Inpatient Hypoglycemia Prevention Project

By

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Abstract

Diabetes is commonly encountered in the inpatient environment. Hypoglycemia can occur in this population due to a multitude of reasons. One causative factor for its occurrence stems from providers being unable to intervene to glycemic values and trends prior to a hypoglycemic event. Nurses, however, have this ability. A literature review revealed several articles and expert opinions which identified recommendations for the adjustment of insulin regimens when blood glucose levels are 100 mg/dL or less in order to achieve and maintain a CIT blood glucose target of 140-180 mg/dL. The proposal of the Inpatient Hypoglycemia Prevention Project was the revision of the insulin, sliding-scale, order-sets within OSF SJMC to include the order for nurses to contact the providers when patient blood glucose levels are at or below 100 mg/dL; prompting for an adjustment of the insulin regimen. Implementation of this revision occurred over 15-weeks, with the goal to reduce hypoglycemic events by 6% and LoS by 2 days. Prospective studies were completed to evaluate and determine the outcome of this intervention. The total potential participants identified include 117 in the pre-implementation phase and 98 in the post-implementation phase. Pre-implementation hypoglycemic events were 12.5%, but there were no post-implementation hypoglycemic events (p-value = 7.49). LoS was 5.75 days pre-implementation, while LoS post-implementation was 13.5 days (p-value = 0.1357). Due to low sample population size, the results were not statistically significant; however, further research could provide a more conclusive study.

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Inpatient Hypoglycemia Prevention Project

Chapter I

Introduction to Problem

Clinical Practice Issue

The increasing prevalence of diabetes in the United States is a growing concern. In 2015, there were 30.3 million individuals (9.4%) in the United States with diabetes, of whom 1.5 million were newly diagnosed (American Diabetes Association, 2017). Due to the complexity of this disease and high frequency of complications, a total of 7.2 million hospital discharges had diabetes listed as a diagnosis in 2014 (National Center for Chronic Disease Prevention and Health Promotion, 2017). Because of the high prevalence of diabetes and the burden it places on the inpatient environment, the provision of updated, evidence-based guidelines is essential to the effective management of diabetes.

Effective management of diabetes within the inpatient setting relates to the achievement and maintenance of established glycemic targets. This is typically accomplished through effective insulin order-sets on the average hospitalized patients. These orders-sets provide specific orders and protocols based on the glycemic target, including blood glucose monitoring, insulin administration, hypoglycemia correction, and provider communication. Without effective management, hypoglycemia and hyperglycemia will occur. Both hyper and hypoglycemia have been associated with adverse events.

Hypoglycemia is described as a blood glucose level at or below 70 mg/dL and severe hypoglycemia is described as a blood glucose level at or below 40 mg/dL (Davis & Lastra-Gonzalez, 2008). In a large, retrospective study involving 126 hospitals across the United States, the frequency of hypoglycemic events during point-of-care glucose monitoring was 10.1% in the ICU and 3.5% in the non-ICU (Cook et al, 2009). Hypoglycemia can cause immediate, specific complications, such as seizures and coma, or generalized complications, including increased

length of stay (LoS) in the hospital (Davis & Lastra-Gonzalez, 2008). Therefore, prevention of hypoglycemia through effective management is essential to best patient outcomes.

Recent research has shown that conventional insulin therapy (CIT) with the target of 140 -180 mg/dL has similar rates of mortality, but a lower frequency of hypoglycemia than intensive insulin therapy (IIT) with the target of 80-110 mg/dL in hospitalized patients (Kansagara, Rongwei, Freeman, Wolf, & Helfand, 2011). Therefore, in the hospital setting, a glycemic target of 140-180 mg/dL is considered best practice and glycemic values of 100 mg/dL or less should be avoided, according to expert opinions (Umpierrez et al., 2012).

Currently, OSF St. Joseph Medical Center (SJMC) discontinues all oral, anti-hyperglycemic medications upon admission. Insulin is used as the primary treatment of hyperglycemia using CIT as the target. Insulin, sliding-scale, order-sets at OSF SJMC consists of three primary measures to achieve and maintain glycemic targets. These measures are: insulin administration based on glycemic values from 180-400 mg/dL or meal intake, communication to providers for glycemic values over 400 mg/dL, and a nurse-driven hypoglycemia protocol when blood glucose levels are 70 mg/dL or less. However, until this project, there had not been appropriate measures to prevent hypoglycemia within the insulin, sliding-scale, order-sets. In the past, this has required the providers, including physicians and mid-level providers, to monitor glycemic values and trends proactively, making adjustments as needed.

Problem Statement

Relying solely on provider monitoring of glycemic values and trends presents a challenge regarding effective management of inpatients with diabetes. Glycemic values and trends can change in-between provider monitoring. These changes in glycemic values and trends are caused by multiple factors, the most common include steroid use, infection, activity level, and nutritional intake. (Davis & Lastra-Gonzalez, 2008). Because of this gap in monitoring, a

provider may not be able to identify hypoglycemic events before they occur. However, primary nursing staff can recognize glycemic values and identify trends before providers.

Significance to Nursing

Because of the ability of nurses to identify and trend glycemic values sooner than providers, a communication order for nurses to contact providers for glycemic values of 100 mg/dL or less can decrease events of hypoglycemia and reduce LoS. The communication should occur through SBAR form, which stands for situation, background, assessment, and recommendation. The recommendation would be the adjustment of the insulin regimen. Collaboration between the nurse and provider is essential. With this order, facilitation of collaborative behavior occurs, resulting in improved patient outcomes.

Project Aim

The goal of this project was to improve the effective management of inpatient diabetes by increasing the time glycemic values are within their target range. The target range was the CIT goal of 140-180 mg/dL. In order to achieve this goal, decreasing events of hypoglycemia by 6% and LoS by two days after 15-weeks were the project objectives. Additional objectives included: 75% of nurses will complete the education by the end of the educational phase and 75% of the nurses will correctly implement the insulin, sliding-scale, order-sets protocol.

Purpose of Project

The underlying purpose of this project was to meet the scholarly requirements of Bradley University's Doctor of Nursing Practice program. However, as a result of successful implementation of this project, increased safety at OSF SJMC through decreased hypoglycemic events and reduced LoS are additional benefits. Outcomes were measured by completion of prospective studies. Based on successfulness of this project, the changes at OSF SJMC will become accepted ministry-wide at OSF.

Project Goals and Objectives

As stated previously, the goal of this project was to increase the effective management of inpatient diabetes by increasing the time glycemic values are within their target range. Based on the evidence, the target range established was the CIT goal of 140-180 mg/dL. There were two objectives which guided the accomplishment of this goal. The first objective was to decrease events of hypoglycemia by 6% in 15-weeks and second objective was to reduce the LoS by two days also within 15-weeks. In order to achieve the above objectives, two additional objectives existed. First, 75% of nurses completed the education by the end of the educational phase. Second, 75% of the nurses correctly implemented the insulin, sliding-scale, order-sets protocol within two weeks of implementation of the project. All objectives met the qualification of SMART goals, which are specific, measurable, achievable, realistic, and timely.

Research Question

The research question was developed in PICOT form with guidance from the above stated goals and objectives. The research question is as follows: in hospitalized patients receiving sliding-scale, insulin therapy, does the reporting from nurses to providers of blood glucose levels of 100 mg/dL or less, versus only provider monitoring, decrease hypoglycemic events by 6% and length-of-stay by two days over a 15-week period? This research question was used throughout the course of this project. It guided this project in development, implementation, and evaluation.

Aligning with Organizational Strategic Plan

OSF SJMC is a level-two trauma hospital, part of the OSF Healthcare organization ministry. All OSF organizations operate under the ministry-wide mission and values. According to OSF, the mission is: “In the spirit of Christ and the example of Francis of Assisi, the Mission of OSF HealthCare is to serve persons with the greatest care and love in a community that celebrates the Gift of Life” (OSF Healthcare, n.d.). The vision statement reads as the following:

> Embracing God's great gift of life, we are one OSF ministry transforming health care to improve the lives of those we serve. This vision refers to all components of OSF HealthCare including OSF Healthcare System, OSF Healthcare Foundation and OSF Saint Francis, Inc. (OSF Healthcare, n.d.).

The values of this ministry consist of: justice, compassion, integrity, teamwork, employee well-being, supportive work environment, trust, stewardship, and leadership (OSF Healthcare, n.d.). Through the use of collaboration, this project resulted in the assurance of patient safety, and supported the overall value of life. Therefore, this project correlated with the organization's mission, vision, and values.

Search Process

In the collection of evidence, databases used were: Google Scholar, Pubmed, American Diabetes Association, U.S. National Library of Medicine, and CINAHL. This search included keywords such as: diabetes, blood glucose, glycemic target, hypoglycemia, management, control, hospital, inpatient, collaboration, communication, nurse, physician, length-of-stay, intensive insulin therapy, and conventional insulin therapy. These keywords were used in various combinations in the process of the search. Articles were limited to peer-reviewed and less than 10 years old. Through this search criteria on these databases, using these keywords, 1,399 articles were resulted. This number was further narrowed to 56 articles based on accessibility to the articles. After excluding all articles with focused areas of studies outside of research question parameters (e.g. glycemic control post-op, inpatient hyperglycemia prevention, and outpatient glycemic control), 11 research articles and four expert opinions were selected.

Synthesis of Evidence

The evidence accumulated relate to three primary categories: hypoglycemia, LoS, and collaboration. Currently, there are four organizations which recommend CIT over IIT. These organizations include American Association of Clinical Endocrinologist (n.d.), the American

Diabetes Association (2017), the American College of Physicians (Qaseem, Chou, Humphrey, & Shekelle, 2013), and The Endocrine Society (Umpierrez et al., 2012). Furthermore, The Endocrine Society recommends the adjustment of insulin therapy when glycemic values are 100 mg/dL or less. Currently, there have not been any studies to date which specifically measure the occurrence of hypoglycemia with blood glucose levels of 100 mg/dL or less. Although, many studies have demonstrated the benefits of CIT over IIT in regards to decreased hypoglycemia events with no significant difference in mortality.

Hypoglycemia

First, it must be recognized that inpatient hypoglycemia is a cause for concern. While hypoglycemia cannot be entirely preventable, it should be avoided with the use of proper measures. As awareness for the need of improved glycemic control in hospital settings increased and new methods for glycemic management were developed and implemented, a need for baseline data of inpatient glucose levels was identified. Cook, et al. (2009) acknowledged this need in a retrospective, cohort study of 126 hospitals in the United States. In this study, the prevalence rate of hypoglycemic events occurred in the ICU at 10.1% and in the non-ICU at 3.5%. With these results as baseline, hospitals can effectively measure their impatient glycemic control outcomes, including rate of hypoglycemic events, and compare them to national averages.

CIT vs. IIT

Intensive insulin therapy (IIT) is an inpatient insulin regimen with a typical glycemic target of 80-110 mg/dL. This was considered the ideal glycemic target for reducing mortality rates caused by factors associated with hyperglycemia in the hospital setting. However, after growing concerns regarding the occurrence rates of hypoglycemic events, several researchers began comparing inpatient outcomes with a less aggressive insulin treatment, conventional insulin therapy (CIT), which typically had a glycemic target of 140-180 mg/dL. Five studies

comparing the occurrence of hypoglycemic events associated with CIT vs. IIT from 2009-2012 were selected in the collection of evidence. In order to provide an updated totality of evidence regarding the impact of CIT vs. IIT in regards to mortality and hypoglycemic rates in the intensive care unit (ICU), Griesdale et al. (2009) completed a meta-analysis of 26 randomized controlled studies (RCTs). This meta-analysis, with a combined total of 13,567 participants, found IIT increased hypoglycemic rates by six-fold without improvement in mortality in comparison to CIT in the critical care setting (Griesdale et al., 2009). One of the RCTs included in this meta-analysis was The Nice Sugar Study, which was the very first, large-scale study of its kind; comparing CIT versus IIT. In this parallel RCT study, conducted in 42 hospitals, IIT (81-108 mg/dL) was associated with hypoglycemic rates of 6.8%, while CIT (<180 mg/dL) was associated with hypoglycemic rates of 0.5% (The Nice Sugar Study Investigators, 2009). In a systematic review of 10 RCTs, which evaluated the benefit and harm of IIT in hospitalized patients in the following categories: ICU, post-operative unit, myocardial infarction, stroke, and brain injury, it was discovered that IIT increased the relative risk of severe hypoglycemic events by a relative risk of 6 in the critical care setting without improvement of mortality in comparison to CIT (Kansagara, Rongwei, Freeman, Wolf, & Helfand, 2011). In another systematic review/meta-analysis of 19 studies set in non-critical care units, it was determined that IIT increased the relative risk for hypoglycemic events by 1.58 with no correlation of reduced risks regarding death, stroke, or myocardial infarction (Murad et al, 2012). Though, this study measured IIT as 80-180 mg/dL. The results of a retrospective, cohort study of 523 patients in a surgical ICU demonstrated hypoglycemic event occurrence was 23.8% with blood glucose levels <157 mg/dL versus 3.5% with blood glucose levels >157 mg/dL (Al-Tarifi, Abou-Shala, Tamim, Rishu, & Arabi, 2011). Common variables found in these studies include comorbidities, blood glucose measuring accuracy, corticoid steroid use, and nutritional status. In summarization of these studies, all have shown IIT is associated with more frequent hypoglycemic events with significant evidence.

Length of stay

When hypoglycemic events occur, one associated impact recognized is increased length of stay (LoS). Increased LoS is a concern for quality patient care as it is associated with increased costs and reduced patient outcomes. Three studies from 2009-2015 were selected as evidence in regards to the correlation of hypoglycemic events with LoS. In order to determine the impact of hypoglycemic events on patients in the hospital, Brodovics, et al. (2013) completed a retrospective, cohort study of 107,312 admissions, which determined LoS increased from 5.2 days to 8.2 due to hypoglycemic events. McEwan, et al. (2015) noted in another retrospective, cohort study of over 1,000 type-1 and type-2 diabetics, LoS increased on average from 4.41 days to 11.91 due to hypoglycemic events. Finally, Turchin et al. (2009) completed a retrospective, cohort study to primarily determine the mortality rate associated with hypoglycemic events. In this study of 4,368 admissions on the general ward, including 2,582 diabetics, it was established that LoS was increased by an average of 2.5 days per each day hypoglycemic events occurred (Turchin et al, 2009). The identified common variables include cause of hypoglycemic events, hypoglycemia symptoms, blood glucose measuring accuracy, use of corticoid steroids, and nutritional levels. Increased LoS is strongly correlated with hypoglycemic events based on this evidence.

Collaboration

Collaboration between interdisciplinary team-members is an important component of effective patient care. Each member of the interdisciplinary team has different perspectives, experiences, knowledge, and abilities, which aid the achievement of best patient outcomes. Because of the ability of nurses to identify blood glucose levels and trends more frequently than providers, collaboration through communication from nurses to providers is essential in order to make time-sensitive changes as necessary. However, decision-making is the least used of the collaborative behaviors. In a descriptive study involving 114 nurses and 33 physicians, decision-making was approximately used infrequently (Nair, Fitzpatrick, McNulty, Click, & Glembocki,

2011). Lancaster, Kolakowsky-Hayner, Kovacich, & Greer-Williams (2015) found in a qualitative study, interviewing 12 physicians, 13 nurses, and 11 unlicensed assistive personnel, physicians see themselves as the primary decision-maker, but agree nurses are an integral component of the care team, as they spend more time with the patient and often know of changes the physicians are not aware of. In order to achieve a sound collaboration among interdisciplinary team-members, which leads to best patient outcomes, decision-making behaviors are necessary in communication. The key to assuring effective communication between nurses and providers is through implementing SBAR, an effective tool used to frame essential components of communication (Institute for Healthcare Improvement, n.d.). Through the use of SBAR, decision-making behaviors are facilitated.

Theoretical Framework

High reliable organizations are described as organizations in complex and high-risk fields, who operate for extended times without major failures. Airlines are often used as examples of high reliable organizations. The theory of high reliability is described as a state of persistent mindfulness within an organization (Agency for Healthcare Quality and Research, 2017). There are five characteristics associated with high reliability organizations. These characteristics include: preoccupation with failure, reluctance to simplify, sensitivity to operations, deference to expertise, and commitment to resilience (Agency for Healthcare Quality and Research, 2017). Healthcare organizations are pursuing high reliability standing, but have yet to achieve this accomplishment. For healthcare, high reliability focuses on patient safety, which is the freedom from accidental injury (Hughes, 2008). The Institute for Healthcare Improvement (IHI) has a three-step model for implementing the high reliability theory within healthcare. The three steps are: prevent failure, identify and mitigate failure, and redesign the process based on findings (Nolan, Resar, Haraden, & Griffin, 2004).

Within this project, the theory of reliability was used as a foundation for development and implementation. The goal being preventing inpatient hypoglycemia and increased LoS. It

was identified that monitoring of glycemic values and trends by providers was not proficient enough to prevent hypoglycemic events. Therefore, the process was redesigned through implementation of this project in order to prevent accidental injury caused by preventable events of hypoglycemia. Use of this IHI model provides the characteristics of a high reliability organization.

Chapter II

Methods

Needs Assessment

Prior to this project, there lacked adequate measures to prevent hypoglycemic events in the inpatient population whom were receiving insulin therapy via the insulin, sliding-scale, order-sets, specifically at OSF SJMC. The intervention of this project addressed this deficit. With decreased hypoglycemic events, LoS is reduced as well. This increases the duration of time patients are within the CIT target.

Project Design

This project was a prospective cohort research study established on current evidence-based recommendations found in the literature review. Data were collected initially to establish a baseline over 15-weeks. After the intervention was implemented over 15-weeks, data were collected again. The findings were then compared for statistical analysis.

Setting

The setting used is a level-two trauma hospital, OSF St. Joseph, located in Bloomington, Illinois. This hospital is part of a larger organization which expands across Illinois and several other states. Units involved in this hospital included ICU/post-ICU, medical/surgical, and orthopedic/neurology. These inpatient environments are similar to the settings seen in the CIT versus IIT literature.

Population

The sample population for this project included all adult inpatients with an insulin, sliding-scale, order-set (general adult or critical care mild, moderate, or aggressive) at OSF SJMC. Inpatient units involved were ICU/post-ICU, medical/surgical, and orthopedic/neurology. Patients who were pregnant, prisoners, or in the transitional care unit (TCU) or birthing center were excluded. Potential participants who met the criteria above were identified through reports

generated in Epic software. Using the Cochran's formula, 385 was the total population sample size selected in order to achieve statistically significant results. Recruitment for pre-implementation occurred over 15-weeks from 07/27/18 - 02/11/19 and recruitment for post-implementation occurred over 15-weeks from 02/12/19 - 04/23/19.

Project Plan

Pre-implementation

The progression of the project is detailed in the timeline (Appendix A). Once IRB approval was obtained, potential pre-implementation participants were identified through the use of reports generated through Epic software and consents were obtained. This recruitment spanned over 15-weeks from 07/27/18 - 02/11/19. Pre-implementation data collection occurred after this recruitment phase ended. Data were collected through a prospective study using Epic software. Information collected adhered to the data extraction plan (Appendix B). Education of nurses and providers occurred during this pre-implementation phase, spanning over four-weeks.

Education

For initial training, nurses and providers, including hospitalists and intensivists, received an email with information regarding the project, which included an informative flyer written in SBAR format (Appendix C). This flyer was also posted in the nurses' breakroom and the hospitalists' office. The flyer was also a topic of discussion during a monthly hospitalist meeting scheduled within the time of this pre-implementation phase. This was the extent of provider education. Nurses were assigned a power point on the Healthstream website (Appendix D), containing education focused on the implementation of the intervention. A test was administered after completion of the Healthstream education (Appendix E). If education was not completed on Healthstream within the two-weeks prior to implementation, education was provided through email or printed material as needed. Nurses were also read a brief overview of the implementation process by charge nurses during safety rounds at the beginning of each shift (Appendix F). The process of education for nurses within OSF Healthcare system float pool who

are frequently scheduled shifts at SJMC essentially remained the same, aside from increased use of email for communication. Ongoing education provided beyond the initial four-weeks was based on assessed needs due to factors of compliance, lack of knowledge, and/or modifications.

Intervention

The implementation phase occurred once the pre-implementation phase was completed. The intervention was a communication order for nurses to call providers when blood glucose levels were 100 mg/dL or less on patients who were receiving insulin via the insulin- sliding-scale, order-sets (general adult and critical-care mild, moderate, and aggressive). This communication order was requested to be added into the medication administration record (MAR) as a pre-checked order within the order-set. This required initial approval from the SJMC Process, Training, and Technology Council (PTTC). Once approval was obtained, they then forwarded the proposal to the Ministry System Intake Council. The Ministry System Intake Counsel then directed the proposal to the appropriate ministry committees, including the Physician Content Advisory Council, who then made the final approval decision. In the case that the implementation of the intervention within the MAR did not occur prior to the implementation phase, reminder cards were posted at each computer station, describing the implementation process, for the nursing staff (Appendix G). The flowsheet, Labs Needing Provider Notification, was used by the nurses to document in Epic software the course of events, including patients' blood glucose levels, the communication to the provider, and the orders received, if any.

Post-implementation

Potential post-implementation participants were identified through reports generated using Epic and informed consents were obtained. Recruitment spanned over 15-weeks from 02/12/19 - 04/23/19. Provider and nurse compliance was monitored weekly during the implementation at minimum. At the end of implementation, post-implementation data were collected through Epic software, again adhering to the data extraction plan. The results from the

assessment and evaluation were analyzed for statistical findings by OSF Healthcare Analytics Services. Quality indicators and milestones were monitored and collected throughout the duration of the program.

Data Analysis

The project manager collected the data from the Epic software and transferred it to a spreadsheet. A paired, samples t-test was then used to compare the rates of hypoglycemic events and LoS. The confidence level selected was 95% and 0.05 was the determined confidence interval. Diagnosis of diabetes, NPO status, age, glucose level between 70-100 mg/dL, hypoglycemia, event of provider contacted, occurrence of intervention, compliance of flowsheet documentation, and completion of education by nurses were other data measurements, calculated using percentage, mean, and range.

Ethical Issues

IRB

This project required the approval of an institutional review board (IRB). After the project proposal was presented to OSF SJMC's Nursing Research Committee and approval was acquired, IRB approval was then obtained through OSF Healthcare affiliate University of Illinois College of Medicine Peoria (UICOMP), which is a federally approved IRB. An application to Bradley University's Committee on the Use of Human Subject in Research (CUHSR) was also submitted. The IRB application was filed as an expedited review.

Informed consents

Informed consents were provided to all potentially interested participants who were determined to be self-decision makers. The project manager and team leader approached each potential participant face-to-face. After providing information regarding the study and leaving the informed consent, the project manager or team leader re-visited potential participants on a

following day to potentially obtain consent. Those who were unable to provide consent, or whom were not eligible, were not allowed to participate.

Security

OSF Healthcare continuously monitors access to patient charts for security purposes. Access to patient data is restricted based on need and clearance; therefore, clearance was obtained through the proper channels at OSF SJMC. Data collected had identifiers, such as names, removed and placed on a separate list. This master list of names was stored in a locked container in the team leader's locked office with the informed consent forms. De-identified data were stored on the project manager's password-protected computer. The master list containing the patient names will be destroyed at the end of the project. Informed consent forms will be destroyed after six years from the end of the project via shredding.

Chapter III

Organizational Assessment and Cost Effectiveness Analysis

Organizational Assessment

OSF Healthcare embraces and encourages mission partners to engage in process improvement and research through career ladders, councils, and other avenues. This assists in establishing an environment which embraces change. However, after interviewing nurses on the involved units, it was discovered that the majority were resistant to the idea of the intervention. On the other hand, the majority of the providers were supportive. The implementation of this intervention required the interdisciplinary collaboration and full participation of both nurses and providers. Other identified barriers include recruitment of participants, integration of intervention in Epic software, and completion of education. Decreased hospital costs would be an unplanned benefit.

Cost Factors

The cost of this project was minimal, but flexible and difficult to assess. OSF SJMC absorbed any costs related to education of nurses, as well as costs associated with the use of pre-established resources, such as computers and information technology staff, as agreed upon by managers of involved units. Printed material used for education was paid for by the project manager, which was projected at a cost of $50. OSF Healthcare nurses, who are paid an hourly wage, were eligible to be paid for time spent completing education on the Healthstream website, as long as the total hours paid did not exceed 40 hours per week. Estimated time to complete the Healthstream education for this project was 15 minutes. Since the estimated total number of nurses receiving Healthstream education was 80, and if every nurse received base pay for the completion of the Healthstream education over 15 minutes, the maximum cost would have been $500 for paid education. Therefore, this was the paid education budget. Income as result of this project would have been related to the reduction of events of hypoglycemia and LoS, but the projected amount is unable to be calculated. Total cost is depicted in Table 1.

Table 1.

Budget

EXPENSES	**TOTAL**
HEALTHSTREAM PAID EDUCATION	$500
PRINTED MATERIAL	$50
TOTAL EXPENDITURES	$550
INCOME	**TOTAL**
REDUCED EVENTS OF HYPOGLYCEMIA PER DAY PER PATIENT	UNKNOWN
REDUCED LoS PER DAY PER PATIENT	UNKNOWN

Chapter IV

Results

Implementation Process

Due to multiple factors, several amendments were required and submitted to the UICOMP IRB (Appendix A). Twice, the recruitment phase was adjusted. Once this was due to the overlapping of UICOMP IRB approval into the initial proposed pre-implementation recruitment phase. The UICOMP IRB approval process took twice as long as OSF SJMC leaders advised due to high inquiry volumes. The second amendment to the recruitment time was due to the low number of potential recruitments. The recruitment duration was changed from six-weeks to 15-weeks while still in the pre-implementation phase. Another amendment was regarding the implementation of nurse reminders for the intervention process in the case of delayed integration into the MAR of Epic software. This was a quality assurance measure, missed in the initial proposal. Finally, the last amendment was due to the recommendation by OSF SJMC leaders to change the documentation of the intervention from a smartphrase to a flowsheet as a result of changes in processes of lab documentation. Because of these barriers and amendments, the project took longer than initially accounted for. The amount of required flexibility, ingenuity, and critical thinking involved in the development, planning, and initiation of this project was not considered thoroughly enough.

Project Outcome

Overall, final Healthstream completion rate by nurses was 74%. This included 75% by ICU/post-ICU, 77% by medical/surgical, and 70% by orthopedic/neurology. Compliance of the nurses in implementation of the intervention was 100%. Of the 117 identified potential participants, only eight participants were recruited in the pre-implementation phase. In the post-implementation phase, there were 98 identified potential participants, of whom only four participants were recruited. The rate of hypoglycemic events was 12.5% pre-implementation and there were no hypoglycemic events post-implementation (p-value = 7.49). 37.5% of the

individuals had a blood glucose of 70-100 mg/dL and 25% had both a blood glucose of 70-100 mg/dL and a hypoglycemic event in the pre-implementation phase. In the post-implementation phase, 50% of the individuals had a blood glucose of 70-100 mg/dL. These blood glucose rates are outlined in table 2. Pre-implementation, the average LoS was 5.75 days, ranging from 2-12 days, while the average LoS post-implementation was 13.5 days, ranging from 3-29 days (p-value = 0.1357). The other data measured included age, NPO, age, diabetes, type of diabetes, and intervention of the provider, which is outlined in table 3.

Table 2.

Blood Glucose Levels

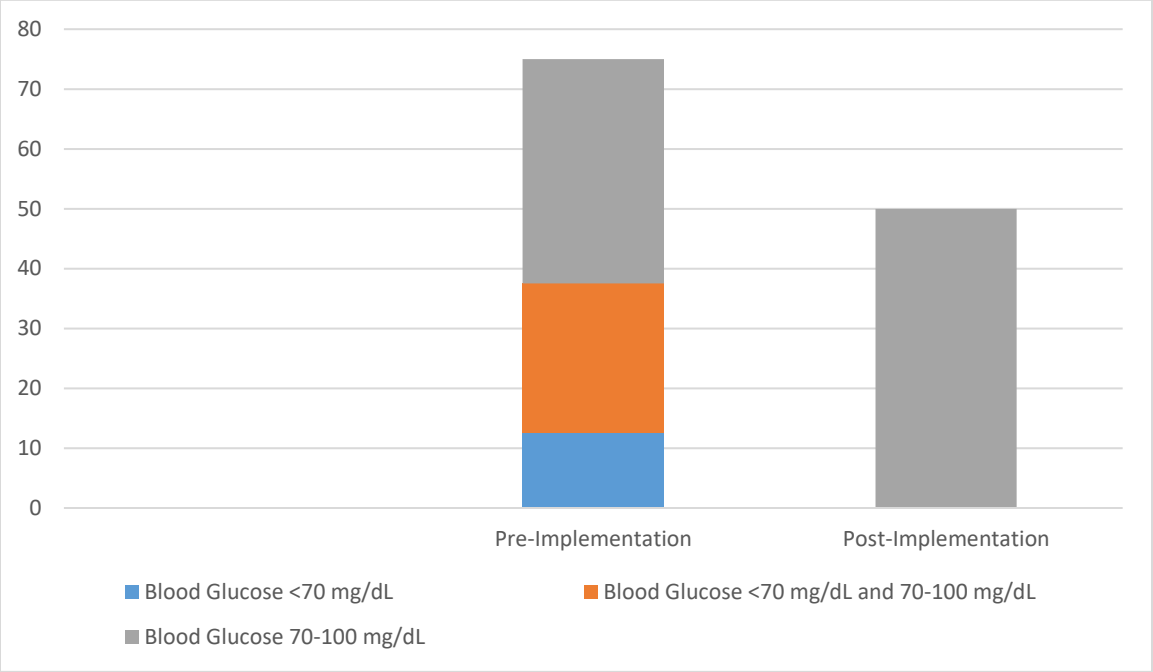

Table 3.

Other Data Measurements

	Pre-implementation	**Post-implementation**
NPO	50%	50%
Age	Range 56-86; Mean 69.25	Range 58-77; Mean 68.25
Type of Diabetes	Type-2 Diabetes – 100%	Type-2 Diabetes – 50% None – 50%
Intervention	N/A	Continue current regimen – 100%

Chapter V

Discussion

As education was delivered to the nurses, it was met with receptiveness. Despite this, nurse education did not meet the established outcome measurement of 75%, but fell slightly below at 74%. When reviewing the list of nurses who had not completed the education, several of the names on the list were of nurses who were no longer employees. This could have falsely reduced the completion rate. Education was provided to nurses and providers regarding changes as they occurred. Providers, on the other, were not as receptive to education. On several occurrences, education was reiterated to providers on the evidence shown in the literature.

Despite approval by the Physician Content Advisory Council for the intervention to be integrated throughout OSF Healthcare within the MAR of Epic software, it was not successfully completed prior to the end of the implementation phase of this project. The reminder cards were in place for this reason, to provide a reference for nurses, so the intervention could be implemented effectively. They were placed on the computers in the units at the beginning of the implementation and then replaced halfway through. The integration of the intervention into the MAR of Epic software is still pending.

As a result of the education and use of the reminder cards, nurse compliance of implementing the intervention was at 100%. This rate successfully exceeded the outcome measurement of 75%. Providers, however, did not follow the evidence-based practice despite the education provided. When given the recommendation to adjust the insulin regimen, the providers continued with the current treatment.

One of the largest limitations of this study was the population size. The Cochran's formula found 385 participants were needed for statistically significant results. However, the total population size was only 12 for both pre and post-implementation recruitments. Therefore, the sample size did not produce statistically powerful results. In addition, the use of reminder cards for nurses may not have been as an effective process in comparison to an order-set with the

communication order embedded. There were several limitations relating to the sample population, which included: lack of measurements for steroid use, activity level, and nutritional intake, which could cause variability in blood glucose readings. This project also did not measure for multiple hypoglycemic events in individuals. Furthermore, this project included two individuals in the post-implementation phase who were not diabetic, yet were on an insulin, sliding-scale, order-set. In addition, one post-implementation recruitment had a long LoS, totaling 29 days.

The intervention used in this project is similar to other processes, such as when blood glucose levels are less than 70 mg/dL or greater than 400 mg/dL. With integration into the MAR of Epic software and the provision of education to new nurses and providers with initial Epic training, this project would be sustainable. Epic software trainers and nurse educators would assume this responsibility. While this intervention is only being implemented throughout OSF Healthcare, it could also be integrated into MAR systems at other healthcare facilities.

Since the population sample was small, future research could expand with a larger sample in order to achieve more statistically significant results. Measuring for variables such as steroid use, activity level, and nutritional intake, which could cause variabilities in blood glucose readings, could also improve findings. Future research could also focus more on the requirements necessary to increase the duration of time remaining within the CIT target altogether. This would provide a larger understanding as to the factors which result in inadequate blood glucose control in the inpatient setting. The findings of this project will be disseminated with a virtual presentation to Bradley University faculty and peers, submission of final paper to national DNP depository, and a poster presentation to stakeholders at OSF SJMC. The basis of the project and pre-implementation results have already been shared with Magnet surveyors during OSF SJMC accreditation visit.

Through this project, nurses were given the ability to use their skills and knowledge to assess blood glucose levels and how they correlate to patient outcomes and treatment methods.

Through collaboration with providers, using decision-making behaviors, evidence-based practice was initiated. Providers, both physicians and mid-levels, such as nurse practitioners, were able to help improve patient outcomes with the assistance of the nurses.

CIT is the blood glucose target at OSF SJMC. However, the intervention of this project helps to further assure that this target is achieved and maintained. Through approval by the Physician Content and Advisory Council, this intervention is written into practice policy throughout OSF Healthcare and is pending integration. Further development of policies which encourage collaborative behaviors as used in this project could improve more patient outcomes. This project has assisted with increasing patient safety in the inpatient setting through preventing failure, identifying and mitigating failure, and redesigning the process based on findings. Overall, through increased patient safety, OSF SJMC has taken a step closer to achieving high reliability status.

Chapter VI

Conclusion

Overall, there is significant evidence in the literature which supports the implementation of this intervention, for nurses to notify the provider when blood glucose levels are 100 mg/dL or less, recommending an adjustment in the insulin regimen. This intervention decreases hypoglycemic events and reduces length of stay. However, due to the population sample size, the evidence was not strong enough for conclusive findings with this project. Future research could be implemented in order to achieve more statistically significant results.

DNP Essentials provide foundational competencies for the graduate advance nurse practitioners. The DNP Essentials used in this project include Essential I: Scientific Underpinnings for Practice Competencies, Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking, Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice, Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care, Essential V: Health Care Policy for Advocacy in Health Care, Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes, Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health, and Essential VIII: Advanced Nursing Practice Competencies. DNP Essentials were integrated in the following manner: Essential I, conduction of literature review; Essential II, development of quality improvement strategy; Essential III, translation of research to practice; Essential IV, utilization of information systems/technology; Essential V, revision of healthcare policy; Essential VI, collaboration with interdisciplinary team; Essential VII, promotion of population health; and Essential VIII, implementation of therapeutic intervention. Meeting the competencies listed within these essentials allowed for the assurance of quality methodology in progression of the project.

The plan for dissemination currently includes a virtual presentation to faculty and peers at Bradley University, submission of a final paper to national DNP repository, and placement of poster presentation in nurses' breakrooms and providers' office at SJMC. A presentation including pre-implementation findings was already provided during the post-implementation phase to Magnet surveyors. This was to meet requirements for a Magnet accreditation site visit at OSF SJMC. Further dissemination will be provided upon request by OSF SJMC leaders.

Through this project, knowledge was gained on the processes of collecting research, implementing evidence-based practice, and conducting human research. This large, organizational project was met with several barriers. These barriers required solutions that were innovative and effective. Managing these barriers allowed for growth as a leader in both a personal and professional manner.

Appendix A

Timeline of DNP Project

- 05/23/18. Approval of project from OSF SJMC Nursing Research Committee.
- 07/06/18. Approval of project from UICOMP IRB.
    - Proposed implementation 06/01/18 - 08/12/18 and post-implementation 08/13/18 - 11/29/18.
- 07/06/18 - 08/12/18. Pre-implementation recruitment
- .07/25/18. Initial education disbursement.
    - Healthstream initiated 07/30/18.
        - Follow-up on education 08/14/18.
        - Follow-up on education 08/27/18.
- 09/11/18. Approval of amendment from UICOMP IRB.
    - Proposed change dates of pre-implementation to 07/27/18 - 09/07/18 and post implementation to 09/08/18 - 10/20/18. No action by PI. Education disbursed.
- 10/09/18. Approval of amendment from UICOMP IRB.
    - Proposed implementation of reminders for nurses regarding the implementation process. No action by PI. Education disbursed.
- 11/06/18. Approval from OSF SJMC Physician Content Advisory Council for integration of intervention in Epic software MAR.
- 12/11/18. Approval of amendment from UICOMP IRB.
    - Proposed change dates of pre-implementation to 07/27/18 - 02/11/19 and post-implementation from to 02/12/19 - 04/23/19. Education disbursed.

- 12/11/18 – 02/11/19. Pre-implementation recruitment.

- 02/12/19. Collection of pre-implementation data. Disbursement of reminders.

- 02/12/19 - 04/23/19. Post-implementation recruitment. Monitoring of nurse and provider compliance.

- 03/08/19. Approval of amendment from UICOMP IRB.
    - Proposed change of documentation of intervention by nurses from smartphrase to flowsheets per OSF SJMC recommendations. Nurses educated.

- 03/22/19. Re-disbursement of reminders.
- 04/23/19. Collection of post-implementation data.
- 04/24/19 – 05/22/19. Writing of final paper.
- 05/23/19 – 06/04/19. Dissemination of findings in oral presentation.

Appendix B

Data Extraction Plan

Assessment and Evaluation

- Purpose: Retrieval of patient population data to evaluate effectiveness of intervention.
- Time Frame: Data will be collected one time for baseline assessment from 02/12/19 to 02/19/19 and one time for evaluation from 04/24/19 to 05/01/19.
- Sample Patient Population: All inpatients (ICU/Post-ICU, Orthopedic/Neurology, and Medical/Surgical) receiving insulin therapy via the insulin, sliding-scale, order-sets (general adult and critical-care mild, moderate, and aggressive), who are not pregnant nor prisoners.
- Data Values: Diabetes diagnosis (Y/N), type of diabetes (1 or 2; none), blood glucose 70-100 mg/dL (Y/N; value in mg/dL), hypoglycemia event of blood glucose 70 mg/dL or less (Y/N; value in mg/dL), patient age (value in years), patient names, NPO (Y/N), and length of stay (value in days).

Flowsheet Monitoring

- Purpose: Determination of rate for nursing compliance with intervention and occurrence of insulin regimen adjustment.
- Time Frame: Data will be collected three times weekly during first two weeks of implementation on each unit, and then weekly. This will start on 02/12/19 until 04/23/19.
- Sample Patient Population: All inpatients (ICU/Post-ICU, Orthopedic/Neurology, and Medical/Surgical) receiving insulin therapy via the insulin, sliding-scale, order-sets (general adult and critical-care mild, moderate, and aggressive) with a glucose level 70-100 mg/dL who are not pregnant nor prisoners.
- Data Values: communication order checked in insulin, sliding-scale, order-sets (Y/N), flowsheet (Y/N).
- Other Flowsheet Data Values: Provider contacted (Y/N), glucose level (value in mg/dL), and occurrence of intervention (insulin adjustment, no insulin adjustment, or other).

Appendix C

Inpatient Hypoglycemia Prevention Project

About

This project is a DNP scholarly project for Bradley University. As such, it will designed as a healthcare improvement plan. The measurable outcomes established for this project, include: decreasing hypoglycemic events by 6% and the length of stay by 2 days over a 15-week period. Implementation will occur in the inpatient units CCC, Ortho/Neuro, and FCC. Implementation of intervention will begin on 09/08/18. More information will be provided in up-coming announcements and educational material.

Situation. Hypoglycemia events in the inpatient setting is a known cause for decreased patient outcomes. Associated problems caused by hypoglycemia events include increased length-of-stay and mortality rates. Glycemic levels and trends can be closely correlated with such occurrences of hypoglycemia. Currently, OSF St. Joseph hospital does not have an effective system in place to quickly identify and correct blood glucose trends, preventing hypoglycemia.

Background. Four organizations exist which recommend CIT. These organizations include the American Association of Clinical Endocrinologist, the American Diabetes Association, the American College of Physicians, and The Endocrine Society. The Endocrine Society includes another recommendation for the adjustment of insulin regemin when blood glucose levels are 100 mg/dL or less. These recommendations are based on the many studies demonstrating the correlation of hypoglycemia with intensive insulin therapy (IIT) glycemic target of 80-110 mg/dL over conventional insulin therapy (CIT) glycemic target of 140-180 mg/dL. Through a careful review of literature, five major studies were identified, confirming the benefits of CIT over IIT. IIT has been shown to produce significantly greater occurrence of hypoglycemia with the same mortality rate over CIT. Also in this review of literature, three studies were selected, demonstrating a significant correlation between hypoglycemic events and increased length-of-stay. In addition, two studies were chosen, supporting the use of decision-making behaviors and collaboration between nurses and physicians.

Assessment. Communication of blood glucose levels per insulin, sliding-scale, order-sets at OSF St. Joseph hospital state to notify

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providers when blood glucose levels are above 400 mg/dL or below 70 mg/dL. Aside from this, nurses are not required to communicate blood glucose levels to providers. Therefore, providers are primarily responsible for monitoring and identifying blood glucose levels and trends between 70-400 mg/dL. Since nurses have the ability to closely monitor and identify blood glucose levels and trends before physicians, the communication of blood glucose levels of 100 mg/dL or less, and the recommendation for correction of insulin regimens, could prevent events of hypoglycemia before they occur.

Recommendation. The recommendation is to add a pre-checked, communication order to the insulin, sliding-scale, order-sets (general adult and critical-care mild, moderate, and aggressive) and requiring nurses to call providers when blood glucose levels are 100 mg/dL or less. Through SBAR form, the nurses will communicate to providers the blood glucose levels and trends, recommending an adjustment of the insulin regimen if appropriate. Following communication with providers, nurses will then document in the patient's chart using a flowsheet. This will decrease events of hypoglycemia and reduce length-of-stay. Overall, this will increase the duration of blood glucose levels within the recommended glycemic targets of 140-180 mg/dL of hospitalized patients receiving sliding-scale, insulin therapy.

Appendix D

Inpatient Hypoglycemia Prevention Project

EDUCATION SESSION

The Why

- Hypoglycemia is a cause for concern.
  - It can cause adverse events, such as seizures, coma, dementia, & death.
- Preventing the preventable hypoglycemia.
  - CSF LinkC insulin standing orders require provider monitoring of blood glucose trends in between 70-400 mg/dL.
  - Providers may not have the appropriate capacity to monitor and identify glycemic trends in a timely manner.
- Research and organizational recommendations.
  - Research shows there is an approximate 4% greater risk for hypoglycemia when blood glucose levels are between 80-110 mg/dL (Dhatariya, et al., 2007).
  - Research correlates length of stay increases by approximately 2 days with each hypoglycemic event (Turchin, et al., 2009).
  - Current governing organizations recommend insulin regimen adjustment when blood glucose levels are 100 mg/dL or less (American Association of Endocrinologists, n.d.).

The Solution

- Nursing empowered.
  - Nurses have the ability to monitor and identify glycemic trends more frequently and sooner than providers.
- The purposed change in SJMC insulin order sets.
  - A pre-checked standing order within the insulin, sliding-scale, order-set for nursing to notify providers when blood glucose levels are less than 100 mg/dL.
- The Nurses responsibility.
  - The nurses will then, using SBAR form, communicate to the providers the blood glucose level and recommend an insulin regimen adjustment.
- Documentation.
  - In interdisciplinary notes, the nurse will then use the flowsheet to document the blood glucose level, the communication to the provider, and the outcome of the communication.

Directions

- Example of sliding scale insulin on SJMC. Proposed changes include the insertion of order for add-on order with blood glucose levels 100 mg/dL or less to contact instructions.

- Proposed example of documentation in Results Reading Paradise Healthcare of the Clifford Beers Guidebook.

References

Appendix E

1. When should the nurse contact the provider based on new Insulin Order Set.
    a. When blood glucose is 200 mg/dL or less.
    b. When blood glucose is 150 mg/dL or less.
    c. When blood glucose is 100 mg/dL or less.
2. What form of communication should the nurse use when presenting blood glucose levels to providers?
    a. Open communication.
    b. SBAR.
    c. Descriptive.
3. What would the nurse recommend as a change when calling the provider?
    a. Change in diet order.
    b. Change in insulin regimen.
    c. Change in communication order.
4. How should the nurse document call to provider regarding blood glucose level.
    a. Results Needing Provider Notification Flowsheet.
    b. Interdisciplinary note.
    c. No need to document. It’s recorded in the MAR.

Appendix F

"When patients who are on sliding-scale, insulin therapy have a glycemic value of 100 mg/dL or less, call the provider and recommend for a change in the insulin regimen if appropriate. Afterwards, use flowsheet Results Needing Provider Notification of the Critical Result flowsheet, documenting blood glucose level and any subsequent changes."

Appendix G

When patient blood glucose levels are between 70-100 mg

1. Notify provider of glucose level and recommend a change in the insulin regimen.
2. Document in patient chart under Labs Needing Provider Notification of the Critical Result flowsheet.

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