

Evaluation of Insulin Pump Protocol for Diabetic Patients in Postpartum Care Unit

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Abstract

It is crucial for gestational diabetic patients to receive insulin, by either injection of long-acting insulin or by continuous infusion of short-acting insulin. Left untreated or improperly controlled, gestational diabetes leads to morbidity and possible mortality in both mother and baby. A reliable indicator of inadequate control of gestational diabetes is hypoglycemia, which may be severe in postpartum mothers if insulin dosage has not been reduced immediately after delivery. Continuous subcutaneous insulin infusion is a way to tightly control blood glucose for patients who present with unique glucose regulation challenges. Evidence-based policy for using new health technologies associated with obstetrics helps prevent adverse events for both mother and baby. The need for diabetes management begins with healthcare professionals advocating, educating, leading, and collaborating with other health care disciplines to develop and implement best practices. The purpose of the project is to identify the need for change in protocol and practice to prevent postpartum hypoglycemia in new mothers on CSII protocol. The DNP project assesses compliance with protocol for administration of insulin at an acute care hospital that uses insulin pumps, both pre- and post-intervention. The project will use the Middle Range Theory of Unpleasant Symptoms and Lewin's Change Theory as theoretical frameworks. These selected theories support health care professionals in the education and advocacy for patients. In addition, the theories support and encourage health care professionals to advocate for policy change and implement evidence-based protocol change.

Keywords: Insulin pump, gestational diabetes, type 1 diabetes mellitus, type 2 diabetes mellitus, pregnancy

Insulin Pump Protocol Evaluation

Introduction

Diabetes is increasing in prevalence worldwide and this remains true for patients that are pregnant (Tobia, 2013). It is imperative for medical staff, facilities and providers to focus on safe best practices when caring for the pregnant diabetic patient. Technology is providing innovative modalities in the treatment of diabetes such as insulin pumps that inject a programmed amount of insulin into the patient to provide a tighter control of blood glucose. When new treatment modalities are being utilized in the healthcare industry, protocols are created using current evidence to guide the practice. It is important for health care providers to stay current and adhere to these protocols to prevent patient harm.

Diabetes can be a difficult disease to control especially when there are significant fluctuations in hormones that are occurring such as in post-delivery patients (Drever, & Feig, 2013). Continuous subcutaneous insulin infusion (CSII) helps patients manage their diabetes and have tighter control of their blood glucose (Matejko et al., 2015). Under special circumstances, such as the post-partum period, evidence supports the use of CSII protocols. Strict adherence of a protocol must be achieved to protect the mother from experiencing hypoglycemia that may disorient and cause harm to both infant and mother. Harm can come to the infant as the mother experiences low blood glucose that may cause disorientation, thereby increasing the risk of dropping the infant (Chapman-Novakofski & Montvilo, 2017). Insulin requirement decreases from 25% to 40% in the postpartum patient due to lactation and hormone instability (Castorino, Paband, Zisser, & Jovanovič, 2012). Due to the instability of hormones, the patient's blood glucose levels should be reviewed and adjusted to prevent both hypoglycemia

and hyperglycemia. When adjusting the insulin dosage for use in CSII pumps, the provider must take in to consideration the patient's nutritional intake and if she is breastfeeding. This doctor of nursing practice (DNP) project will review the current CSII protocol and implement changes by (1) examining pre-and post-intervention retrospective chart audits for protocol adherence, determining barriers for adherence to these protocols, (2) providing a practice change based on evidence found during chart audits, and, through educational intervention, improving the knowledge, skills, and attitudes pertaining to the unit CSII protocol change among unit health care providers to reduce the occurrence of patient hypoglycemia.

Background

Insulin is a protein hormone secreted by the beta cells of the pancreatic islets of Langerhans for metabolism of carbohydrates and the regulation of blood glucose levels. Diabetes mellitus is a disease involving dysregulation of or impaired sensitivity to insulin. Hormones of pregnant patients including insulin, can rapidly change during all aspects of pregnancy and after delivery (Jornsay, 2000). Severe hypoglycemia can occur due to the fetus draining the glucose from the mother. Therefore, continuous monitoring and treatment of hypoglycemia are essential to the health of both mother and baby (Mathiesen, 2016).

During pregnancy, the placenta produces lactogen, which increases insulin resistance. This is compounded by the increased need for insulin due to the expected weight gain. During active labor and delivery, the need for insulin is almost zero because blood glucose is maintained between 70-90 mg/dL to prevent hyperglycemia in the mother and hypoglycemia in the fetus. For the first 24 to 36 hours after delivery, the mother requires very little insulin and can become at risk for hypoglycemia (Castorino, Paband, Zisser, & Jovanovič, 2012).

Once the baby is delivered, diabetic patients should have insulin recalculated to the postpartum weight. Healthcare providers managing these patients must consider that lactating mothers have a reduction of 35% to 50% of insulin (Castorino, Paband, Zisser, & Jovanovič, 2012). Lactation involves a caloric consumption on the level of exercise. Therefore, the use of CSII therapy utilizing proper protocols will improve the management of diabetes (Meetoo, 2004).

The use of continuous insulin pumps has shown to lower blood glucose and maintains stable blood glucose levels for patients requiring insulin. They also improve the quality of life by allowing patients to engage in everyday activities while maintaining a more consistent blood glucose level (Matejko et al., 2015). However, this is not always the case for patients diagnosed with diabetes during pregnancy. Due to pregnancy, the patient's hormones, including insulin regulation become a challenge for medical professionals to manage. Pregnancy can produce extremely low or high blood glucose levels. In a study of 85 people diagnosed with type 1 diabetes mellitus (T1DM) who were pregnant, four out of every 10 patients suffered from severe hypoglycemia (Jornsay, 2000). Severe hypoglycemia occurred in 77% of the study subjects who experienced any hypoglycemia during sleep, which poses a condition that is particularly difficult to detect and manage (Jornsay, 2000). Providers must anticipate hypoglycemia during sleep in diabetic patients and take steps to mitigate this condition from occurring.

Nurses spend more time with the patient in the postpartum unit than either physicians or patient family members. Because of the time spent with the patient, the nurse is continually assessing the patient for any signs and symptoms outside of normal. Therefore, it is essential for the nurse to comply with the CSII protocol in obtaining the consultation with the certified

diabetic educator (CDE) and to decrease the rate of insulin infusion to reduce the likelihood of adverse outcomes. Nurses see and treat patients when they are most vulnerable. Nurses can educate and remind both the physician and patient of the importance of reducing the insulin infusion to prevent hypoglycemia. The CDE educates the patient regarding the huge fluctuation of hormones occurring in the body and helps the mother understand why it is important to properly regulate the CSII. These volatile changes in hormones post-delivery are extremely critical to control hence the need for a specialist.

Problem Statement

Utilizing current CSII protocols and improving compliance will improve patient outcomes. Diabetic patients using CSII pumps are experiencing low blood glucose levels in the postpartum care unit. These hypoglycemic events may not only negatively affect the mother and baby but also may increase the cost of healthcare by creating a need for the treatment of new conditions created by hypoglycemia and its effects (Chamberlain et al., 2016). Insulin pumps may be accurately adjusted to manage insulin infusion rates, thereby minimizing the adverse effects of diabetes mellitus (DM). The use of CSII pumps will increase along with the increased diagnostic rates of DM. Thus, it is crucial for facilities and medical professionals to implement and adhere to proper insulin pump protocols.

Over 5000 babies are born each year in the hospital where this DNP project will be conducted. This facility also has a level III neonatal intensive care unit (NICU). The hospital provides care not only for healthy pregnant patients but also for the patients who experience complications during pregnancy. This includes patients who require insulin pumps for the management of T1DM, type 2 diabetes mellitus (T2DM) and gestational diabetes mellitus

(GDM). Hypoglycemia can be a complication for patients diagnosed with DM, but this complication becomes more of a concern in patients who happen to be pregnant. The patient tries to maintain blood glucose levels as close to normal while hormones are changing continuously causing large fluctuations in the glucose levels (Castorino, Paband, Zisser, & Jovanovič, 2012). Studies have shown that 41% of diabetic patients using insulin pumps can become severely hypoglycemic (Hernandez, 2016). 77% of the occurrences of hypoglycemia can occur during sleep causing the patient to become unconscious (Jornsay, 2000). During pregnancy, hormone imbalance can occur quickly and may increase the frequency of hypoglycemic episodes. The pregnant patient may present with poor glycemic control, which is detrimental to both baby and mother (Mahmood Buhary et al., 2016). Poor glycemic control can increase neonatal intensive care unit (NICU) admissions, intensive care unit (ICU) admissions, cesarean sections (C-sections), miscarriages, hypoglycemia, and preterm deliveries (Chapman-Novakofski, & Montvilo, 2017).

Purpose Statement

The purpose of the project is to identify the need for change in protocol and practice to prevent postpartum hypoglycemia in new mothers on CSII protocol. Educating the medical providers in the current evidence and best practices is crucial in changing practice standards to improve patient outcomes. The nursing staff will be informed on the updated protocol prior to implementation on the unit.

Project Objectives

The objectives of the project include the following:

1. Evaluate current CSII protocol process to determine compliance issues and potential causes of hypoglycemia by a pre-intervention chart audit.
2. Develop and implement a revised CSII protocol
3. Conduct post-intervention chart audits to determine compliance with revised CSII protocol.
4. Design and implement an education seminar for women's health nurses on the management of DM and how to use the revised CSII protocol.

The Project Question

The PICOT format-compliant focus for the DNP project includes several components: 1) project participants consisting of women's health nurses and obstetrical physicians; 2) an intervention consisting of protocol revision followed by an education and relevance training seminar, distribution of badge buddies, and availability of other reference resources for unit women's health nurses and OB physicians; 3) a comparison of pre- and post-intervention proportions infusion rate change orders and reductions, CDE consults, and the actual number of unit hypoglycemic events; 4) the expected outcome, which consists of higher proportions post-intervention compliance with revised CSII protocol elements and a reduction in the incidence of hypoglycemic event occurrence; 5) a timeframe over which the project lead will conduct a retrospective pre-intervention review of postpartum patient charts for CSII protocol compliance and hypoglycemic events, followed by the intervention implementation and post-intervention patient chart audits for determining adherence to revised protocol. A review of up to 10 charts of patients diagnosed with DM pre-and post-intervention is expected.

The project question: Will providing a practice change to existing protocol and training in the importance of adhering to the revised CSII protocol in the postpartum context improve compliance of women's health nurses and OB physicians with the utilization of the CSII protocol and ultimately reduce the incidence of preventable hypoglycemia?

Literature Review

Literature Search Parameters

A literature search was conducted to evaluate the current literature available regarding this practice problem. Literature sources were sought through the Western Governors Universities library EBSCO publishing resource for health professionals, which includes CINAHL Plus and Medline access.

Key words associated with this search were diabetes post-partum, gestational diabetes, T2DM, CSII, diabetes education, hypoglycemia post-partum, and CSII post-partum, and combinations of the key words were used to focus the search results relevant to diabetic pregnant and postpartum patients on or not on CSII.

Refinement of keywords produced an optimized list: CSII, pregnancy, and poor control of diabetes. A Boolean search consisting of diabetes and poor glucose control was utilized. The years of publication were limited to 2012 through 2017. The broadest key word search term was diabetic pregnancy. Approximately 250,000 articles resulted from this search.

This project lead evaluated articles for inclusion in this project by scanning for dates within five years, which shortened the list substantially. All articles included for this project were peer reviewed and were published within the five years. Articles that did not pertain to GDM or DM during pregnancy, insulin control, CSII, were eliminated from the search. Due to

CSII being a relatively new phenomenon, the patient and health care professionals require a “review of CSII protocol” associated with insulin infusion post-delivery. Due to CSII being used in the postpartum unit, a “review of CSII protocol” should occur. The final search terms were “diabetic pregnancy”, “CSII pregnancy”, “pregnant diabetic”, and “post-delivery in the diabetic” were used to conduct an exhaustive search.

Type 1 Diabetes Mellitus

T1DM is associated with the pancreas that is not producing insulin after autoimmune attack of the endocrine pancreas. According to the American Diabetes Association (ADA) (2012), 1.25 million people are diagnosed with T1DM, and the need for continuous insulin is essential to the patient’s well-being. Seven and half percent of all diabetics that are pregnant are diagnosed as T1DM (Prakash Narayanan & Samad, 2015). Four out of ten T1DM are said to have a severe hypoglycemic event with 77% occurring at night during pregnancy, (Jornsay, 2000). The reason for extreme low glyceic results is due to the fetus draining glucose from the mother. Therefore, it is crucial for the mother to be on an insulin regime that also does not cause hyperglycemia or hypoglycemia, which in turn could affect the baby (Drever, & Feig, 2013).

Type 2 Diabetes Mellitus and Gestational Diabetes Mellitus

T2DM and GDM patients are insulin-resistant; the pancreas is producing enough insulin but is not producing the intended cellular effects (Domínguez-Vigo, Álvarez-Silvares, Alves-Pérez Domínguez-Sánchez, & González-González, 2016). Both T2DM and GDM are on the rise with trends similar to those for obesity. It is suggested that GDM can range from 1.7 to 25% in some areas and continues to grow rapidly. The variance in diagnosis is due to race, ethnicity, genetics and age. GDM is defined as being diagnosed in the second or third trimester.

According to the American Diabetes Association (2016), if the patient is diagnosed with diabetes in the first-trimester the patient is considered T2DM. However, the American College of Obstetricians and Gynecologist (ACOG) considers that GDM is a carbohydrate or glucose intolerance that is diagnosed during pregnancy. Testing for GDM is usually implemented between 24 and 28 weeks of gestation, (Chapman-Novakofski, & Montvilo, 2017). GDM is associated with many high-risk issues such as miscarriage, fetal morbidity, fetal malformation and high risk for the mother to develop T2DM in the future (Chamberlain et al., 2016). Therefore, it is important that healthcare providers assist in the control of patient blood glucose in order to prevent comorbidities associated with all diagnosis of diabetes in Labor and Delivery and Postpartum Care (Castorino, Paband, Zisser, & Jovanovič, 2012).

Cost

The ADA indicated that the cost associated with diabetes in the United States (U.S.) have risen from 174 billion in 2007 to a staggering 245 billion in 2012 showing a 41% increase (American Diabetes Association [ADA], 2012). The estimation for patients with T2DM during pregnancy is five percent of the sum of patients that are pregnant with diabetes (Cheung, Lih, Lau, Park, Padmanabhan, & McElduff, 2015).

Women that have been diagnosed with GDM have a high risk of also developing T2DM. Consequently, GDM is usually a precursor to a diagnosis of T2DM (Domínguez-Vigo et al., 2016). The development of T2DM in the mother accentuates the problem of future pregnancies and can lead to multiple comorbidities, such as neuropathy, retinopathy and nephropathy (Chamberlain et al., 2016). GDM equates for 87.5% of the patients being managed for diabetes in the postpartum unit (Chapman-Novakofski & Montvilo, 2017).

Weight Gain

Large gestational age infants (LGA) are associated with a mother's glycemic control and weight gain during pregnancy (Boriboonhirunsarn & Kasempipatchai, 2016). Patients with GDM should be encouraged to exercise to improve glucose levels. Exercise not only helps to control blood glucose but contributes to preventing excess weight gain (Harrison, Shields, Taylor, & Frawley, 2016).

New Devices

One way to control blood glucose levels is the use of insulin pumps, which has become the standard of care. It is suggested that pump therapy improves both quality of life and glycemic control (Matejko et al., 2015). Insulin pumps allow diabetes to revolve around the patient's lifestyle instead of the lifestyle living around diabetes. The new devices such as insulin pumps, continuous glucose monitoring, and loop system will provide improved infant and mother outcomes in Labor and Delivery (Toiba, 2013). In addition, the use of continuous insulin therapy has lowered HbA1C's and reduced hypoglycemia when compared to the use of multiple insulin injections (Bellini-Ribeiro, Liberatore, Custodio, & Martinelli, 2016).

According to Jornsay, (2000), the parameters for GDM blood glucose concentrations are individual-specific but should approach established normal ranges:

1. Fasting: 60 to 90 mg/dl
2. Before meals: 60 to 100 mg/dl
3. One hour after meals: 90 to 120 mg/dl
4. Middle of the night: 70 to 120 mg/dl

In addition, hemoglobin A1c (glycated hemoglobin, HbA1c) should fall within the normal range, below 5.7%.

Theoretical Framework

Lewin's Change Theory

The theoretical framework is the guide or considered the map to the DNP project (Moran, Burson, & Conrad, 2014). Conceptual framework provides the actions and foundations that are found in the methodology that is entailed in the DNP project (Bemker, & Schreiner, 2016). The theories that will be used for this DNP project are Lewin's Change Theory and the Middle Range Theory of Unpleasant Symptoms (MRTUS). The reason for choosing Lewin's Change Theory is that an improvement in adherence to the CSII protocol is needed, which begins with recognition of the need for change. This theory involves recognition of the need for change as a first step, followed by the design and implementation of the proposed change.

Tenants of the Theory

Lewin's Change Theory developed by Kurt Lewin in 1951, who is noted as the "father of social psychology." Lewin's approach consists of three stages, unfreezing, change and refreezing. Lewin's Theory applies to the need for change with both health care professionals and diabetic patient's self-reliance or self-care. The first stage, unfreezing relies on personal psychological defenses, resistance and perceptual defenses. In the unfreezing stage, there is a perception that change is needed and then assessed. Unfreezing is where that change is noted, and there is an increasing force for that change (Mitchell, 2013). The second stage is to determine where change is needed, and change is occurring (moving). Moving is when the action of change is happening and consists of a planning and implementation stage. The

"change" would be a possible recommendation for changes to the protocol or processes. The third and final stage, refreezing occurs when equilibrium has occurred, and change is permanent. Refreezing is when the desired outcome has occurred, and implementation and evaluation occur (Mitchell, 2013). "Refreezing" or incorporating the project would entail the application of new policies, advocacy and the continued prevention and implementation of guidelines to prevent hypoglycemia.

Application to Project

Lewin's Change Theory provides a framework for prompting individuals and organizations to discover and accept that some sort of change may be necessary, consider the possible modifications, and then implement the changes in policy or behavior. In addition, Lewin's Change Theory helps change agents conquer resistance and facilitate the acceptance of best practices in healthcare. Since CSII technology is on the cutting edge of healthcare and science. Health professionals should be knowledgeable of this technology and become involved in policy-making to achieve the ultimate goal of lowering the occurrence of hypoglycemia (Staggers, McCasky, Brazelton, & Kennedy, 2008).

Middle Range Theory of Unpleasant Symptoms

The Middle Range Theory of Unpleasant Symptoms (MRTUS) is used to understand why hypoglycemic reactions are occurring with patients using CSII in the postpartum unit. The tenants of this theory hold that nurses and doctors must facilitate interventions to prevent unpleasant symptoms. The theory suggests that nurses may observe multiple unpleasant symptoms occurring in the patient receiving CSII therapy, including dizziness, nausea, or hypoglycemia due to insulin over-infusion and failure for a CDE and/or endocrinologist to

consult. MRTUS helps to examine influencing factors (CSII), symptoms (hypoglycemia) and performance (reducing the amount of insulin infused by 50%). The purpose of the theory is to provide interventions to patient's health and helping to aid in the adjustment of multiple factors associated with the symptoms (Seung Eun, Vincent, & Finnegan, 2017). Consequently, the project will identify and document the need for change to protocol, educate staff and evaluate documentation associated with both consults and the reduction of insulin infusion.

Application of Theory

There is a need for the evaluation of the current protocol CSII for diabetic patients in the postpartum unit at the project site and a subsequent change of protocol. The purpose of the assessment of the CSII protocol compliance in the postpartum unit is to demonstrate a need for protocol change, provide leadership during and after the change, and, ultimately, advocate for the diabetic patients by preventing hypoglycemia.

Project Design

The following DNP project will utilize a quality improvement design to decrease the risk of hypoglycemic events in postpartum through evaluation and modification of current CSII protocol practices. The project design is organized according to the FADE model: focus, analyze, develop, execute, and evaluate (Moran, 2016).

Focus

During the focus phase, the goal is to define the area of needed improvement (Moran, 2016). The area of needed improvement for this project is reducing hypoglycemic events among CSII protocol patients during the postpartum period.

Analyze

The purpose of the analyze phase is to collect and critically analyze data and determine the true causes of the problem (Duke University School of Medicine, 2016). Identification of the problem will provide clear opportunities for improvement and potential solutions to this problem. Information collected for the analyze phase consisted of chart reviews, process reviews, and review of the current CSII protocol.

Chart audits. The project lead conducted a retrospective chart audit under the supervision of the unit's nurse educator. Patients who have been prescribed the CSII protocol between January to June 2017 charts were audited to determine whether the protocol was carried out as intended.

A total of seven chart audits were conducted by the project lead to determine compliance with the CSII protocol, which focused on three specific protocol elements: 1) order for and reduction of infusion rate, 2) consult with CDE, and 3) consult with endocrinologist. Another measurement obtained during these chart audits were the number of hypoglycemic events. Audit results suggest compliance with CSII protocol is low, with hypoglycemic events resulting. One of the key guidelines in the CSII protocol is that a 50% insulin infusion rate reduction by order and administered post-delivery. In 100% of charts, a 50% post-delivery reduction of the insulin infusion rate was ordered. One patient had a 30% reduction in insulin infusion post-delivery, and one had a 10% reduction in insulin infusion post-delivery. All seven patients for which charts were audited experienced at least one hypoglycemic event.

Process review. After conducting interviews with nurses in the postpartum unit, it was discovered that physicians have asked patients on CSII protocols to reduce their own insulin infusion rates by making the necessary adjustments to their own insulin pumps. According to

these nurses, some physicians believe that patients are adequately familiar with diabetes self-management and are thus able to set and adjust operating parameters themselves. At home, under normal circumstances, patients do regulate their own insulin pumps. However, during hospitalization, it is vital the pumps be set and adjusted by healthcare professionals, for both health and liability reasons. Although patients who are on insulin infusion pumps tend to be highly knowledgeable of their condition, pregnancy and delivery can alter their normal responses to insulin administration. Therefore, a change to protocol would be adjustment of insulin infusion only by medical staff and not the patient. Second, a change to protocol is the insulin infusion rate before admission will be recorded on the “prior to admissions medical sheet”. Moreover, the need in the protocol for consults, from the CDE, endocrinologist and nurse can help educate the post-delivery patient on the importance and reasons for the reduction in insulin infusion.

Protocol review. A comparison of the current CSII protocol with evidence-based practices demonstrated many similarities. The current CSII protocol requires the following: reduce basal insulin infusion rate by 50% immediately after delivery; a consult with a certified diabetes educator; a consult with an endocrinologist; routine blood-glucose measurements by hospital glucometer, four times daily before meals and at bedtime; a call to a medical provider if patient glucose measures above 180 mg/dL; and administration of 15 gm of carbohydrates and a recheck blood glucose when the patient’s blood sugar is less than 70 mg/dL and the patient is able to take food by mouth. The hospital’s current CSII protocol is mostly consistent with protocols reported in the literature. One important difference is that the hospital’s CSII protocol does not specify a maximum time between transfer from the delivery room to the postpartum unit and insulin

infusion rate reduction by 50%. The reduction of insulin infusion should occur at patient entry into the postpartum unit after the orders have been written for the infusion rate reduction. If no orders are written, then the nurse needs to call the prescriber and remind the prescriber of the need to order the reduction of the insulin infusion rate.

Develop

The purpose of this phase is to articulate an action plan based on analysis findings (Duke University School of Medicine, 2016). The development of a review of protocol power-point presentation will be distributed to all nurses, including full and part time and contract. The house physician will be included in the review of protocol. Strategies to assure compliance with protocol include delivering a thorough review of protocol for both OB physicians and women's health nurses, administering a pre- and post-intervention knowledge test for both OB physicians and women's health nurses, and badge-buddies to remind the wearer to following protocol for both OB physicians and women's health nurses. The educational intervention will also include reminders for the women's health nurses to make phone calls to the OB physicians to order 50% insulin infusion rate reductions when the orders have not been made.

The change in practice for better compliance of protocol will include several features: 1) Only medical staff will adjust insulin infusion rate, 2) Prior to admissions insulin infusion will be recorded on "Prior to Admissions Medicine Sheet," 3) Only hospital glucometer will be used to record patient's glucose results, and 4) Endocrinologists consult only if CDE request need.

Execute

Education will take place in the form of several presentations by both the project lead and the nurse educator at the postpartum conference room for both women's health staff and OB

physicians to attend. The 30-minute classes will be offered at three different times between 7AM and 7 PM in order to contact all staff members. A 10-item questionnaire will be administered before and after the educational intervention to assess knowledge and familiarity with the CSII protocol pre- and post-intervention. Evaluation of chart audits will occur after education of the additions of change in practice to identify if the protocol was adhered to and changes helped compliance.

In conclusion, preliminary evidence indicates that there is insufficient compliance with CSII protocol at the practice site. Pre-intervention data was analyzed through chart audits to determine whether CSII patients on the current protocol: had insulin reduced by 50%, had a consult with a CDE, and received a consult with a CDE or endocrinologist. This data was gathered from charts of T1DM, T2DM, and GDM patients receiving CSII in the postpartum unit at an acute hospital. An intervention in the form of an educational seminar will be delivered to unit providers on the importance and benefits of revised CSII protocol compliance and changes. Charts meeting inclusion criteria will then be audited post-intervention on the same key indicators and analyzed to determine whether CSII protocol compliance improved.

Project Participants & Stakeholders

Project Participants and Practice Setting

The participants in the project are the OB physicians and the women's health registered nurses (RNs) employed in the postpartum unit. The estimated number of OB physicians for this unit is 16. The estimated number of RNs is 40, for a total estimated participant number of 56. The 40 nurses are all female, ranging from 22 to 70 years of age. The hospital at which the project will be conducted is a not-for-profit 380-bed hospital founded in 1902, with a 36-bed

postpartum unit that cares for approximately 360 patients per month, of which roughly 27 are diabetic.

Stakeholders

A key element of any QI project is full stakeholder support from influential members that can help promote, advocate, collaborate and persuade others in positions of influence (Moran et al., 2014). Stakeholders for this project are the pharmacists, OB physicians, endocrinologist, CDE's, women's health nursing staff and patients receiving CSII therapy. The primary stakeholders for the project include the nursing educators and the director of nursing (DON), as they have given permission to conduct the project. The DON has expertise in quality improvement and grants and is associated with a vast number of quality improvement projects.

In order to obtain full support from key stakeholders, the project lead will provide a presentation that will report the findings of the analysis to the director of the postpartum unit along with the nurse educator. The medical director of obstetrics will also be made aware of the presentation. The presentation will include the current issues surrounding the CSII protocol, including failure to order a 50% decrease in insulin during the postpartum period and doctors allowing patients to manage their own insulin administration. The incidence of 100% hypoglycemia will be stressed in the presentation along with the need for consults to take place with both the CDE and endocrinologist.

Recruitment Methods

The following project will use a convenience sample of 25 RNs working in the postpartum unit. Convenience sampling will be used for the project and is defined as an approach to gathering data that uses a readily available sample group (Emerson, 2015). The questionnaire data collection will not capture any personal details or any identifiable details of the participants. The collected data will be kept in a database accessed by the project lead that will require a password.

The chart audits for CSII protocol will take place in the postpartum unit at a non-profit acute care hospital in the mid-eastern region of the United States. The data gathered will include nursing documentation and medical provider documentation on patients who are receiving the CSII protocol. The inclusion criteria for patient chart audits consist of all women receiving CSII therapy with a diagnosis of T1DM, T2DM or GDM who were pregnant and delivered vaginally or by cesarean section. Excluded from this project are non-diabetic and diabetic patients who are managing through diet alone or who are receiving oral therapy or subcutaneous injections. Patients admitted to the facility who are on CSII but not admitted to the postpartum unit are not included.

Chart audits.

Inclusion criteria:

- 1) Patients on CSII protocol
- 2) Patients that are diagnosed with T1DM, T2DM or GDM
- 3) Patients that have delivered and are in the postpartum unit

- 4) Patient who are receiving rapid acting insulin delivered by CSII.

Exclusion criteria:

- 1) Patients who are not on the CSII protocol
- 2) Patients who are on the CSII protocol but are not in the postpartum unit

Retrospective chart reviews revealed that CSII protocol was not being followed 100% of the time. Consults need to be provided by CDE's usually within the first 24 to 48 hours and follow up consults with an endocrinologist if needed during the patients stay in the hospital. Nurses did not follow orders to reduce insulin infusion because of unfamiliarity with the protocol and the lack of knowledge in regard to how hormone concentrations fluctuate and lead to hypoglycemia. Addition of prior to admission insulin infusion will be displayed for nurses to easily find in "pre-admission medication sheet" therefore allowing to calculate if insulin infusion was reduced.

Medical providers.

Medical providers are not employees of the hospital. Therefore, it will be difficult to mandate a meeting with the providers. All findings of the project will be discussed with the key stakeholders. The medical director of obstetrics will be notified of all findings and the need for protocol compliance among OB physicians and women's health nurses that have permission to practice at the facility.

Inclusion criteria:

- 1) OB attending physicians

Exclusion criteria:

- 1) Physicians that only specialize in GYN patients

- 2) Pediatric physicians that visit family
- 3) Neonatologist
- 4) Physicians in the hospital that do not provide care to postpartum patients

Nurses

Nurses are employees of the hospital and will be mandated to attend the review of protocol

Inclusion criteria:

- 1) RNs that deliver care for patients admitted to the postpartum unit
- 2) RNs that float into postpartum unit
- 3) RNs that are per diem or as needed on the postpartum unit

Exclusion criteria:

- 1) Nursing Assistants
- 2) RNs that do not provide care on postpartum unit

Tools/Instrumentation

Knowledge Assessment Questionnaire

Reliability is defined as consistent and to be trusted (Tappen, 2011). Validity is to be factual and logical. Reliability of a tool cannot be confirmed with the scope of the scholarly project. However, it can be limiting the time frame of data collection so answers (when provided by human participants) do not change over a period of time. Since the questionnaire will be designed by the project lead, the reliability and validity will not be applicable to the project. The option to the project lead is to have the tool reviewed by the evaluator, director and the educator for validity and reliability. A content validity index is presented in Appendix A.

The interrater reliability was chosen as a tool due to the consistency of measuring the questionnaire using the same questionnaire. Therefore, the instructions, rater scores, and scale will be consistent for everyone filling out the questionnaire. The development of the questionnaire is based on the CSII protocol content and will be examined by both the nursing director and educator for accuracy and relevance.

The questionnaire will have a total of 10 questions, including demographic questions requesting years of practice and education. The remaining eight questions will pertain to the CSII protocol (Appendix B). The pre-and post-questionnaire will be the same for both physicians and nursing staff

Audit Tool

The project lead will create a chart audit tool that will be utilized to collect the data from the charts deemed appropriate for this project (Appendix C).

The audit will collect the following information:

- 1) Did the patient experience a hypoglycemic event? Y/N
- 2) Was an order to reduce the patient's insulin infusion rate by 50% when admitted to the post-partum unit
- 3) How long did it take to reduce the insulin infusion rate (from order to actual time reduced)?
- 4) What interventions took place if insulin was not reduced?
- 5) Did the patient receive a consult by the diabetes team and how long did the patient wait to receive the consult?

The project lead along with the postpartum nurse educator will engage in a retrospective chart review of all CSII patients that arrived in the postpartum unit post-delivery from January 1, 2017, through June 1, 2017 (pre-intervention) and from December 4, 2017, through January 1, 2018 (post-intervention).

Physician Compliance with Protocol

Leadership tools will be designed and implemented to remind of the need to follow protocol. These tools will include formal education for OB physicians and women's health nurses in the importance of following protocol policy. Badge buddies, given to all personnel on the postpartum unit, will remind personnel to follow policies requiring the reduction of insulin infusion and the request for consults with both CDEs and endocrinologists (Appendix D). In addition, a power point presentation stressing the need to follow protocol will be made available to all staff members. In order to reach all staff members, formal presentations will take place in the conference room on the postpartum unit at both 7 AM and 7 PM.

Institutional Review Board Approval

The following quality improvement project will include the chart review of patients prescribed the CSII protocol. There will be no direct risk or contact with patients, and the data collected will not involve direct patient contact. There will be no identifiable information of the patients or participants. No names or other information to link employees or patients to data. Data will be stored in an Excel spreadsheet on a password-protected laptop computer, belonging to and accessible only by the project lead. The specific information identified in the evaluation of protocol compliance will be measured (yes or no): insulin infusion reduced by fifty percent when entering postpartum unit, patient had a consult with CDE, patient had a consult with

endocrinologist. This project was determined exempt from the Institutional Review Board (IRB) at the project site.

Data Collection Procedures

Chart Audit

A list of all patients on CSII in the postpartum unit will be given to the project lead by the hospital pharmacy from January 1, 2017 to June 1, 2017. The pre-intervention chart review was conducted over a period of six months prior to the implementation of the intervention. Sample size consisted of seven retrospective chart audits between January 1, 2017 and June 1, 2017. Project participants will attend a training seminar describing the revised CSII protocol, and the revised protocol will be implemented on the unit. Following implementation of the revised protocol, a post intervention chart audit will be conducted to assess the success of the protocol change. Audits will be conducted on charts for patients who require CSII in the postpartum unit post-delivery. Both the nurse educator and the project lead will audit the CSII charts for adherence to the protocol. Determination of protocol adherence is made according to whether (1) the patient's insulin infusion rate was reduced by 50% after delivery on the postpartum unit, (2) the patient received a consult with a CDE, and (3) the patient's pre-admission insulin infusion sheet value was recorded. Values for four binary variables were recorded for each chart during pre-intervention audits: insulin infusion rate reduced by 50% (yes/no), patient's pre-admission insulin infusion was recorded (yes/no), patient had consultation with a CDE (yes/no), and patient experienced a hypoglycemic event (blood glucose level dropped below 70 mg/dL). This chart audit will be conducted over a six-month period prior to the educational intervention session.

The same audit tool will be used to conduct post-intervention chart audits over a three-month period.

Pre- and Post-Intervention Questionnaire

The participants in this DNP project will complete a questionnaire on the day of the training seminar at the beginning of this session. They will complete the same questionnaire immediately after the protocol review. The questionnaire will be distributed by the nurse educator and the project lead as a hand out sheet. The questionnaire should take approximately 10 minutes to complete and will be handed back to the nurse educator and project lead. Upon completion of the training seminar and pre- and post-intervention questionnaires, the participants will be given a badge buddie that will briefly summarize the revised CSII protocol and be used for quick reference. It is anticipated that a total of 40 nurses will participate in the review of protocol. The training seminar will take place for two days and cover all shifts.

Intervention/Project Timeline

Week	Activity Description
1	Project Planning
2-6	Pre-intervention chart audits
7	Intervention design
8	Intervention design
9	Knowledge test design
10	Knowledge test design
11	Pre-intervention knowledge test, intervention implementation, post-intervention knowledge test
12-23	Post-intervention chart audits
24	Data analysis

14	Data analysis
15	Project evaluation and conclusion
16	Project evaluation and conclusion

All providers and staff will then be required to participate in the diabetic protocol education that will take place in the postpartum conference room during November 2017 (See timeline in Appendix E). The training seminar of the revised CSII protocol will take place over two days and will cover both shifts. The seminar will be delivered by the project lead and the unit nurse educator. There will be a sign-in sheet for all participants on which to log in and log out. This attendance sheet will be kept in locked file cabinet in a locked office at the study site. The training seminar will include a pre-seminar questionnaire on information included in the existing CSII protocol. The seminar will provide information on the revised CSII protocol. The seminar is approximately 30 minutes in length and will also provide participants a chance to ask questions. Information will be provided on change in practice by two people and will span approximately 30 minutes. Upon conclusion of the training seminar, a post questionnaire will be given. Both the pre- and post-questionnaires will be handed out by the nurse educator and the project lead. The pre- and post-questionnaires will consist of eight CSII protocol-adherence questions and two questions asking for highest level of education attained and years of experience in health practice. Upon completion of the post-questionnaire, the participants will be provided with a CSII protocol index card that will describe protocol compliance. Any participants who still have questions will be provided an opportunity to receive training information again. Following implementation of the revised CSII protocol on the nursing unit then post intervention chart audits will be conducted by the project lead. After successful

completion of the CSII education, the post-intervention chart audits will begin and span a period of one month.

Ethics and Human Subjects Protection

Due to the QI nature of this project, Institutional Review Board (IRB) approval will not be needed for the DNP project. There is minimal risk to the participants or the facility and benefits to the postpartum unit include protocol compliance which results in quality patient outcomes on the unit. The project lead will use a private office with only one door that locks from the inside at the practice site for all chart reviews. When stored temporarily, charts will be kept in a locked file cabinet within a locked room. The list of CSII patients will be provided by the pharmacy and be given to the nurse educator. The nurse educator will then remove any patient-identifying information from each patient chart. Once all the patient's identifying information is removed, the list will be given to the project lead for audit. Action plan and project timeline summaries are presented in tabular format in Appendix E.

Analysis/Evaluation

The DNP project intervention of a revised CSII protocol and a training seminar is expected to raise the compliancy rates of the protocol on the postpartum unit due to a practice change. The practice change includes: 1) requiring insulin infusion recorded on the "prior to admission medicine sheet," 2). insulin infusion adjusted by medical provider and not the patient, and 3) glucose values recorded only from hospital glucometer. A revision of the CSII protocol and a training seminar is important to the compliance with the protocol and are expected to be associated with a decrease in the proportion of postpartum patients who experience a hypoglycemic event.

Data collected from both chart audits and questionnaires will be entered into an Excel (Microsoft) spreadsheet, copied into and cleaned as a comma-delimited text file, and used for analysis by SPSS software (IBM). All statistical analyses will be documented in SPSS output files. Descriptive statistics will consist of raw proportions for each of the variables pre- and post-intervention. Questionnaires will be stratified by physician and nurse categories. A histogram of physician orders for reductions in insulin infusion rates is presented in Appendix F.

The pre-intervention proportions (infusion rate reduction, consult with endocrinologist, consult with CDE, and hypoglycemic event) will be compared individually with post-intervention proportions by two independent samples z test of proportions. Although the data are collected pre- and post-intervention, the audited charts will be from two different sets of patients pre- and post-intervention. Hence, a z test of independent proportions is appropriate. Additionally, a chi square test for homogeneity will be used to compare post-intervention proportions with pre-intervention proportions. Moreover, a chi square test for independence will be used within the two chart audit groups (pre- and post-) to determine whether each proportion is independent of all others. One expects that the proportion hypoglycemic events will be dependent in an inverse manner with proportion infusion rate reduction. It is not yet clear whether one may expect the two consult proportions to be independent of infusion rate reduction and/or hypoglycemic event. The number of charts audited pre-intervention is seven. One anticipates that the number of charts available for post-intervention auditing will be comparable. Therefore, given the small number of charts, nonparametric testing for differences in proportions may be appropriate. Fisher's exact test may be used in place of z test and chi square test of homogeneity.

The comparisons of post-intervention questionnaire scores with pre-intervention questionnaire scores will be made using McNemar's test of paired proportions. One expects that an effective intervention will result in a statistically significant increase in post-intervention test scores compared with pre-intervention test scores. The number of nurses is expected to be 40, and the number of physicians is expected to be 16; these participant numbers are large enough for the statistical tests proposed.

Evaluation

The project lead will evaluate the revised CSII protocol through chart audits and determine if there is a practice change. The expected practice changes are a greater compliance in the use of the protocol, resulting in the reduction of hypoglycemic events, and placed physician orders, which will show a reduction of the insulin infusion by 50%, and a completion of a consult by the CDE or endocrinologist.

Evaluation of the data will identify if the modifications to protocol, helped adhere to compliance of the CSII protocol. Evaluation can be a judgment and should incorporate structure, process, and outcome. Components of evaluation are identifying the subject, developing the information related to the topic, gathering data, measuring the data and implementing for improvement, (Shin, & Kim, 2013).

Significance/Implications for Nursing

The purpose of this DNP project is to bring awareness to the CSII protocol procedures and to modify to the CSII protocol if necessary to prevent hypoglycemic occurrences of patients receiving CSII therapy in the postpartum unit. The suggested modifications will help to encourage health professionals to advocate, educate, and change policies concerning CSII

protocol. Suggestions for changes in the CSII protocol will help to reduce hospital length of stays, reduce readmissions, and potentially reduce costs while implementing best practices to improve patient outcomes.

The assessment of CSII protocol compliance is beneficial for both CSII patients and women's health nurses. Increased compliance and modifications with CSII protocol will allow nurses to provide a higher level of safe, effective postpartum care. Increased compliance with CSII protocol will produce informed patients with lower incidence rates of hypoglycemia and will reduce the need for continuous patient blood glucose level monitoring. Reductions of hypoglycemia will also reduce the potential for the patient falling and possibly dropping the infant due to dizziness occurring during hypoglycemia. One important reason people become nurses is to provide the best health care possible; they rely on policies and procedures to guide and influence their practices to deliver safe patient care. This DNP project also promotes interdisciplinary collaboration, which provides an increased respect among the providers within the health care industry. It promotes collegiality, improves knowledge by the utilization of evidence-based research, and develops of best practices to improve patient outcomes.

Analysis of Results

A retrospective chart audit which included seven records was conducted; the charts reviewed indicated that 100% of the patients experienced hypoglycemia. In six of the seven patients, the hypoglycemic event was considered severe and one patient experienced a hypoglycemic event which was not considered severe. In addition, the second round of retrospective chart audits (post-intervention, n=6) revealed that all six patients had a reduction of

an insulin infusion rate by 50% administered. Three of the six patients whose charts were audited post-intervention experienced each a single hypoglycemic event.

The retrospective chart audit also included determination of compliance of the original CSII policy. The audit included four questions to determine compliancy. The results to the compliance questions were as follows: 1) Did the patient have a CDE consult? The retrospective chart audit showed 100% compliance. 2) Was insulin reduced by 50%? The retrospective chart audits showed that there was a 100% compliance to this question. 3) Was the prior-to-admissions insulin infusion rate recorded on the prior-to-admissions medicine sheet? The post-intervention retrospective chart audits showed that four of the six patients had the prior-to-admission insulin infusion rates recorded on the patients' charts. Of the two patients that did not have prior-to-admission insulin infusion rates recorded, one subsequently experienced hypoglycemia. 4) Did the patient experience hypoglycemia? The post-intervention retrospective chart audits showed that three of the six patients had hypoglycemic events, and one of the patients had a severe hypoglycemic event. Each patient experienced only one hypoglycemic event. All six of the patients had glucose level measured by hospital glucometer, as mandated by the CSII policy.

Tables**Table 1.** Nurse demographic information.

Criteria	N
Overall	24
Female	24
Male	0
Education	
CNA	1
LPN	1
ADN	6
BSN	16
Experience	
1-2 yrs	2
3-5 yrs	5
6-10 yrs	4
11-15 yrs	0
>15 yrs	13

The demographic information for the nurses who participated in the intervention is presented in table 1. Of the 24 participating nurses, all (100%) were female, 16 (67%) had a

BSN and the majority (54%) had 15 or more years of healthcare experience. Just under half (46%) of the nurses had 10 or fewer years of healthcare experience.

Table 2. Nurses' pre- and post-intervention knowledge assessments.

Item	% Correct		p-value ¹
	Pre- Intervention (n = 24)	Post- Intervention (n = 24)	
Overall mean test score	86.9	97.4	0.001* ²
3. The patient's insulin infusion rate before entry to the postpartum unit is easily found on the patient's chart?	29.2	79.2	0.0005*
4. Patients on insulin infusion pumps (CSII) should have their insulin infusion rate reduced by 50% when entering the postpartum unit after delivery.	91.7	100	0.5
5. All patients on insulin pumps (CSII) should have a CDE consult.	95.8	100	1
6. Patients are required to have their glucose levels checked four times a day (before meals and at bed time).	87.5	100	0.25
7. I educate my patients and family on the importance of reducing the insulin dosage by explaining how after delivery insulin requirements are greatly reduced.	91.3	100	0.5
8. It is important to check patient's blood sugar four times a day to prevent harm (before breakfast, lunch, dinner and bedtime).	100	100	1
9. If the patient is showing signs of hypoglycemia (lethargic, confused, shaky, nausea), the patient's blood sugar should be checked right away.	100	100	1
10. It is essential to use the hospital glucometer, that is calibrated daily instead of going by the patient's glucometer.	100	100	1
* Statistically significantly different from pre-intervention (alpha < 0.05)			
¹ McNemar's test unless otherwise noted.			
² Paired t test of difference in mean scores			

The results of pre- and post-intervention nurse knowledge testing are summarized in Table 2. The overall knowledge test score improved post-intervention (97.4%, up from 86.9%, $p < 0.01$). Correct answer rate improved significantly post-intervention for questions 3 and 4, which asked about ease of finding prior-to-admission insulin infusion rate and insulin infusion rate reduction, respectively. For questions 5-10, no statistically significant increase in correct response rate was observed.

Table 3. Patient chart items and outcomes pre- and post-intervention.

Item	Pre-Intervention (n = 7)		Post-Intervention (n = 6)		p-value ¹
	No	Yes	No	Yes	
Consult w/ CDE	1	6	0	6	1
50% IIR reduction	6	1	0	6	0.005*
PTA IIR recorded	7	0	2	4	0.021*
1 or more hypoglycemic events	0	7	3	3	0.07
Hospital glucometer used	0	7	0	6	N/A

¹ Fisher's exact test
 * Statistically significantly different from pre-intervention (alpha < 0.05)
 Abbreviations: CDE, certified diabetic educator; IIR, insulin infusion rate; PTA, prior-to-admission

Summarized in Table 3 are the results of the pre- and post-intervention chart audits.

Statistically significant increases in 50% IIR reductions and prior-to-admission IIR recordings were observed post-intervention ($p < 0.01$ and $p < 0.05$, respectively). A substantial reduction in the occurrence of one or more hypoglycemic events was also observed but was only significantly different post-intervention at a significance level of 0.01 but not at a level of 0.05. No significant changes were found post-intervention in CDE consults or use of hospital glucometer.

Discussion and Significance

Significance of the DNP project implementation helped to lower the rate of hypoglycemia and symptoms associated with hypoglycemia in postpartum patients receiving CSII. The purpose for the assessment of the CSII protocol compliance in the postpartum unit was to demonstrate a need for protocol change/additions, provide leadership during and after the change, and, to ultimately, advocate for the diabetic patients to prevent hypoglycemia. Consequently, reducing hypoglycemia events will mitigate potential harm to both mother and baby (Prakash Narayanan & Samad, 2015). The DNP project utilized a quality improvement design to decrease the risk of hypoglycemic events on the postpartum unit through evaluation

and modification of previously used CSII protocol practices. The change in protocol practice was determined through the assessment of protocol adherence as follows: (1) the patient received a consult with a CDE (2) the patient's insulin infusion rate was reduced by 50% after delivery on the postpartum unit, (3) the patient's pre-admission insulin infusion sheet value was recorded, (4) patient's experiencing a hypoglycemic event (blood glucose level dropped below 70 mg/dL) and (5) the patients glucose reading was recorded from the results of the hospital glucometer.

The project lead conducted a retrospective chart audit under the supervision of the unit's nurse educator. Charts of patients who were prescribed the CSII protocol between Dec. 1, 2017 to Jan. 20, 2018, after implementation of the new change of practice protocol, were reviewed to determine whether the protocol was carried out as prescribed.

Educating the medical providers in the current evidence and best practices were consistent with changing practice standards to improve patient outcomes. The implementation of the change in protocol protected not only the baby by preventing possible harm such as dropping of the infant due to disorientation but also prevents injury to the mother (Chamberlain et al., 2016). Education of medical providers and the distribution of the "badge buddies" helped to provide a review of the change of protocol knowledge at the provider's fingertips. Educated on CSII policy changes were 24 medical providers with varied education backgrounds: six with associate degree in nursing (ADN), 16 with bachelor degree in nursing (BSN), one with licensed practical nurse (LPN), and one with certified nursing assistant (CNA). The 24 medical providers indicated having from three to 15 or more years of practice experience. These changes utilizing current CSII protocols and the addition of new policies improved compliance and helped to improve patient outcomes. Therefore, it was crucial for the facility and medical professionals to

implement and sustain adherence to proper insulin pump protocol changes to prevent the significant fluctuation in glucose levels and hypoglycemia (Castorino, Paband, Zisser, & Jovanovič, 2012).

Significance/Implications for Nursing

The significance of nursing implications is to render the change of practices to keep patients and medical providers safe from harm and to provide best practices in health care. The study from Kim & Floyd, (2015) suggest that diabetes will continue to rise therefore, it is essential that medical providers, policies, and healthcare facilities stay current with best practices and implement the most up-to-date practices and policies. Toiba, (2013) found that improvement of maternal outcomes is consistent with CSII use. Consequently, the change in practice to the CSII protocol has enhanced the quality of diabetes care by helping to prevent peaks and valleys in glucose levels and therefore controlling hypoglycemia. Preventing peaks and valleys in glucose provides a more consistent blood sugar level. This consistent blood sugar allows for the mother to continue with her current role as a caretaker for the infant without harm (Matejko et al., 2015).

The findings of the post-intervention retrospective chart audit included a 100% compliance with three prescribed actions: CDE consult, reduction of insulin infusion rate by 50%, and use of hospital glucometer. Prior to the implementation of this project, the admission medication sheet showed that the insulin infusion rate was recorded in four out of six patients. - Hypoglycemic episodes occurred in three of six (50%) patients. However, the patients who experienced hypoglycemia each only experienced one episode. These hypoglycemic events were not

considered severe in documentation. Policy change, education, and review of CSII protocol have helped to enhance compliance and reduce hypoglycemia events.

All new medical providers must be informed of the CSII protocol changes. New employees must maintain consistent adherence to the CSII protocol so as to prevent harm to mother or baby. Review of CSII policies will help to reduce stress in both the medical provider and mother by reducing hypoglycemia events and possible harm. The nurse is the individual that spends the most time with the patient and monitors the patient's condition for changes. Therefore, the patient looks to the nurse to lead, answer questions, and provide education on health issues. It is essential for the nurse to understand the background and the need to prevent hypoglycemic events and to advocate for the patient. Advocating for the patient cannot be achieved if the nurse does not understand, review, and adhere to policies formed from evidence-based practice.

Although there are currently a limited number of patients on the postpartum unit receiving CSII, the number is expected to increase concomitant with increases in diabetes diagnosis (Toiba, 2013). Therefore, it is essential for healthcare providers to understand the need for proper compliance with policies governing CSII in order to protect the patient from harm and provide the best practices in care. Emergent, evidence-based research provides the foundation for implementing policy changes and helps to keep societal cost down (Mahmood Buhary et al., 2016).

Limitations of the Project

Despite the small sample sizes of the data, particularly in the pre- and post-intervention chart audits, this project was successful in reducing hypoglycemic events. The project generated

a change in protocol and raised the awareness among the nursing staff in how to improve postpartum CSII patient treatment. Overall, there was an improvement in the postpartum CSII patient safety and well-being.

In addition to relying on small samples, there are several other limitations to the DNP project. One limitation is that the intervention did not include the unit physicians as participants. It has been noted that some medical schools provide a limited number of hours in diabetes education (Fazel, Fazel, Bedrossian, Picazo, & Pendergrass, 2016). Moreover, the innovation of medical devices and new therapies is rapidly changing. Therefore, it is essential for physicians treating diabetic patients to stay current and aware of the new treatments to provide the best care to patients (Mahmood Buhary et al. 2016). As new physicians are added to the facility, it is essential that a process is created to identify and implement diabetes-related protocol changes. Future efforts to extend the accomplishments of this project should reach beyond nurses and include physicians.

A third limitation is the short timeframe of the project. An extended time frame would have allowed for an increased number of available patient charts to be included in the pre- and post-intervention chart audits used in the project. However, the results—due to the review, education, and protocol changes—should continue to be positive and extend similarly to larger samples. Low numbers of patients notwithstanding, the project generated meaningful results.

-Lastly of concern is that the post-admission insulin infusion rate reductions varied for CSII patients - and may have been a project limitation. Minimizing the time between delivery and insulin infusion rate reduction is a key determinant in preventing hypoglycemic events. A

well-defined guideline for reducing the insulin infusion rate upon entering the postpartum unit may improve efforts to prevent hypoglycemic events.

Project Dissemination

As part of the ongoing dissemination of CSII policy compliance, “Badge Buddies” have been distributed to all medical providers and will be provided to all new medical providers as they arrive onto the unit. The “Badge Buddie” is a quick review of the CSII protocol that is connected to the medical provider's identification badge that will be worn at all times while in the facility. “Badge Buddies” provide a resource at the medical provider's fingertips as a reminder of the CSII protocol for compliance. Second, the resource handbook for CSII policy and procedure is located at the nurse's desk. The resource book reviews the CSII insulin policy, including insulin pump use, hypoglycemia and hyperglycemia, checklist criteria for CSII, patient agreement, PowerPoint presentation, and patient worksheet. Orientation to the unit will include both the review, education, and resources available to help comply with CSII policy.

The results of this project will be disseminated to the wider public via a poster presentation at an upcoming area health care conference. In addition, the expansion of the project to include more pre- and post-intervention chart audits is expected to yield a statistically significant reduction in hypoglycemic events, a finding that would then be appropriate for submission in manuscript form to a peer-reviewed academic journal for possible publication. Finally, these results will be summarized and made available to the staff at the study site.

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Appendix A**Content Validity Index Table**

Item	Expert 1	Expert 2	Expert 3	Mean
1	4	2	4	3.3
2	4	3	4	3.7
3	4	4	4	4
4	4	4	4	4
5	4	4	4	4
6	4	4	4	4
7	4	4	4	4
8	4	4	4	4
9	4	4	4	4
10	4	4	4	4

The total mean score is 39 with an average per-question score of 3.9, which indicates that the questions are moderately to highly relevant.

Appendix B

Please answer the following two demographic questions.

1. What is your highest level of education?
 - a. CNA
 - b. LPN or LVN
 - c. Diploma
 - d. ADN
 - e. BSN, BS, BA
 - f. MSN, MS, MA
 - g. PhD, EdD, DNP
 - h. Medical provider
2. How many years do you have in medical care experience?
 - a. 1-2 years
 - b. 3-5 years
 - c. 6-10 years
 - d. 11-15 years
 - e. 15 years plus

For each of the following, circle true or false.

3. The patient's insulin infusion rate before entry to the postpartum unit is easily found on the patient's chart?

True False

4. Patients on insulin infusion pumps (CSII) should have their insulin infusion rate reduced by 50% when entering the postpartum unit after delivery.

True False

5. All patients on insulin pumps (CSII) should have a CDE consult.

True False

6. Patients are required to have their glucose levels checked four times a day (before meals and at bed time).

True False

7. I educate my patients and family on the importance of reducing the insulin dosage by explaining how after delivery insulin requirements are greatly reduced.

True False

8. It is important to check patient's blood sugar four times a day to prevent harm (before breakfast, lunch, dinner and bedtime).

True False

9. If the patient is showing signs of hypoglycemia (lethargic, confused, shaky, nausea), the patient's blood sugar should be checked right away.

True False

10. It is essential to use the hospital glucometer, that is calibrated daily instead of going by the patient's glucometer.

True False

Appendix C**Chart Audit**

1. Is there an order to reduce insulin by 50% on chart? (Y | N)
2. Was the insulin infusion rate reduced by 50%? (Y | N)
3. Is the insulin infusion rate upon entering the hospital on the chart? (Y | N)
4. Is there blood glucose result in the chart? (Y | N)
5. Has the patient had a consult from the CDE (Y | N)
6. Has the patient received a consult form the endocrinologist? (Y | N)
7. Is there documentation in the chart of the medical provider notified if order was not put in for consult for both C.D.E. and endocrinologist? (Y | N)
8. Is there documentation in the chart of the medical provider being notified that pre-insulin infusion and post-insulin infusion are needed to be provided on the chart?
(Y | N)

Appendix D**Badge Buddie****Postpartum Insulin Pump Protocol**

1. Reduce Basal Insulin by 50%
2. Check glucose levels QID (before meals and at bedtime)
3. Consult by Certified Diabetes Educator
4. Consult by Endocrinologist is recommended
5. Infusion site rotation q 48-72 hrs. (Document glucose level 1 hr. after site change)
6. Call MD or DO for blood sugar > 180
7. Glucose level = or <70 start "Hypoglycemic Protocol"

Hypoglycemic Protocol

1. Glucose < 70, suspend insulin pump for 20 minutes
2. Treat with 15 grams carbohydrates, examples (4 oz. juice, 8 oz. milk, 6 oz. regular soda)
3. Repeat check of glucose in 15 to 30 minutes
4. Glucose > 90 mg/dl reconnect insulin pump to current settings
5. If glucose remains = or < 70 mg/dl repeat carbohydrate intake
6. Contact prescriber for repeat incidences of hypoglycemia

Appendix E

Table 1 Action Plan						
Action Plan						
Type	What	How	Who	When	Where	Why
Strategy	Use an educational intervention to improve compliance with CSI protocol, which is anticipated to lead to a reduction in hypoglycemic events.	Intervention evaluation.	Stakeholders.	Project duration (1/1/2017 through 2/1/2018).	Postpartum unit at area hospital.	(1) Evaluate an intervention, (2) improve compliance with CSI protocol, and (3) reduce hypoglycemic events.
People Organization	Postpartum unit at an area hospital (study site).	Project Lead mainly interacts with the Nurse Educator for data collection, intervention implementation, and all other arrangements.	Stakeholders: Project Lead, Director of Nursing, Nurse Educator, unit physicians, unit nurses.	Static arrangement.	All stakeholders are located at the study site.	Success of the project depends on buy-in and participation by all stakeholders.
Process	The project consists of pre-intervention data collection, intervention implementation, and post-intervention data collection.	Data are collected from patient charts that meet the inclusion criteria. Intervention is given in a classroom setting.	All stakeholders participate in the intervention. Data collection involves the Project Lead, Nurse Educator, and hospital pharmacy.	Pre-intervention data collection took place from 1/1/2017 to 6/1/2017. Intervention will be in 10/2017. Post-intervention data collection from	Work will be conducted at the study site and offsite when analyzing and communicating results.	The process is the structure of how the project will be executed.
Technology	Computational resources include laptop computer with spreadsheet, statistical, and word processing software.	Personal computational resources are used in this project.	Project Lead.	Continuous.	Study setting and work locations.	Modern research data-keeping and analyses depend upon use of appropriate computational resources.

Table 2 Project Schedule				
Project Schedule for...				
Tasks	Who	Hours	Start	End
Planning Phase	Project Lead, Nurse Educator	4	12/10/16	12/20/16
Pre-intervention Chart Audits	Project Lead, Pharmacy, Nurse Educator	40	1/2/17	6/1/17
Intervention Design	Project Lead, Nurse Educator	40	9/1/17	10/1/17
Knowledge Test Design	Project Lead, Nurse Educator	20	9/1/17	10/1/17
Implementation	Project Lead, Nurse Educator, Physicians, Nurses	5	11/8/17	11/8/17
Post-Intervention Chart Audits	Project Lead, Pharmacy, Nurse Educator	40	11/9/17	2/1/18
Data Analysis	Project Lead	20	2/1/18	3/1/18
Project Assessment	Project Lead	10	2/1/18	3/1/18
		Total:	179	

Appendix F

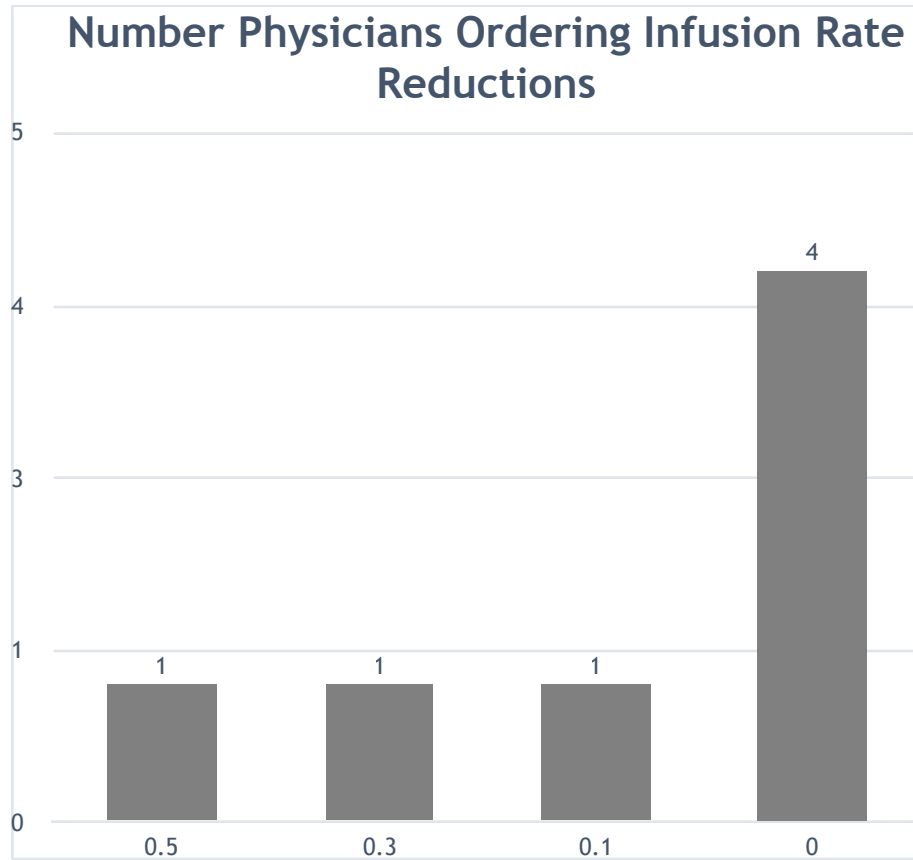


Figure 1. The number of physicians out of a total of 7 (vertical) who ordered any insulin infusion rate reduction are represented by the bars according to the percent reduction ordered (horizontal).