHARGE, THE DIETICIAN REVIEWED THE FOOD CHART WITH THE PATIENT FOLLOWING A LOW SODIUM, LOW CHOLESTEROL CARBOHYDRATE CONSISTENT DIET.
- THE PRACTITIONER TAKING CARE OF THE PATIENT MUST MAKE SURE THE PATIENT HAS AN APPOINTMENT WITH HER PCP AND THE ENDOCRINE CLINIC.

AT DISCHARGE IN ADDITION TO HER INSULIN, WHAT ELSE MUST BE ORDERED?

a. GLUCOMETER
b. LANCETS
c. BD NANO INSULIN NEEDLES
d. ALCOHOL PREPS
e. GLUCOSE STRIPS
f. ALL OF THE ABOVE

CORRECT ANSWER: F.

IT'S TIME TO HALT THE EPIDEMIC!



Thank you

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Lesson Plan #1

TOPIC: Know the Difference: Diabetes Classifications

Objective	Content	Presenter	Teaching Methods and Materials	Time Frame	Evaluation
At the end of this presentation the APP will be able to:					
• Discuss the affects of diabetes on the economy	• Prevalence of Diabetes a. Epidemic b. Cost • Overview of Pathophysiology a. Glucose metabolism	Marie Frazzitta, DNP.FNP-C CDE	Lecture Power point presentation Discussion Hand out	20 minutes 10 minutes Q&A	Pen and Paper
• Provide an overview of different classifications of diabetes	• Diabetes Classifications a. Type 1 b. Type 2 c. Prediabetes	Sharon Hasfal ANP-BC	Lecture Power point presentation Discussion Hand out	20 minutes 10 minutes Q&A	Pen and Paper

Lesson Plan #2

TOPIC: Diabetes Emergencies

Objective	Content	Presenter	Teaching Methods and Materials	Time Frame	Evaluation
At the end of this presentation the APP will be able to:	I. Glucose metabolism	Alyson Myers MD	Lecture Power point presentation Discussion Hand-out	10 minutes	Pen & Paper

To discuss the pathophysiology of diabetes	II. Management of Diabetes				
*To describe the pharmokinetics of insulin	I. Types of Insulin a. Bolus b. Basal c. Mixed II. Onset and Action of Insulin	Alyson Myers MD	Lecture Power point presentation Discussion Hand-out	10 minutes	Pen & Paper
*To illustrate the causes and management of hyperglycemia	I. Causes of Hyperglycemia II. Management III. Case Study	Alyson Myers MD	Lecture Power point presentation Discussion Hand-out	20 minutes	Pen & Paper
*To review the causes and management of hypoglycemia	I. Cause of Hypoglycemia II. Management III. Case Study	Alyson Myers MD	Lecture Power point presentation Discussion Hand-out	20 minutes including Q&A	Pen & Paper

Lesson Plan #3

TOPIC: Inpatient Management of Diabetes: Case Presentations

Objective	**Content**	**Presenter**	**Teaching Methods and Materials**	**Time Frame**	**Evaluation**
At the end of this presentation the APP will be able to:					
Manage hypoglycemic events per		Sharon Hasfal ANP-BC	Lecture Power point presentation Discussion	10 minutes	Pen & Paper

hospital protocol.			Hand-out		
Understanding their role in managing patients on an insulin pump.		Sharon Hasfal ANP-BC	Lecture Power point presentation Discussion Hand-out	20 minutes	Pen & Paper
Managing newly diagnosed patients with diabetes from admission to discharge.		Sharon Hasfal ANP-BC	Lecture Power point presentation Discussion Hand-out	20 minutes 10 minutes Q&A	Pen & Paper

Lesson Plan #4

TOPIC: Insulin Pump

Objective	**Content**	**Presenter**	**Teaching Methods and Materials**	**Time Frame**	**Evaluation**
At the end of this presentation the APP will be able to:					
• To ensure patient's safe self-administration of insulin via a personal insulin pump while in the hospital	I. Concept of Insulin Pump Therapy. II. Types of Insulin Pumps.	Patricia Garnica, FNP-BC, CDE	Lecture Power point presentation Discussion Hand-out	20 minutes 10 minutes Q&A	Pen & Paper
• To provide guidelines to staff regarding the appropriate	I. Review of Hospital Policy II. Endocrine Consult	Sharon Hasfal ANP-BC	Lecture Power point presentation Discussion	20 minutes 10 minutes Q&A	Pen & Paper

process for a patient to ***self manage*** their diabetes while using their personal insulin pump.	III. Forms IV. Providers Responsibilities.		Hand-out		

Lesson Plan #5

TOPIC: Perioperative Management of Patients with Diabetes

Objective	Content	Presenter	Teaching Methods and Materials	Time Frame	Evaluation
At the end of this presentation the APP will be able to:					
• Management of pre-op patient on oral and non oral hypoglycemic agents.	I. Causes of Hyperglycemic events. II. National Guidelines III.	Dr. Steven Herling	Lecture Power point presentation Discussion Hand-out	10 minutes	Pen & Paper
• Management of pre-op patient on insulin.	I. Management of insulin pre-op.	Dr. Steven Herling	Lecture Power point presentation Discussion Hand-out	20 minutes	Pen & Paper
• Optimal intraoperative glucose levels.	I. Target blood sugars. II. SubQ vs. IV infusion.	Dr. Steven Herling	Lecture Power point presentation Discussion Hand-out	20 minutes 10 minutes Q&A	Pen & Paper

Lesson Plan #6

TOPIC: Transition of Care

Objective	Content	Presenter	Teaching Methods and Materials	Time Frame	Evaluation
At the end of this presentation the APP will be able to:					
The participant will be able to develop a treatment plan for the inpatient with diabetes.	I. Patient with newly diagnosed diabetes. II. Hemoglobin A1C III. Glycemic management inpatient.	Patricia Garnica, ANP-BC, CDE.	Lecture Power point presentation Discussion Hand-out	30 minutes	Pen & Paper
The participant will be able to develop a treatment plan for the patient who is discharged into the community.	I. Review of outpatient medications. II. Discharge diabetes plan	Patricia Garnica, ANP-BC, CDE.	Lecture Power point presentation Discussion Hand-out	20 minutes 10 minutes Q&A	Pen & Paper

Appendix F

Advanced Practice Providers Pre/Post Test Questionnaire

1. Are you a:
   - o Nurse Practitioner
   - o Physician Assistant

2. What department do you currently work? _____

3. How important do you think it is to treat hyperglycemia in the critically ill?
   - o Very important
   - o Important
   - o Neutral
   - o Not important at all.

4. How important do you think it is to treat hyperglycemia in the non-critically ill patient?
   - o Very important
   - o Important
   - o Neutral
   - o Not important at all.

5. How important do you think it is to treat peri-operative hyperglycemia?
   - o Very important
   - o Important
   - o Neutral
   - o Not important at all.

6. What is the goal glucose level to achieve in the critically ill patient receiving insulin therapy?
   - o **80-139 mg/dl.** (Stringent)
   - o 140-180 mg/dl (Moderate)
   - o 181-200 mg/dl
   - o Don't Know

7. What is the goal glucose level to achieve in the non-critically ill patient receiving insulin therapy?
   - o **80-139 mg/dl** (Stringent)
   - o 140-180 mg/dl (Moderate)
   - o 181-200 mg/dl
   - o Don't Know.

8. What is the goal glucose level to maintain during the peri-operative period?
    - 80-110 mg/dl
    - 80-150 mg/dl
    - **80-180 mg/dl**
    - Don't Know.

9. Hypoglycemia in the hospitalized patient is a blood glucose:
    - **≤ 70 mg/dl**
    - ≤60 mg/dl
    - ≤50 mg/dl
    - ≤40 mg/dl
    - Not sure

10. Hyperglycemia in the hospitalized patient is a blood glucose:
    - Greater than 130 mg/dl
    - **Greater than 140 mg/dl**
    - Greater than 150 mg/dl
    - Greater than 160 mg/dl
    - Not sure.

11. Are you comfortable treating and managing patients with hyperglycemia?
    - Very comfortable
    - Comfortable
    - Neutral
    - Not comfortable.

12. Are you comfortable treating and managing patients with hypoglycemia?
    - Very comfortable
    - Comfortable
    - Neutral
    - Not comfortable

13. Are you comfortable initiating insulin therapy?
    - Very comfortable
    - Comfortable
    - Neutral
    - Not comfortable

14. Are you comfortable working with patients on an insulin pump?
    - Very comfortable
    - Comfortable
    - Neutral

- Not comfortable

15. Are you comfortable educating newly diagnosed patients with diabetes.
    - Very comfortable
    - Comfortable
    - Neutral
    - Not comfortable

16. What is the blood glucose goal you should reach when a patient has a blood sugar of 51 mg/dl?
    - ≥ 70 mg/dl
    - ≥ 80 mg/dl
    - ≥ 90 mg/dl
    - **≥ 100 mg/dl**

17. A patient is admitted to the hospital with an insulin pump. They are alert and know how to manage their insulin pump. What are the things the practitioner need to do in order to meet the compliancy of the hospital's policy on insulin pumps?
    - Make sure they brought in a least 3 spare sets of their supplies
    - Sign the Patient Attestation Form
    - Assess patient's ability and competency in using their insulin pump
    - Consult the Endocrine Department or the patient's Physician managing their insulin pump.
    - **All of the above**.

18. When do you (as a practitioner) or the patient must remove the insulin pump?
    - MRI
    - CT Scan
    - X-rays
    - **All of the Above.**

19. Metformin in not indicated on patients with an eGFR:
    - > 45
    - >50
    - **<35**
    - <30
    - None of the above.

20. You are preparing a patient for surgery the following the day. Pt patient has Type 2 diabetes and is receiving 50 units of Lantus in the hospital. What should you do as a Practitioner to prevent the patient from experiencing a hypoglycemic event while NPO?

- Decrease the Lantus by 50%.
- Check blood sugars every 6 hours while NPO.
- Start the patient on IVF if the blood sugars tend to be consistently low.
- Answers A and B only
- **All of the above**.

21. True or False: An event note does not need to be written if a patient has a hypoglycemic event in the hospital.
    - True
    - **False**

22. Pt has a blood sugar of 558 mg/dl. What is your treatment plan?
    - Infuse IV Fluid
    - Give insulin
    - Make NPO
    - Check urine for Ketones
    - **All of the above**.

23. True or False: A patient with known or suspected diabetes should have a Hemoglobin A1C drawn if it has not been documented within a 3 months period?
    - **True**
    - False

24. If a patient has a low blood sugar prior to meals (ie: 72 mg/dl) and they are due premeal insulin. What would you advise the nurse to do?
    - Continue to give the pre-meal insulin.
    - Hold the premeal insulin.
    - **Hold the premeal insulin and wait to see how much food is consumed**.

25. At the time of discharge which of the following(s) must be done:
    - Pt must have an appointment made with their Endocrinologist or the outpatient diabetes clinic.
    - Case Manager to set up outpatient Home Care Services to reinforce diabetes education.
    - Documented inpatient diabetes education.
    - Ensure patient has a glucometer, gluco-strips and Lancets.
    - Review of medication reconciliation with the patient.
    - **All of the above.**