

IMPROVING INSULIN ADMINISTRATION TIMING AND PATIENT BLOOD GLUCOSE
MANAGEMENT ON A MONTANA MEDICAL SURGICAL PATIENT CARE UNIT: A
QUALITY IMPROVEMENT PROJECT

by

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of

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in

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DEDICATION

This DNP project is dedicated to my wonderful wife Jessica, who has supported me from the very start of my nursing career, from the struggles of being a new grad RN to a graduate student working part-time to keep the lights on; without her, none of this would be possible.

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ABSTRACT

Background: Effective blood glucose management and prevention of hyperglycemia (BG >180mg/dL) and hypoglycemia (BG <70mg/dL) are critical for inpatient surgical care. A single instance of hyperglycemia can lead to poorer surgical outcomes, increased morbidity and mortality, and heightened infection risk in surgical populations, particularly those undergoing primary joint arthroplasty or abdominal surgery. **Local Problem:** At the selected project site, insulin administration times vary, ranging from just a few minutes to over 90 minutes after the collection of capillary blood glucose (CBG). Patients receiving insulin more than 30 minutes after CBG collection are not receiving optimal treatment, which necessitates further capillary BG testing or insulin dosing adjustments. **Methods:** The DNP student and Information Technology (IT) team developed a chart review and data collection tool to assess bi-monthly whether insulin administration time from CBG collection improved in one medical/surgical care unit. The proportion of CBGs collected by RNs was evaluated using a voluntary reporting system by staff. Pre-implementation included a week of staff education on insulin administration, pharmacodynamics, best practices, and workflow alterations. Data analysis determined whether education and adjustments to the workflow could improve insulin administration proportions within 30 minutes of capillary blood glucose collection. **Results:** The proportion of insulin administrations within 30 minutes of CBG increased from 59% pre- intervention to 76% within two weeks, remaining statistically significant over the six- week period. The average interval from CBG collection decreased from 29.5 min to 23.8 min, marking a statistically significant reduction. RN CBG collection rates achieved the project goals within the first two weeks and maintained this throughout implementation, with over 50% of administrations completed by RNs. **Conclusions:** Achieving meaningful compliance with national insulin administration standards is feasible through a two- fold approach to quality improvement: intentional workflow alterations and effective, holistic education for RN and CNA staff members, enabling RNs to quickly administer insulin following CBG collection.

Keywords: “inpatient” AND “insulin administration” AND “nursing” AND “timing”

CHAPTER ONE

REVIEW OF THE LITERATURE

Background

Hyperglycemia is common in both inpatient and outpatient hospital care. Adequate glucose management, or normoglycemia, helps prevent cardiovascular disease, renal dysfunction, and further metabolic disease. In 2023, the Centers for Disease Control (CDC) estimated that 11.6% of the United States population across all age ranges had diabetes. Out of the 38.4 million people with diabetes, nearly 8.4 million of them did not know they had diabetes. In early 2010, almost 25% of all hospital admissions consisted of patients with known Type 1 or Type 2 Diabetes (Umpierrez et al., 2012). With the growing rates of obesity, cardiovascular, renal, and metabolic disease, clinicians, nurses, and support staff must more frequently monitor and treat hyperglycemia. Within the hospital walls, adequate blood sugar treatment promotes better outcomes and reduces hospitalization times nationwide (Kirk & Oldham, 2010). Blood glucose and patient outcomes are heavily researched and consistently show that blood glucose levels $>200\text{mg/dL}$ increase all-cause mortality, especially in conditions such as heart failure with reduced ejection fraction, myocardial infarction, and cerebrovascular incident (Kirk & Oldham, 2010). Despite the large volume of research surrounding the importance of blood glucose management on patient outcomes, hospitals of all sizes and prestige need help to meet the normoglycemic needs of patients in their care.

Hospitals striving to improve patient outcomes primarily focus on blood glucose metrics and insulin administration as areas for quality improvement (Swanson et al., 2012). The

American Diabetes Association's (ADA) *Diabetes Standard of Care* directly addresses the need for hospitals to adopt an organized, systematic approach to managing inpatient diabetes and hyperglycemic patients. This is crucial, as the care remains suboptimal despite recent improvements (American Diabetes Association, 2024). The popularity of inpatient diabetes management teams and initiatives is rising nationwide due to the rapid increase in patients requiring glucose management in the inpatient setting. A 2012 study examining millions of inpatient point-of-care (POC) measurements at 575 hospitals found that nearly 32% of all non-ICU patients experienced hyperglycemia during their stays (Swanson et al., 2012). Current standards provided by Endocrinology experts, such as Umpierrez and his colleagues, continue to set the benchmark for glucose management in the United States. The American Association of Clinical Endocrinology (AACE) advocates for consistent fasting blood glucose $<140\text{mg/dL}$ and maximal post-prandial glucose levels $<180\text{mg/dL}$ (Hawkins et al., 2012). Achieving a goal blood glucose of $140\text{-}180\text{mg/dL}$ is challenging due to various factors. The timing of insulin, such as administration following meals, the timing of blood glucose and subsequent treatment, and the medication regimen used to control blood glucose, are crucial in achieving the highest proportion of time in the target glucose range. Sliding scale insulin (SSI), basal-bolus insulin (BBI), or lack of insulin treatment regimens are all options that exist in today's hospitals. Additionally, multiple governing bodies, such as the ADA and American Society of Health-System Pharmacists (AHSP), advocate for further testing in patients who present on admission with $\text{BG} > 140\text{mg/dL}$ due to their risk for poor long-term health outcomes post-hospitalization (Hawkins et al., 2012).

There is substantial disagreement regarding which of the three accepted glucose management strategies is the most effective method to manage inpatient glucose levels in non-

critically ill patients. Despite two landmark medication trials that show improved blood glucose with an ideal regimen, healthcare clinicians and nurses across the country struggle to meet the glycemic needs of patients with hyperglycemia and both forms of diabetes mellitus. Current benchmark standards advocate for basal insulin such as Detemir, Lantus, or Basaglar in addition to rapid-acting insulin for correcting hyperglycemia and mealtime carbohydrate coverage such as aspart or lispro in the management of hyperglycemia in patients with diabetes and in patients whose sliding scale short-acting insulin is not meeting their metabolic needs (Umpierrez et al., 2013). Additionally, the timing of insulin administration is directly related to the quality of glucose management. Hospitals are encouraged to maintain and create multidisciplinary teams whose sole purpose is to develop policy and education for staff regarding managing hyperglycemia and diabetes in the inpatient population (Umpierrez et al., 2012).

Evidence-Based Proposed Solution

The timing of insulin administration is a critical factor in allowing digested glucose or liver-produced glucose release to reach the cells for metabolism (Engle et al., 2016). Given that the current research suggests that education alone is not enough to impact meaningful change in improving insulin administration time, this project will focus on using education and a medication administration feedback tool to reinforce timing standards of practice. Utilizing a goal administration time of <30 minutes from BG to insulin correction and <30 minutes from food arriving at a patient's room and insulin coverage will help improve glucose management by adequately treating blood glucose promptly and preventing post-prandial hyperglycemia. Nurse-patient ratios are the suspect reason for delayed insulin on a unit such as an Inpatient Medical floor; however, both Registered Nurses (RN) and Certified Nursing Assistants (CNAs) struggle

to communicate blood glucose levels. Additionally, these classes of professionals could benefit from education regarding the pharmacokinetics (understanding how insulin acts within the body) of insulin products and the role timing and communication play in incorrect dosing of these medications. Previous successful quality improvement projects have suggested online and in-person education regarding insulin pharmacology and best practices as the first step to improving insulin administration timing (Cohen et al., 2019; Freeland et al., 2011). Other studies indicated that education alone was insufficient to enhance insulin timing clinically (Goel et al., 2020; Houck et al., 2013). This scoping literature review evaluates the literature to understand what methods/interventions exist in patient care and what has been successful and unsuccessful in previous initiatives.

Methods

This scoping review utilized a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework (figure 1.1) to help guide the inclusion and exclusion of evidence articles. The PRISMA framework encourages a multi-step approach to identifying and selecting an array of evidence to support this project's goal of reducing insulin coverage administration timing in a medical/surgical nursing care unit. The multi-step framework for this project included identifying a meaningful and relevant research question, uncovering all appropriate studies, carefully selecting studies that apply to the chosen research questions, delineating and reviewing the data, and summarizing and interpreting the results.

Search Strategy

The search was conducted on September 4th, 2024, using the comprehensive CATSEARCH database tool developed by Montana State University. This tool allowed the author to uncover relevant articles from reputable databases such as PubMed, Web of Science, and ProQuest. Search terms, including “inpatient” AND “insulin administration” AND “nursing” AND “timing” were carefully selected to ensure the inclusion of all relevant literature in this review.

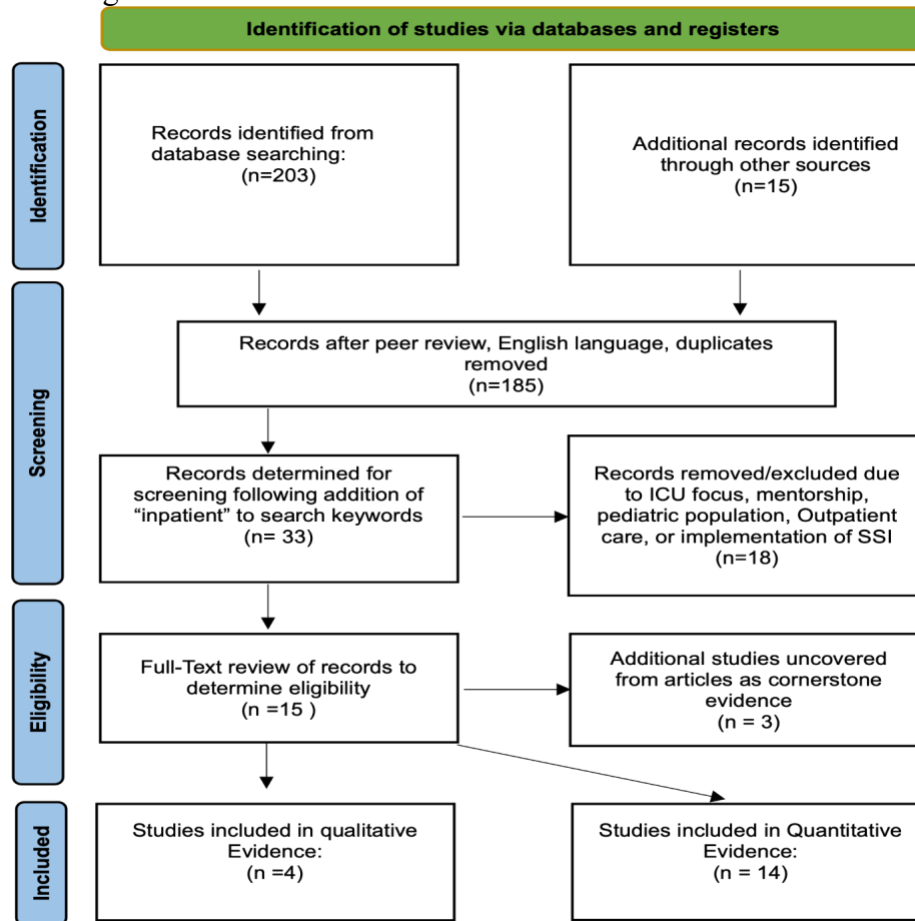
Inclusion Criteria

Inclusion criteria for this review included peer review status, primary English language, and inpatient non-intensive care focus. Search filters removed articles based on peer review status first and foremost. Filters removed all articles older than 2004, given the vast amount of endocrinology research still being used for best practices completed between 2008 and 2012. For inclusion in this review, articles should be Quality Improvement projects, Expert Opinions, Clinical Practice Guidelines, Randomized Control trials, Systematic Reviews, and Cohort studies. The following exclusion criteria filtered resources that may provide confounding or extraneous evidence non-contributory to the identified patient population and site: Intensive Care Unit (ICU) focus, Continuous Glucose Monitor (CGM) use, nursing mentorship, pediatrics, outpatient diabetes care, and studies focusing on the initial implementation of sliding scale insulin (SSI). After filtering the stated inclusion and exclusion criteria, a review of study abstracts and titles began. Each article included in this study was independently reviewed in its full text by the author of this paper and was determined to fit the a priori inclusion criteria.

Search Results

Initial literature searches yielded 220 results, of which 25 were excluded based on peer review status and language of origin. Upon inclusion of the word "inpatient" into the search phrases, only 17 results were produced. Further review of the initial 220 results produced 15 more articles with applicable focuses and met the base inclusion criteria for this study. In total, the author personally reviewed 33 articles' abstracts and titles. Fifteen articles provided baseline evidence for this study; however, since many of these studies cited three hallmark randomized control trials, these were vetted to determine if they met the inclusion criteria in this scoping review. In total, this scoping review extracted 18 articles.

Figure 1: Study PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Flow Diagram



Framework for Appraisal

Two frameworks were utilized to evaluate and grade the quality of evidence included in this literature review. Upon extraction of the 18 articles included, all were evaluated utilizing the *Hierarchy of Evidence*. The *Hierarchy of Evidence* places articles into 5 categories of risk for bias, ranging from expert opinion, which holds the highest risk for bias's effect on the results, to systematic reviews, which hold the lowest risk for an effect of bias. Additionally, after the determination of the level of evidence, an evidence table was utilized to evaluate each article included. For each article, the year of publication, study design, purpose, sample size,

description, statistics, conclusions, and validity were examined. Four QI projects are considered level six evidence, two level five expert opinion articles, three descriptive studies, one mixed methods level 3 evidence, four level three evidence control trials, and four systematic reviews.

Synthesis of Literature

A review of the available literature regarding best practices and evidence surrounding the administration of correction and meal-dosed rapid-acting insulin yielded consistent themes that allow for the following inferences. Major themes retrieved from the literature include randomized control trials that focus on the timing of insulin administration, and the type of insulin used for the sliding scale, mealtime dosing effects on the timeline of administration; RNs and CNAs both require education regarding insulin pharmacokinetics to understand dosing patterns effectively and finally, that simply education alone of bedside staff is not adequate alone to create meaningful clinically significant reductions in the time between insulin administration time and blood glucose or meals.

Criteria for Insulin Therapy While Inpatient

Rapid-acting insulins such as *insulin aspart* and *insulin lispro* are considered to be the best choice for inpatient blood glucose control in patients with diabetes and those who do not have diabetes but are acutely hyperglycemic due to their rapid time of action <15 minutes, ease of use, and predictability to control blood glucose in the inpatient setting (Cobaugh et al.,2013). Based on previous literature and expert reporting, providers should, with assistance from RN staff, place patients with elevated blood glucose on insulin sliding scale regimens upon admission for blood glucose correction >139mg/dL and an additional basal insulin regimen for

in-between meal glucose control (Umpierrez et al., 2013; Umpierrez et al., 2012; Cebaugh et al., 2013). Nearly every clinical practice guideline from the governing bodies of endocrinology, pharmacy, internal medicine, and hospital medicine recommends that providers place any patient with an admission blood glucose $>140\text{mg/dL}$ on insulin therapy or bedside blood glucose testing for a minimum of 24 hours during the inpatient stay (Umpierrez et al., 2012). This testing is thought to reduce the risk of both hyperglycemia and hypoglycemia in the inpatient setting, which are both tied to adverse patient outcomes (Umpierrez et al., 2012).

Patients with hyperglycemia, despite sliding scale correction insulin dosing, whether due to glucocorticoid use or post-operative hyperglycemia in the case of cardiac surgery, should be placed on basal-bolus insulin as best practice (Umpierrez et al., 2012). Persistent hyperglycemia requires RNs and providers to work together to maintain and alter the basal-bolus regimen to allow blood glucose maintenance between $140\text{--}180\text{mg/dL}$ (Cebaugh et al., 2013; Umpierrez et al., 2012). Upon acquisition of fasting normoglycemia, it is essential that medications, both long-acting bolus insulins and rapid-acting insulins, be administered promptly to prevent unnecessary hyperglycemia or raised risk of unintended hypoglycemia due to inappropriate increases in the dosing regimen (Umpierrez et al., 2012; Umpierrez et al., 2013; Lampe et al., 2017).

Ideal insulin timing following a Point of Care Blood glucose or meal:

Lampe and colleagues provided observational data surrounding insulin administration in the inpatient setting, with the various insulin types such as rapid-acting and regular insulin. Clinical practice guidelines from the American Society of Endocrinology encourage RNs to administer rapid insulin $<30\text{--}60$ minutes from testing, with an ideal period being less than 30 minutes to allow for appropriate dosing (Umpierrez et al., 2012). Interestingly, there has been a

correlation between the timing of the POC blood glucose, whether an RN or CNA did that value, and the subsequent dose (Lampe et al., 2017). RNs in one study were likely to reduce insulin dose by nearly 21% if they had acquired the blood glucose level, which on average was 51 minutes after the CNA's POC BG, both of which were clinically and statistically significant measures (Trotter et al., 2013).

An article from 2005 suggested that insulin administration following a hyperglycemic POC reading took on average 62 minutes, with only 22% of administrations falling under the 30-minute ideal window, while nearly 94% of mealtime doses of insulin were administered in a 30-minute window (Manning & Jackson, 2005). This study serves as a primary example of a clinical finding discovered almost 20 years ago, which continues to plague hospitals in the era of electronic medical records (EMR), Automatic medication dispensing cabinet medication cabinets, and point-of-care testing machines that integrate directly into the EMR. An interesting caveat to current research is that the type of insulin administered for a correction dose correlates directly to dosing administration timing (Lampe et al., 2017). Understanding the pharmacokinetics of insulin administration is imperative to optimal medication timing and blood sugar regulation. It has been long understood how regular insulin and the recommended mealtime correction timing works, but this is not the same for rapid-acting insulins. The timing of these two types of insulin is different. Therefore, careful education is required to ensure the proper timing is understood and followed, preventing long timing gaps and unexpected fluctuations in blood glucose.

The Role of Education for Registered Nurses (RN) and Certified Nursing Assistants (CNA)

Education is necessary to change nursing practice and promote lifelong learning for medical staff. It is the cornerstone of building quality initiatives and can improve inpatient blood glucose metrics such as insulin timing, hyperglycemia incidence rates, and hypoglycemia incidence rates; however, it cannot be the only strategy used to improve quality (Freeland et al., 2011; Engle et al., 2018; Szlek & Nicholaus, 2018).

Evidence suggests that bedside care providers (RNs and CNAs) on units struggle to meet performance metrics in insulin administration. Hypoglycemia and hyperglycemia should be re-evaluated periodically with intermittent surveillance to encourage an understanding insulin's role in patient outcomes (Szlek & Nicholaus, 2018; Engle et al., 2018). Discussing the pharmacokinetics of antidiabetic medications such as insulin allows bedside care providers to understand the need for communication and coordination of care to enable the medications to be administered at the right time, every time (Trotter et al., 2013). Additionally, education should include the opportunity for staff to discuss their observations contributing to missed or delayed administration of medications such as insulins. Proper insulin timing reduces hyperglycemia episodes (BG>180mg/dL) in the inpatient population.

Need for Communication

Effective communication plays a crucial role in the medical field. Closed-loop communication is a vital component of high-performing teams and is ingrained into the brains of every medical professional. Teams of providers, RNs, and CNAs taking care of patients with hyperglycemia or diabetes, communication regarding insulin dosing, mealtimes, and capillary blood glucose (CBG) timing and reporting is an integral part of ensuring insulins are

administered in an appropriate and timely fashion (Kaisen, 2018). In the observational study by Kaisen in 2018, timely CBG testing (within 30 minutes of a meal or insulin correction) was accomplished in nearly 86% of patients when the RN directly communicated to the CAN regarding the timing of the CBG around meals. Other observational studies have shown that coordinating and achieving glycemic management goals is very difficult when communication between bedside caregivers is not closed-loop or synchronized for activities (Lampe et al., 2014). Effective communication keeps patients safe and helps to minimize human error caused by the omission of details, and the administration and timing of an insulin medication following a CBG or meal is no exception to this standard.

Discussion and Conclusions

Over the last 20 years, a wealth of information supports the timely administration of insulin products within 30-60 minutes of meals, ideally <30 minutes, and using sliding-scale insulin to correct hyperglycemia in all patients with elevated blood glucose or diagnosed diabetes. This review highlights how pivotal RNs and CNAs are to the time-sensitive administration of mealtime and correction of insulin doses concerning improvement in patient outcomes. Closed loop, interprofessional communication within the care team for blood glucose results is essential to maintaining normoglycemia. Furthermore, understanding how insulin acts within the body, known as pharmacokinetics, is vital education needed for any care practitioner involved in glucose management activities. In conclusion, this scoping review shows that patient outcomes are improved by the timely administration of rapid-acting insulin products for hyperglycemia, and meals reduce the risk for hyperglycemia.

CHAPTER TWO

QUALITY IMPROVEMENT PROPOSAL

Introduction:

High-quality blood sugar management, which involves insulin administration within 30 minutes of a blood glucose measurement, maximizes positive patient outcomes in primary and tertiary healthcare settings (Cobaugh et al., 2013). Hyperglycemia in the inpatient setting, which is often considered tertiary care, is highly researched and consistently is associated with worse healthcare outcomes like increased hospital length of stay (Umpierrez et al., 2013). Additionally, hyperglycemia is tied to increased risk for multi-organ system failure in the post operation surgical population (Pasquel, Fayfman & Umpierrez, 2019). There is also an increased risk for patients to experience hyperglycemia in the post-op setting, which can be attributed to factors such as stress hormone release, steroid use following surgery, and changes in metabolic status (Pasquel, Fayfman & Umpierrez, 2019). For most patients following orthopedic and cardiac surgery, postoperative blood glucose management is a standard of care, given the high volume of research surrounding the adverse effects of hyperglycemia on patient outcomes. In other tertiary care populations like general surgery patients, representing a high proportion of postoperative patients, glucose control remains a top priority in preserving and improving outcomes and long-term health post-op.

Preventing hyperglycemia in the hospital population, both those receiving medical and surgical services, is essential to improving patient outcomes and reducing postoperative complications (Umpierrez et al., 2012). Historically, despite comprehensive and specific

guidelines surrounding the management of hyperglycemia in the inpatient setting, achieving glycemic goals in the inpatient population remains a challenge (Kaisen et al., 2018). Previously successful quality initiatives have focused on improving glycemic control in hospital populations through various interventions. A recent Quality Improvement (QI) initiative focusing on inpatient blood glucose control in postoperative and medical patients outside of the critical care areas shows that education for bedside providers such as Registered Nurses (RN) and Certified Nursing Assistants (CNA) is necessary to achieve glycemic control. Additionally, education is necessary to reinforce concepts that improve patient outcomes without increasing risk for hypoglycemia, defined as fasting and post-prandial capillary blood glucose (BG) < 140mg/dL (Umpierrez et al., 2012).

Improving staff understanding regarding inpatient glucose management best practices and addressing workflow allows for adequate treatment of hyper- and hypo-glycemia through a sliding scale treatment algorithm. In addition to reducing the incidence of hypoglycemia events (CBG < 70mg/dL), normoglycemia (80-130mg/dL) not only improves patient outcomes but also decreases long-term healthcare expense, reduces the risk of 30-day readmission rates following surgery, and improves overall patient satisfaction (Umpierrez et al., 2013).

Additionally, financial advantages of glucose management cannot be ignored. According to the current guidelines for hospital repayment set by the Centers for Medicare and Medicaid (CMS), there is an increased association of 30-day readmission rates following an incidence of severe hypoglycemia, defined as a BG < 40mg/dL, in addition to hyperglycemia which they consider to be an event with a BG > 300mg/dL. Although neither of these measures impact

payment themselves, the 30-day readmission of a patient may impact payment to the organization for any further care required by the patient (CMS, 2022).

The problem faced by a regional medical center in southeast Montana surrounds adequate and timely treatment of hyperglycemia with prescribed sliding-scale rapid-acting insulin (SSI). Currently, there is no standard administration time present in the hospital policy to guide RNs regarding insulin administration and blood glucose correction in hyperglycemic surgical and medical patients. Data extracted from the electronic medical record (EMR) shows the administration of insulin following capillary blood glucose (CBG), ranging from a few minutes following a CBG to 90 minutes (L. Ranes, personal communication, October 2024). Standards outlined by multiple governing bodies such as the American Diabetes Association (ADA), and the American Society of Health-System Pharmacists (ASHP), highlight the importance or understanding of the pharmacokinetics of blood glucose and insulin when making insulin administration recommendations. Rapid-acting insulins such as lispro, aspart, or glulisine provide blood glucose reduction as quickly as 5-10 minutes following subcutaneous administration (Donner & Sarkar, 2023). Utilization of a CBG value over 15-30 minutes old can not only be an inaccurate representation of the patient's current glycemic status but also increases the risk of dangerous hypoglycemia and/or further hyperglycemia (Cohen et al., 2024).

During the current financial struggle, this hospital's upper-level management, inpatient glucose committees, and the hospital board of directors are searching for solutions to reduce the incidence of readmissions, along with additional ways to shorten the length of inpatient stays due to unforeseen complications caused by glycemic instability, infection, or post-op complications. The Centers for Medicare/Medicaid Services (CMS) are very strict regarding hospital outcome

measures and readmissions. Hospital readmissions, outlined by the Hospital Readmissions Reduction Program (HRRP), outline conditions that cannot be a 30-day readmission from the date of service due to complications or associated poor outcomes. The conditions which are monitored for critical readmission are: Myocardial infarction (MI), total hip arthroplasty, Chronic Obstructive Pulmonary Disease (COPD), heart failure (HF), pneumonia, and Coronary Artery Bypass Graft (CABG) (HRRP, 2024). Improving glycemic stability in postoperative and medical service patients will not only improve patient outcomes such as 30-day readmission rates, but also allow for reduced length of stay, resulting in increased patient volume and subsequently inpatient revenue (Cohen et al., 2024; Umpierrez et al., 2012; Umpierrez et al., 2013).

Organizational Assessment

The inpatient surgical floor (IPS) on 2 South and 2 North is part of an encompassing health organization spanning Montana and northern Wyoming consisting of one Level I Trauma Center, one Level 3 Trauma Center, 18 Regional Critical Access Hospitals, and 80 clinic specialties. The hospital serves >500,000 people across southeast Montana, northern Wyoming, and the western Dakotas, with 304 inpatient beds (Billings Clinic, 2023). The IPS nursing unit consists of 36 inpatient beds that care for low-acuity medical patients and a broad spectrum of pre- and post-op patients from various surgical specialties.

The Inpatient Surgical Floor (IPS) consistently cares for 30-34 patients on a given shift, with an overall length of stay average of 1.8 inpatient days, less than the national average of 5.1 inpatient days (McDermott & Liang, 2021). On this unit, each nurse takes care of 4-6 patients per shift, is responsible for all assessments, administers medications, cares for patients, and

notifies providers of changes in condition. Initial insulin measurements under 30 minutes from CBG to Insulin lie close to a 72% compliance rate.

Patients cared for on IPS receive four total assessments daily, two assessments each 12-hour shift, from nursing staff and additional focused physical examinations and rapid assessments with clinical changes such as increases in early warning vital signs, concerning post-operative findings such as infection, bleeding, or changes in mental status. Nurses examine patients from head to toe during assessments and cluster care with other tasks, such as medication administration, to efficiently care for their assigned patients. In addition to assessments, RNs and CNAs take vital signs every 4-6 hours per provider order, feed patients' meals, and provide patients with assistance to perform activities of daily living (ADLs).

The IPS staffing model is a nursing care model. Staffing meets the national medical/surgical acute care staffing standard set by Congress in March of 2023 (Senate Bill S.1113, 2023). On this floor, nurses maintain a 4:1 patient-to-nurse ratio on the day shift (0700-1900) and a 1:4-6 patient-nurse ratio on the night shift (1900-0700). Nurses are supported by 2-3 Certified Nursing Assistants (CNAs) as staffing allows. The CNAs operate on an 8:1 patient-CNA ratio on the day shift and, on the night shift, work on a nearly 12:1 patient-CNA ratio. The current workflow details the responsibility of capillary blood glucose (CBG) testing to the CNAs, ranging from a minimum of before meals and before bed to every 4 hours. The current CNA blood glucose workflow often results in the acquisition of CBG results outside the appropriate range for correct insulin correction dose timing, ideally less than 30 minutes from each other (Kaizen et al., 2018).

Workflow

RNs and CNAs on IPS use Abbott *Point of Care* blood glucometers to obtain CBG values. These results automatically upload to the electronic medical record system of this health system, *Cerner (CIS)*. For the 36 beds, there are two Abbott point of care (POC) CBG glucometers on the north side of the unit serving 18 patients and three glucometers on the south serving 18 patients. Each side of the unit maintains a blood sugar testing station that contains test strips, alcohol swabs, cotton balls, and lancets to allow for a “one-stop shop” for CBG supplies and resupply.

Insulin aspart is the correctional medication for treating hyperglycemia on the Inpatient Surgical Floor. Hyperglycemia is a blood glucose $>139\text{mg/dL}$ in patients who can eat, are taking in tube feeding or glucose-containing fluid and $>180\text{mg/dL}$ in patients who cannot take in glucose via food or fluid as defined by the standing hospital glucose management sliding scale insulin (SSI) protocol. Multi-dose insulin aspart vials reside inside an automatic medication dispensing cabinet on each side of the inpatient surgical unit within the nursing station. Each station contains the automatic medication dispensing cabinet and maintains supplies for insulin administration, such as insulin syringes, alcohol swabs, and patient labels within 10 feet of the automatic medication dispensing cabinet in a cabinet at eye level.

Participants

This quality improvement project involves staff such as RNs and CNAs, patients, pharmacists, and pharmacy techs. This project aims to increase the compliance percentage, which currently sits at 72% of correction insulin administration based on a benchmark standard of <30 minutes from CBG acquisition to correct insulin correction dose administration

(Umpierrez et al., 2012; Kaizen et al., 2018; Kirk & Oldham, 2010). The director of specialty services, who serves as Head of the Inpatient Glucose Management Committee, served as the official site contact for this project; however, the nurse manager of IPS and the hospital's Medication Safety Officer served additionally as liaisons for this project in an informal capacity. RNs and CNAs supported the implementation of this project prior to implementation and reported high levels of commitment to reaching goals set out by this quality initiative.

Quality Initiative Framework

Quality initiatives are primarily successful based on solid observations and data and correctly identifying an area requiring intervention. The Institute for Healthcare Improvement (IHI) and the American Academy of Family Physicians (AAFP) identify multiple appropriate frameworks for quality improvement. The framework most often referenced for quality improvement by these organizations is the Plan-Do-Study-Act or PDSA, see Figure 2.1, designed initially by the IHI, combining total quality management and rapid cycle improvement.

Figure 2: PDSA Cycle Diagram (IHI, 2023)



frameworks (IHI,2023). For this project, the PDSA's iterative design will be used for continued quality improvement, if necessary, following the initial cycle. The PDSA design allows this QI project to improve outcomes, possibly in other areas of the organization, long after this individual project is complete (Institute for Healthcare Initiatives, 2023). The six-week post-intervention duration of this project will likely only allow for one to two iterations of PDSA, which should create a strong foundation for further work by the organization in question.

The *plan* is the first portion of implementing a PDSA QI initiative. Planning involves clearly defining the objective of the QI initiative. Conversations and interviews with members of unit management, the pharmacy team, and the glucose management team all identified the timely

administration of correctional insulin as a problem spanning across the organization in the medical/surgical areas. Stakeholders expressed continued interest in implementing a multi-faceted approach to improving adherence to insulin administration standards. This project plans to improve adherence rates to timely correction insulin administration through staff education of RNs, who administer insulin, and the CNAs, who are the primary parties responsible for obtaining the CBG values. Implementation of this project will occur on a single-unit basis before expansion to other inpatient service areas. The second phase of the PDSA is *Do*. For the *Do* portion of the PDSA, education will be completed in short 10 to 15-minute pre-shift sessions at the recommendation of site stakeholders due to previous success metrics and positive responses from staff. The study is the 3rd phase of the PDSA, which will be completed during the one-week post-intervention period. Data examined during this period will be collected in bi-monthly periods and examined to determine continued intervention success throughout the six-week intervention period. Finally, the *Act* portion, which is a final re-evaluation of this project, will likely be done following the completion of this QI project after the total 10-week project timeline.

Purpose Statement and Goals

This QI initiative aims to improve overall rates of timely correction insulin administration, which is defined as administration within 30 minutes of CBG value. This QI project evaluated outcomes at two, four, and six weeks by examining the individual insulin administrations for all patients receiving insulin on the IPS unit and quantifying and identifying compliance to the outlined < 30-minute administration goal (Umpierrez et al., 2012; Kaizen et al., 2018; Kirk & Oldham, 2010) transitioning from a focus on CBG collection as part of CNA

workflow to part of the RN workflow (Trotter et al., 2013). This quality initiative chose to examine the incidence of hypoglycemia in patients receiving insulin throughout the implementation period as a secondary metric for improved patient safety (Cobaugh et al., 2013). After implementing this project, long-term goals will include improving system-wide compliance with insulin administration timing benchmarks.

SMART Goals

Specific, Measurable, Achievable, Realistic, and Time-bound (SMART) goals will evaluate the effectiveness of this project throughout its duration. Within the six-week implementation timeline, utilization of short and mid-term goals will be essential, as long-term goals are outside the scope of this QI. Short-term SMART goal 1 Table 2.1 included a 10% improvement from pre-intervention in compliance to < 30-minute insulin correction administration standard to meet 82% compliance.

Table 1: Short-Term SMART GOAL #1

Short-Term SMART GOAL #1: 10% improvement from pre-intervention in compliance to < 30-minute insulin correction administration standard		
All patients admitted to the Inpatient Surgical Unit (IPS) who are placed on insulin treatment for Diabetes Mellitus, metabolic changes, or steroid use will have insulin administered within 30 minutes of their CBG		
Data to be collected	Method of Collection and who is responsible	Planned Data Analysis
1) Time of Insulin Administration 2) Time of Capillary Blood Glucose 3) Time between CBG and Insulin	The author will contact Information Technology to obtain data that was determined necessary prior to study initiation	Collect Data bi-monthly and calculate the percentage of insulin/CBG timing that falls within the goal < 30-minute period.

Short-Term SMART goal 2, Table 2.2 was for >90% of staff, RNs, and CNAs to attend the QI education sessions in person or via online education platforms by the start of the six-week data collection period.

Table 2: Short-Term SMART Goal #2

Short-Term SMART GOAL #2: >90% of staff, RNs, and CNAs are to attend the QI education sessions in person or via online education platforms by the start of the six-week data collection period.		
All patients admitted to the Inpatient Surgical Unit (IPS) who are placed on insulin treatment for Diabetes Mellitus, metabolic changes, or steroid use will have insulin administered within 30 minutes of their CBG		
Data to be collected	Method of Collection and who is responsible	Planned Data Analysis
Of the 62 total staff members, attendance will be taken for both in-person education sessions, and those who did not attend sessions will be sent the online education materials	The author will work with the staff educator and unit manager to obtain a list of staff who attended in-person education and those who have completed their online education within the one-week education period.	Calculate a percentage of staff participation in education from the total staff #.

Mid-term SMART goals (Appendix B) improved upon the primary short-term SMART goal of 10% improvement with a goal of 15-20% increase in compliance by week 6 of implementation. Mid-term SMART goal 2 includes a 50% increase in CBG collection by RNs versus CNAs. Utilization of SMART goals allows this initiative to effectively assess implementation to meet goals outlined in Appendix B. SMART goals allow for close monitoring of the PDSA design and better cycle creation to create realistic and meaningful outcomes.

Table 3: Mid-Term SMART Goal #1

Mid-Term SMART GOAL #1: 10% improvement with a goal of 15-20% increase in compliance by week 6 of implementation		
All patients admitted to the Inpatient Surgical Unit who are placed on insulin treatment for Diabetes Mellitus, metabolic changes, or steroid use will have insulin administered within 30 minutes of their CBG		
Data to be collected	Method of Collection and who is responsible	Planned Data Analysis
1) Time of Insulin Administration 2) Time of Capillary Blood Glucose 3) Time between CBG and Insulin	The author will contact Information Technology to obtain data that was determined necessary prior to study initiation	Collect Data bi-monthly and calculate the percentage of insulin/CBG timing within the goal < 30-minute time period.

Table 4: Mid-Term SMART Goal #2

Mid-Term SMART GOAL #2: 50% of all Capillary Blood glucose will be obtained by RNs vs. CNAs.		
All patients admitted to the Inpatient Surgical Unit who are placed on insulin treatment for Diabetes Mellitus, metabolic changes, or steroid use will have insulin administered within 30 minutes of their CBG		
Data to be collected	Method of Collection and who is responsible	Planned Data Analysis
Total number of CBGs by each class of bedside employee	The author will contact Information Technology to obtain data that was determined necessary prior to study initiation	Collect Data and analyze the percentage of CBGs obtained by RN vs. CNA

Measuring SMART goal outcomes will be accomplished by bi-weekly chart data review. Data regarding insulin administration timing compliance comes from a CERNER query created by the IT department, allowing for examination of the timing of insulin dose and the timing of the most recent CBG value. The proportion of CBGs collected by RNs compared to CNAs will be evaluated using a voluntary reporting system set up by the primary investigator and examined at bi-weekly intervals. Data will be provided to the author over the hospital's secure, encrypted server to ensure data compliance.

Methods

The clinical site for this QI project is a Regional Medical Center in Southeast Montana. This site serves over half a million people throughout eastern and central Montana, Wyoming, and the western Dakotas (Billings Clinic, 2023). The Inpatient Surgical Unit employs 62 staff, including 40 RNs and 22 CNAs. The representative for this clinical site's primary concern for this QI project was creating a realistic, low-cost solution to a problem plaguing the entire facility on all medical-surgical units: delayed insulin administration times beyond 30 minutes. Solutions have been presented in the literature to help solve this issue; however, they are often costly and require extensive training and policy creation. After several site meetings with CNAs and RNs on the unit, the Inpatient Glucose Management Committee, the pharmacy team, and the medical/surgical services director, creating an education and workflow-focused initiative remains the best option to improve insulin compliance for the lowest cost possible and long-term sustainability.

Data collection will be completed bi-monthly for two weeks before staff education and workflow recommendations. It will continue for six weeks, including three bi-monthly data

collection periods following intervention. Data extraction occurs for every patient with active insulin treatment orders, including the timing of the insulin dose and the closest CBG value to the insulin administration. This data will compare the gross compliance percentage to the above SMART goals. Additionally, staff attendance will be monitored for in-person education sessions or via an online learning environment used by the facility covering the same material. After the six-week intervention period, pre- and post-intervention data analysis begins to measure total improvement in insulin administration compliance.

Intervention and Implementation Summary

Implementation Preparation

This quality improvement project's overarching mid-term SMART goal is to have 90% of all correction insulin doses administered within 30 minutes of the CBG indicating treatment at this clinical site. A 15-to 30-minute treatment window is ideal for administering rapid-acting insulin products to correct hyperglycemia (Umpierrez et al., 2012; Kaizen et al., 2018; Kirk & Oldham, 2010). Initial steps for this quality improvement project included obtaining buy-in and interest from stakeholders within the clinical site's medical/surgical unit. After achieving buy-in, discussions commenced regarding perspectives surrounding why insulin treatment times are often far beyond the accepted limit of 30 minutes. This paper's author (L.J.) is responsible for communication and collaboration with Information Technology (IT) to obtain the necessary search query information and data to evaluate this project over the nine-week total project timeline. These preliminary steps will be established and completed by the time this proposal is presented to the clinical site's IRB and the Montana State University IRB on November 20,

2024, to allow for appropriate implementation and data collection as seen fit by these governing bodies.

Implementation

Upon approval of this quality improvement project and completion of all the framework steps outlined above, the author of this paper will collaborate with the lead educator of the clinical site to participate in multiple pre-shift short education sessions for all RN and CNA staff in early January 2025. Before the first education session, the author of this project will obtain and review the timings of two weeks of insulin administration to obtain a current benchmark percentage of timing compliance for the unit and compare to data shared by the unit manager in September of 2024 which showed a 72% compliance rate. By the end of six weeks post-implementation, the goal of this project is 90% compliance to insulin correction dose timing within 30 minutes of a hyperglycemic blood sugar indicating treatment. Additionally, upon completing the six-week implementation, every RN will receive a survey outlining their compliance with obtaining CBGs at the 0800 and 1600 assessment times. Currently, the workflow of this site encourages all CBGs to be obtained by CNAs when possible; however, research supports the use of RN workflow to obtain CBGs to promote the timely administration of correction insulin doses.

Barriers to Implementation

Staff are open to focused education surrounding blood glucose and appropriate insulin treatment regimens; very few barriers to implementation are expected. Of the expected barriers, obtaining quality data on time with each bi-monthly collection is a concern for the author due to the inability to mine data independently from charts requiring IT assistance and approval.

Another barrier to implementation is providing enough education sessions to catch all of the PM and AM shift employees; however, if necessary, creating an online education presentation and attestation for completion will help mitigate this barrier. Education completion at any time within the 1-week education window addresses this barrier effectively.

Evaluation of Data

Data will be collected and evaluated bi-monthly during the six-week post-intervention period, allowing for alterations to the PDSA to meet the SMART goals outlined. Data examination utilizes *Microsoft Excel* and *Intellectus Statistics*. Data collected will include FIN (Financial Identification Number), admitting diagnosis, capillary blood glucose and timing, insulin dose medication time and amount, and location within the IPS unit (north or south). Data collected will be analyzed using a Z-test on *Intellectus Statistics* to determine if a statistically significant change has occurred and if the goal of 90% compliance has occurred by the end of the defined intervention period of six weeks. This data determining statistical significance will aid in determining if this quality improvement project can successfully improve CBG/Insulin administration timing compliance in other care floors of the clinical site.

Safety and Data Confidentiality

This quality improvement project poses no increased risk beyond those patients accept when utilizing services provided at any healthcare center nationwide. This project potentially mitigates the risk of hyper or hypoglycemia by reducing the risk of inappropriate insulin treatment, given the variability of blood glucose over 0-60 minutes, as outlined by the literature review in Chapter One of this document. Patient data collected from the *CERNER* EMR will be maintained on the secure facility intranet utilizing encrypted servers only accessible by

information technology and this doctoral student. Before data sharing with doctoral students, a site IT representative will remove patient identifiers beyond the FIN number, substantially reducing the risk associated with protected health information or patient-identifying data.

Additional data collection will occur regarding information from staff regarding the completion of education tasks, which will be stored within a separate document within the company intranet accessible to the staff manager, unit educator, and doctoral student.

Data shared with the Montana State University DNP faculty committee will be de-identified if any exist before the exchange. Additionally, no paper containing typed or written protected health information or identifying data will be printed or electronically transferred from the company intranet before de-identification.

This quality improvement project has the support of the site representative and critical organizational stakeholders such as the director of medical/surgical services, director of specialty services, staff RNs, staff CNAs, and inpatient glucose management team members. Before the site project proposal presentation, IRB approval for this QI project will be requested on November 1, 2024, as the site will utilize IRB approval from Montana State University instead of independent approval if accepted. This project will be proposed to the site IRB committee on November 20, 2024, at their every other month meeting and defended on December 2, 2024, before the assigned Montana State University doctoral committee. IRB approval from the facility and Montana State University is necessary before any QI intervention implementation at this clinical site.

CHAPTER THREE: IMPROVING INSULIN
ADMINISTRATION TIMING AND PATIENT BLOOD
GLUCOSE MANAGEMENT ON A MONTANA MEDICAL
SURGICAL PATIENT CARE UNIT: A QUALITY
IMPROVEMENT PROJECT

Manuscript in Chapter 3

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Contributions: Complete evaluation and analysis of clinical problem, literature review, project and intervention development, project implementation, data collection, analysis, and results dissemination.

Co-Author: Dr. Rebecca Hoover, PhD, BSN, RN, MMB

Contributions: Directly advise the author regarding clinical problem evaluation, project development, and review of proposal, project, and final manuscript. Provide feedback and constructive criticism for project design and management.

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Contributions: Provide additional guidance on project development and provide a second read on all manuscripts and individual chapters

Manuscript Information

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AbstractBackground:

Appropriate blood glucose management and prevention of hyperglycemia (BG >180mg/dL) and hypoglycemia (BG <70mg/dL) remain essential for inpatient surgical care. A single incidence of hyperglycemia can result in poorer surgical outcomes, increased morbidity and mortality, and increased infection risk in the surgical populations, especially those with primary joint arthroplasty or abdominal surgery.

Local Problem:

At the chosen project site, insulin administration times vary, ranging from only a few minutes to over 90 minutes following the collection of capillary blood glucose (CBG). Patients receiving insulin more than 30 minutes from the time of (CBG) collection are not receiving optimal treatment, which leads to further capillary BG testing or insulin dosing adjustments.

Methods:

The DNP Student and Information Technology (IT) team developed a chart review and data collection tool to assess bi-monthly if insulin administration time from CBG collection improved in one medical/surgical care unit. The proportion of CBGs being collected by Registered Nurses (RN) was evaluated using a voluntary reporting system by staff. Pre-implementation included one week of staff education surrounding insulin administration, pharmacodynamics, best practices, and workflow alteration. Data analysis determined whether

education and workflow alteration could improve insulin administration proportions 30 minutes from the time of capillary blood glucose collection.

Results:

The proportion of insulin administrations administered within 30 minutes of CBG increased from 59% pre-intervention to 76% within two weeks and remained statistically significant over the six-week period. The average interval time from CBG collection of 29.5 min decreased to 23.8 min, a statistically significant reduction. RN CBG collection rates met the goals of this project within the first two weeks and continued to meet this goal throughout implementation, with over 50% of administrations being completed by RNs.

Conclusions:

Creating meaningful compliance with national insulin administration standards is possible through a two-fold approach to quality improvement: careful, intentional workflow alteration and effective, holistic education for RN and Certified Nurse Assistant (CNA) staff members that allows RNs to administer insulin quickly following the collection of a CBG.

Keywords:

“inpatient” AND “insulin administration” AND “nursing” AND “timing”

Introduction

Hyperglycemia, defined as a fasting Capillary Blood Glucose (CBG) >180mg/dL or a two-hour post-prandial CBG>139mg/dL, is common for patients along the healthcare spectrum. Hyperglycemia occurs in nearly 25% of all hospital admissions (Umpierrez et al., 2012) due to

the high incidence of type one and type two Diabetes Mellitus in the United States. Nearly 8.5% of the patients who are diagnosed with hyperglycemia during an inpatient stay are unaware of their status as a person with either type of diabetes (Umpierrez et al., 2013). Lack of blood glucose control awareness can often predispose individuals to poor outcomes from many years of glucose deposition in the bloodstream and co-morbid hypertension, making glucose control in the hospital even more important than previously understood (Umpierrez et al., 2013).

In the hospitalized patient, blood glucose is indicated for treatment with sliding-scale rapid-acting insulin if blood glucose exceeds 180mg/dL (Hawkins et al., 2012). Hyperglycemia in the inpatient setting is best managed with the use of basal insulins such as *basaglar* and rapid-acting insulins such as *aspart or lispro*. Acute and chronic effects of hyperglycemia range from frequent urination and fatigue to damage to the kidneys, vasculature, and other end organs (Umpierrez et al., 2012). Although these negative effects are not limited to the perioperative care space, the perioperative patient population can require more intensive management of blood glucose for post-operative outcomes to meet the standards outlined by the Centers for Medicare and Medicaid Services (CMS) and many insurance companies. (Umpierrez et al., 2013). Hyperglycemia affects the post-operative population with an increased risk for infection, poor surgical healing, and higher morbidity rates, especially in post-arthroplasty patients (Umpierrez et al., 2012). Additionally, research surrounding blood glucose and patient outcomes consistently shows that blood glucose levels >200mg/dL increase all-cause mortality and raise the cost of care due to increased nursing care requirements, further treatment requirements, and even long-term complications (Umpierrez et al., 2013). Patients with heart failure with reduced ejection fraction (HFrEF) or those who are recovering from a cerebrovascular insult and subsequently experience

hyperglycemia often have worse hospital outcomes than their normoglycemic counterparts (Kirk & Oldham, 2010). Additionally, patients requiring treatment with corticosteroids, tube feeding for nutrition, or dextrose-containing intravenous fluids are at an increased risk for hyperglycemia, requiring more aggressive blood glucose management (Kirk & Oldham, 2010).

Adequate glucose control of hyperglycemic CBG (defined as a blood sugar >180mg/dL) and administration of correctional insulin within 30 minutes of CBG results in reductions in morbidity, mortality, and post-operative infection risks (Umpierrez et al., 2013; Weir et al., 2024). By improving the time to glucose monitoring and intervention, healthcare quality can improve while improving the cost-effectiveness of care. By decreasing overall infection and complication risks, hospitals may shorten lengths of stay and reduce 30-day readmissions in populations such as joint arthroplasty, myocardial infarction, and post-open-heart surgical patients. (Cobaugh et al., 2023; Mendez & Umpierrez et al., 2014, Umpierrez et al., 2012). Preventing 30-day readmissions in these populations is crucial for ensuring full reimbursement from CMS and other insurance agencies as they are often seen as highly scrutinized patient cases. Recommendations from current research show that timely administration of correctional rapid-acting insulin within 30 minutes of a CBG is essential to management of hyperglycemia. Management of hyperglycemia and the goal of normoglycemia in post-operative patients show valuable reductions in overall morbidity and mortality and decreased infection and post-operative complication risks (Weir et al., 2024). For hospital organizations, reducing risk of post-operative complications directly decreases the patient days associated with a procedure, prevents poor outcomes which may reduce repayment by CMS, and subsequently increase revenue from

each patient seen. Faster turnover of post-operative patients also directly increases the number of patients a unit can serve, meaning increased income over time.

Previous studies have uncovered many causes for delayed insulin administration; however, nursing workflow remains one of the most direct ways to address long insulin administration time lapses (Lampe et al., 2017). Additionally, there appears to be correlations between which patient care role, Registered Nurses vs. Certified Nurse Assistant, collected the CBG, that show if a CNA collects a CBG, there is a high likelihood of an administration interval >30 minutes (Trotter et al., 2012). There are many factors that may contribute to this correlation such as communication issues, Electronic Medical Record (EMR) slow updating; however, teams of providers, RNs, and CNAs taking care of patients with hyperglycemia or diabetes, must effectively communicate regarding insulin dosing, mealtimes, and CBG timing. Reporting is an integral part of ensuring insulin doses are administered in an appropriate and timely fashion (Kaisen, 2018). This information suggests that education alone is likely not sufficient enough to create meaningful change; however, a workflow alteration encouraging RN collection of CBG may be a valuable Quality Improvement tool to improve the proportion of insulin administrations that fall under 30 minutes. Additionally, many RNs cite a lack of understanding regarding insulin (e.g., pharmacology and pharmacokinetics) as a reason for unknowingly delaying insulin administration (Tretter et al., 2013).

Clinical Problem

Blood glucose values can vary substantially over an extended period of time due to rapid metabolic changes in the body due to stress, various medications, or even patient activity levels (Umpierrez et al., 2012). Experts recommend treating hyperglycemia in the hospital setting with

rapid-acting insulins administered within 30 minutes of blood glucose collection to reduce the risk of unintentional hyper- or hypoglycemia following the medication administration (Umpierrez et al., 2013; Umpierrez et al., 2012; Hawkins et al., 2012). Rapid-acting insulin takes effect within 15 minutes of administration into the subcutaneous tissue; this time, in addition to the time from CBG collection to administration, can often mean a delay of up to 45 minutes between collection of the elevated CBG value and subsequent insulin administration. If insulin is not administered within 30 minutes of the referenced blood glucose value, the risk increases for hypoglycemia, and if repeated poor timing occurs, there is an increased risk of infection and poor wound healing (Weir et al., 2024). On the unit where this QI initiative was implemented, only 57% of insulin administrations occurred within 30 minutes of capillary blood glucose (CBG) collection. The remaining 43% occurred between 30 and 90 minutes, meaning many patients were being treated for blood glucose levels measured up to 90 minutes earlier. Additionally, it takes approximately 20 minutes for the insulin to begin facilitating glucose uptake into the cells, further delaying effective blood sugar management (Donnor & Sarkar, 2023). Nationally, 30 minutes is considered the standard for the maximum interval from CBG collection to insulin administration to reduce the risk of both hyper- and hypoglycemia (Umpierrez et al., 2013).

A baseline metric to determine the percentage of capillary blood glucose (CBG) collections performed by registered nurses (RNs) versus certified nursing assistants (CNAs) was not collected prior to the intervention. However, before the implementation of this project, CBG collection was primarily carried out by nursing assistive personnel and was specifically outlined in their workflow. In order to collect and measure the proportion of CBGs being collected by

RNs, a voluntary data collection system was created in which the care personnel who collected the CBG could denote their role and time of the CBG collection. Collection of this metric was essential to this QI project as Freeland and colleagues found that coordination of care, especially in the setting of insulin administration was a primary barrier to timely insulin administration (Freeland et al., 2011).

Conceptual Framework

The *Plan-Do-Say-Act* (PDSA) framework, developed by the Institute for Healthcare Improvement supports the design and function of this project. This PDSA framework guided a single cycle starting with two weeks of preliminary data collection, followed by one week of education and data evaluation that occurred over a six-week intervention period. This project is primarily quantitative and relies on data extracted directly from the EMR, ensuring a high level of accuracy in data analysis. During the PDSA cycle, frequent conversations between the DNP student and the stakeholders prompted the refining of data to ensure value added to the project for patients and the organization in the form of data that may inform future decisions affecting this medication order set and standards.

Project Aims

This quality improvement project aimed to reduce overall patient risk for unintended hyper- or hypoglycemia events through the timely treatment of hyperglycemia with rapid-acting insulins. Timely treatment of hyperglycemia translates to nursing administration of the corrective insulin within 30 minutes of CBG collection to goal compliance of 90% occurring under 30 minutes from CBG to medication administration.

Methods

This project utilized a pre- and post-intervention strategy to evaluate whether educating staff on the details of insulin therapy, clarifying insulin administration goals, and modifying the workflow for blood glucose and insulin administration would improve insulin administration times. This simple alteration to workflow may improve overall compliance from pre-intervention baseline levels regarding goal < 30-minute insulin administration following the CBG acquisition goal compared to the utilization of an education intervention alone (Cohen et al., 2024). Data collection of the compliance rates for the unit of the times from CBG collection to insulin administration within the 30-minute time from occurred prior to the staff education to establish baseline compliance. Initial site assessments, preliminary data, and research approvals were completed and obtained by the DNP student before the intervention timeline and the start of data collection.

The DNP student made appropriate goals based on the six-week implementation timeline in conjunction with the unit leadership, stakeholders, and the Institutional Review Board (IRB). The primary target metric goal for this project was a 15-20% increase in compliance from baseline for insulin *aspart* correction doses to be administered within 30 minutes of collection of a CBG that, per order guidelines, required insulin treatment (generally >139mg/dL or 180mg/dL if the patient is NPO).-To ensure this project's designs, risks, and methods aligned with current research best practices, IRB approval was requested and obtained through the site IRB and the Montana State University IRB.

Education Intervention

The intervention portion of this QI project started with a one-week-long education period that focused on educating all members of the nursing staff, both RN and CNAs, on the unit. During the week of education, the DNP student presented data regarding insulin pharmacodynamics [the role of glucose control on patient outcomes] and the goals of this quality improvement project, including short and mid-term goals and the role of Registered Nurses (RN) and Certified Nurse's Aides (CNAs) on timely administration of insulin. Staff education occurred over four sessions, two with day shift staff and two with night shift staff. Additionally, the presentation slides allowed for individual viewing and an area for staff to state confirm they understood where to find the presentation for further review of the information if questions arose.

Post Implementation

Data collection began immediately following the educational intervention. Every two weeks, insulin administration timing and CBG data were extracted from the electronic health record. After each data collection session, compliance with the 90% goal of insulin administration within 30 minutes of blood glucose was assessed. No modifications were made to the intervention during the six-week period.

Measures

Collection and subsequent evaluation of data occurred in two ways: 1) voluntary reporting by RNs and CNAs regarding which role collected a specific capillary blood glucose (CBG), and 2) through data mining from the EMR. The data was also evaluated in respect to the

goals of project including: 1) 90% staff attendance to the education sessions lead by the DNP student, 2) an initial 10% increase in correctional insulin *aspart* administration timing compliance from pre-intervention data within the first two weeks after the intervention, 3) RNs obtaining >50% of CBGs for the patients on the unit, and 4) at week six of the intervention period, over 90% of insulin administrations falling within a less than 30-minute timeframe from the CBG. A priori, it was determined that incidences of high blood glucose levels that were not treated within 90 minutes of collection were to be discussed with staff to understand the barriers that presented in causing these events. Additionally, metrics such as the mean interval time from CBG collection to insulin administration were measured and analyzed to identify trends across multiple data points.

Staff participation as a process measure was assessed in two ways: recording attendance at each in-person education session and tracking views of the online presentation. Attendance included eight staff members per night shift session and ten staff members per day shift session, totaling four in-person education sessions, while 22 staff members viewed the online education presentation.

Data regarding insulin administrations was mined directly from the EHR reporting software and required filtering for relevance to this project. This filtering included determining the unit location and selecting the unit for which the project was taking place and the purpose of insulin being either a mealtime carb correction (not included in this project) or hyperglycemia CBG correction dose. Insulin data for hyperglycemia CBG correction dosing was then analyzed for proportion of administrations within 30 minutes of CBG and average number of minutes from CBG to insulin administration.

Table 5: Descriptive Statistics Mined for DNP Project

Descriptive Statistics Measured	Value/ Mean	Standard Deviation
Total Number of Insulin Administrations examined	814	NA
Number of Patients who were administered insulin <i>aspart</i>	109	NA
Average Age	66.2 years	16.8 cm
Average Height	169.8 cm	11.4 cm
Average Weight	95.17 kg	24.1 kg
Average Creatinine	1.52 mg/dL	1.63mg/dL
Male Distribution of Patients	52%	NA
Inpatient vs. Observation Distribution	83.4/16.6%	NA

Analysis

Data from this project was maintained and analyzed utilizing products within the facility's intranet and protected mainframe by utilizing Microsoft Excel and Co-Pilot artificial intelligence (AI). Data analysis necessitated data mining from the EHR and combing of nearly 3000 insulin administrations within each two-week period for those that took place on the study unit to correct hyperglycemia and had a CBG collected within 90 minutes prior to the administration of the insulin correctional dose. Ninety minutes and under was used as a window for data review as this was the data range examined in multiple other QI studies done (Cohen et al, 2024; Freeman et al., 2011). Data analysis was used to calculate the interval between the nearest CBG and the administration of correctional insulin *aspart*. Data was compared to the previous two-week period and to the pre-intervention data at each stage.

Analysis was completed using Z-tests to compare of two independent sample proportions to determine if a difference in proportions either an increase or decrease was statistically significant. A one-tailed Z-tests were utilized given the presumption that over time, the proportion of insulin administrations falling under the 30-minute range would increase. The p-value for this project was set to 0.05, a research standard for statistical significance. To evaluate

whether there is a statistically significant difference between the two independent proportions, a two-proportion Z-test was conducted after every two-week period following the educational intervention. The sample data consisted of two groups, the previous two weeks of post-intervention data and the data from the most recent period, or in the case of the first two weeks of post-intervention data, the pre-intervention data was used as comparison. The null hypothesis for this test (H_0): no difference between the sample proportions ($p^1=p^2$), while the alternative hypothesis (H_a): statistically significant increase in the post-intervention data over the pre-intervention data ($p^1<p^2$). The computed Z-score was then utilized to calculate the associated one-tailed p-value. For the purpose of this project, it is reasonable to infer that if the calculated one-tailed p-values of the data remain under the significance level of 0.05, the intervention of staff education and workflow alteration were successful in improving insulin timing compliance and not a random finding due to chance alone.

In addition to Z-tests, each two-week interval of data was analyzed for its own average or mean interval time from CBG acquisition to correctional insulin administration, which allowed for further review of data trends. Line graphs were used to display the data trends for each two-week period to allow for direct visualization of multiple data trends over the six-week post-intervention period following staff education and are included in the results section below. The data was further examined using paired T-tests to determine if statistically significant changes were occurring from each two-week period to the next. Data was shared with unit leadership every two weeks after review to encourage transparency and allow for dissemination to staff. This transparency could create shared-information bias with the data, but was determined by leadership to be necessary as the site continues to look for a solution for other units.

Ethical Considerations

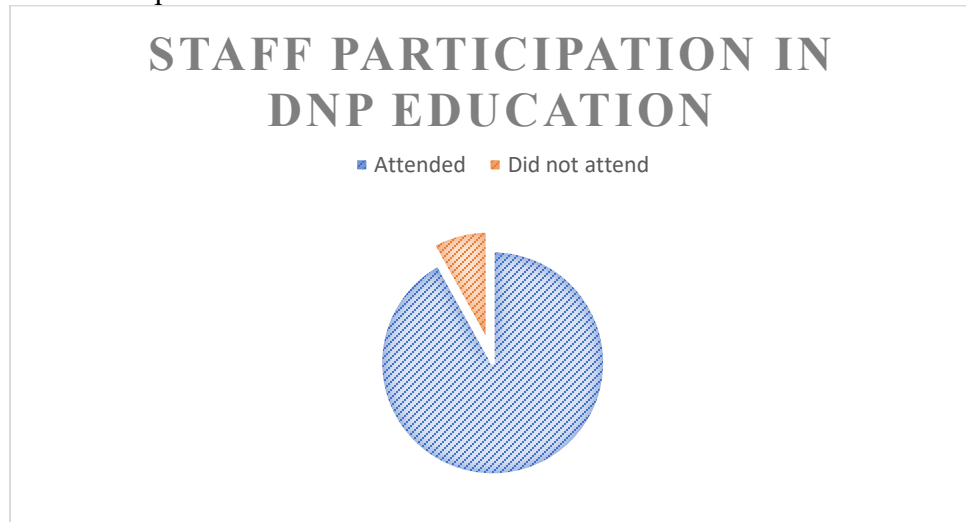
Ethical considerations included human versus non-human research, patient confidentiality, and security of protected health information (PHI). Montana State University and the facility's IRB determined that this project meets the non-human subject research criteria before any intervention. Patient confidentiality was maintained as no data was removed from the facility mainframe. All data was maintained on an online mainframe protected by dual authentication methods and requires access to the hospital EHR for further identification, including health history, presenting diagnosis, and other medications used during the stay. Data collected during this project included admission status (admitted vs. outpatient in a bed), age, gender, height, and weight.

Results

Staff Education and Participation

In total, 58 of the 62 staff members completed the education through the four total pre-shift education sessions and the online option for remote learning if not working on either of those days. After calculating the proportion of staff who attended some form of education regarding this project, 93% of RN and CNA staff members on the unit received the outlined education for this project and the “why” behind this QI initiative. This proportion exceeds the pre-determined short-term goal of >90% staff education regarding this project. Additionally, many of the staff members reported that the provided education made them feel more confident in their ability to administer insulin within a timely manner and more deeply understand the role insulin plays in positive patient outcomes.

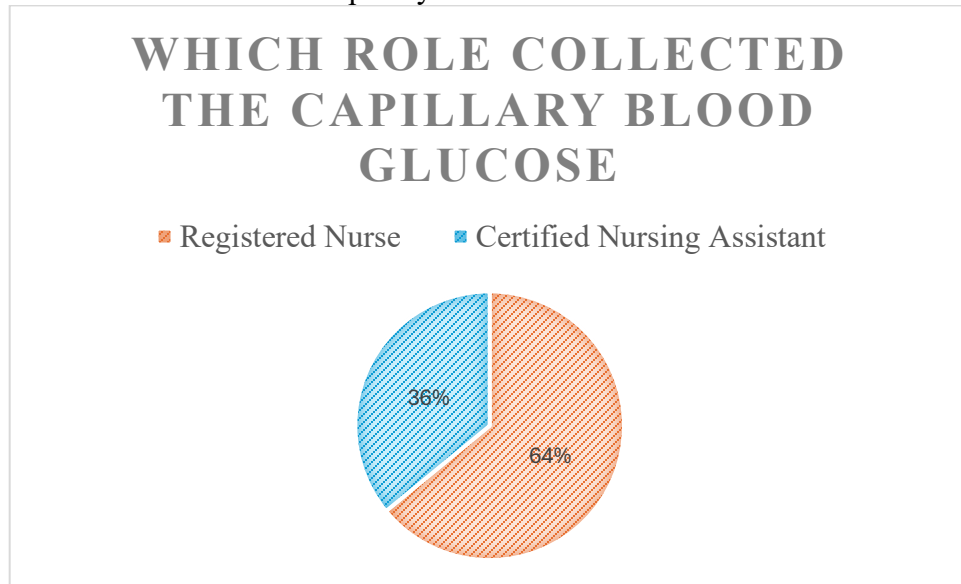
Figure 3: Staff Participation in DNP Education



Workflow Alteration Data

Over the course of this six-week intervention period, staff members reported data on the collection of 114 CBG events, delineating which staff member was responsible for each CBG measure using a form that they were shown during the education period, which was placed next to each CBG collection area at the nursing station. Examination of this data showed that 64% of reported CBGs were collected by RNs during this project intervention period, meeting an additional goal of >50% of CBGs, which will be collected during this project's intervention period.

Figure 4: What Role Collected the Capillary Blood Glucose?



Insulin Administration Timing Compliance

Over the course of the project, a total of $n = 814$ insulin administrations meeting criteria as a correctional insulin aspart dose were examined for patients being cared for on the unit. The primary measured and evaluated metric for this QI project was the proportion of correctional insulin aspart administrations that fall within 30 minutes of the CBG being used as the treatment metric. Over the six weeks of this project, this metric consistently remained higher than pre-intervention proportions, which signaled successful integration into practice and adoption by not only the RN staff but also the CNA support staff members who remain integral to the timely administration of medications such as insulin aspart.

Data evaluation of pre-intervention data

Before the educational intervention, 57% of all correctional insulin aspart doses met the criteria for the under-30-minute timeline. After the educational intervention, the first two weeks

of data collection showed a proportional increase of 19% in timely administration. This resulted in 76% meeting compliance of 30-minutes and met the overall goal set for end of intervention period compliance. Initial statistical evaluation of this data through Z-testing produced a statistically significant improvement in timely insulin administration, resulting in a $p < 0.001$ and a Z-score of -4.75.

Data evaluation weeks two through week four

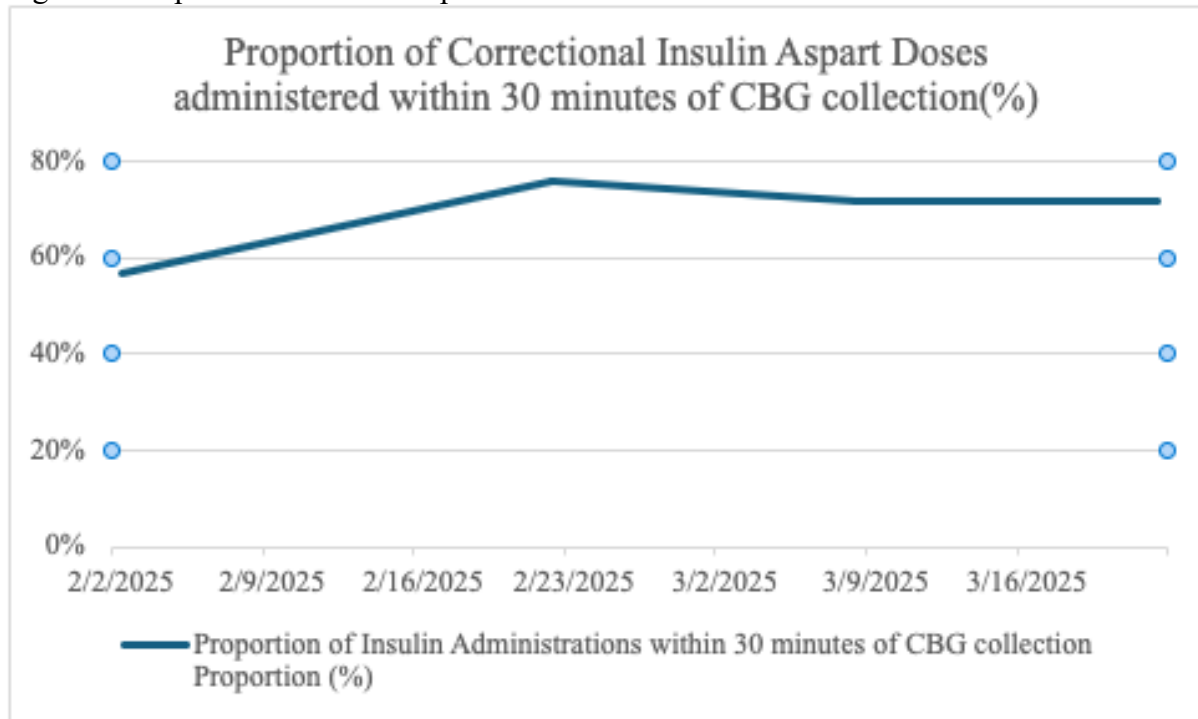
After four total weeks of collection, a re-examination of the data showed a small decrease in the proportion of insulin administrations occurring under 30 minutes from CBG collection. Additionally, during this period, a higher proportion of insulin administrations remained >60 minutes from CBG to insulin *aspart* administration. Compared to the pre-intervention data, this period's proportion of insulin administrations that fell under 30 minutes was statistically significant, with a Z -score of -3.85 and a subsequent $p\text{-value} > 0.001$. Compared to the previous two weeks, there was a non-statistically significant change in proportion, giving a Z-score of -1.14 and a p-value of 0.254, which suggests no statistically significant difference in the two sample proportions., shown in Table 5.

Data evaluation weeks four through week six

In the final two-week period of this project, encompassing weeks four through six, the data remained relatively flatlined, with around 72% of all insulin *aspart* insulin administrations occurring within 30 minutes of the respective CBG being used for treatment decisions. Interestingly, this data remained a statistically significant improvement from baseline and pre-intervention. Data analysis provided of $Z = -3.85$ with a respective $p\text{-value} < 0.0001$; however, it did not meet the over-arching goal for this project of 90% of insulin *aspart* administrations

occurring within 30 minutes of a CBG. A statistically significant increase in proportion was seen consistently across all six post-intervention weeks.

Figure 5: Proportion of Insulin Aspart Administrations under 30 minutes from CBG collection



Trends in insulin administration time

The average insulin administration interval time remained a consistent metric that inversely correlated with increased compliance regarding the timely administration of insulin aspart within 30 minutes of the CBG. Throughout the data collection, the data consistently showed that as the proportion of insulin administrations completed within 30 minutes increased, the mean interval time concurrently responded with a commensurate decrease in value.

Before the educational intervention, the average time of insulin administration was 29.5 minutes; however, data points across the spectrum ranging from one minute between CBG collection and insulin administration to 90 minutes were observed, which may have influenced

this metric as outliers. At week two post-intervention, the average administration time decreased to 21.99 minutes which, when evaluated using a two-sample T-Test, the data showed a T value of 4.11 and a subsequent $p > 0.001$ which supports the alternative hypothesis that there is a statistical difference in the mean insulin administration times over this period.

Data comparison from week two onward continued to show a decreased mean time interval between CBG collection and correctional insulin administration, as shown in Table 3.2. Paired T-tests were continued to compare week two and week four and week four to week six. There was a statistically significant decrease in the average time interval from weeks one through two to weeks three through four, as signaled by a $p\text{-value} = 0.0036$ and a T-score of -2.92 on an independent T-Test (Welch's Test). This result suggests a statistically significant difference in the means of these samples initially. It is important to examine the data from each two-week period. During the second two-week period, the mean did increase slightly from the first two-week period post-intervention to the second two-week period and was determined to be statistically insignificant with a $p\text{-value} > 0.05$. While this cannot be considered statistically significant in the realm of determining a true trend in average insulin administration time, it does show that even a slight increase from the previous does not change the statistical significance from the pre-intervention data.

On examination of data collected during weeks five through six, there continued to be a statistically significant reduction in average insulin aspart interval. Continued reductions in average insulin administration time under the previous two-week period's average reinforces the effect timely administration of insulin can have on patients receiving the best care possible. The average interval time from CBG collection to insulin *aspart* administration was 23.8 minutes,

which, when compared to the baseline average of 29.5 minutes using a paired t-test, provided a statistically significant result of $t=3.03$ with a respective p-value of 0.003, which, allows us to reject the null hypothesis that there is no difference between the sample means.

Figure 6: Average Interval from CBG Collection to Correctional Insulin Aspart Dose (Minutes)

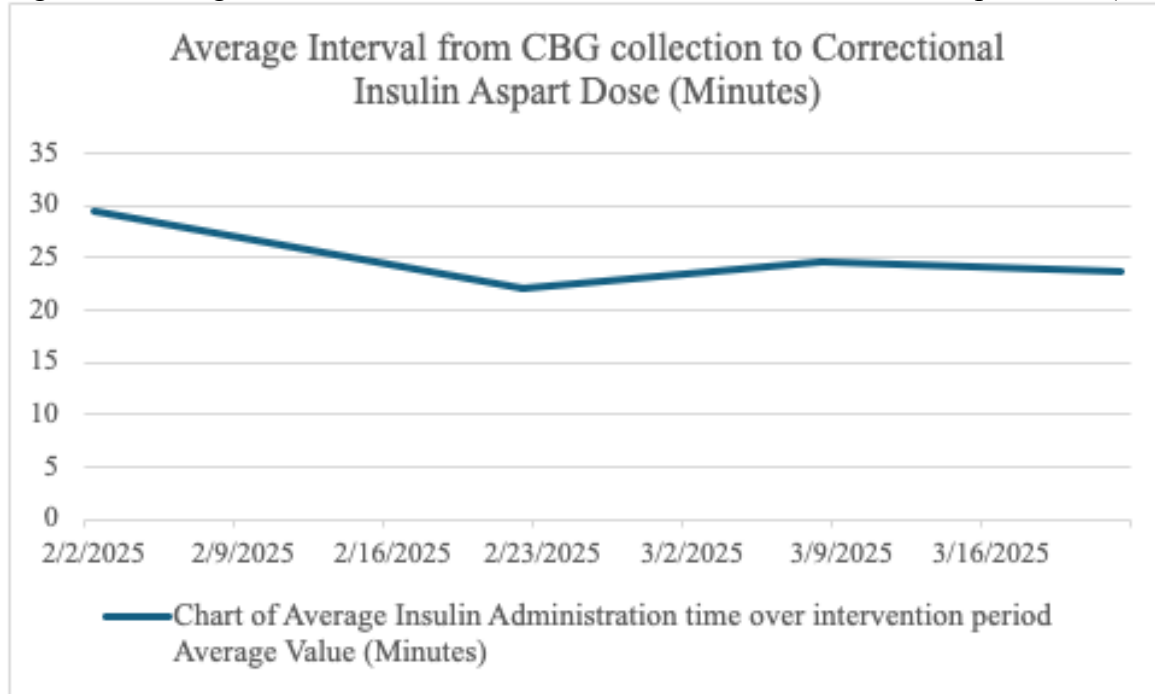


Table 6: Implementation Data Collection and Compliance

Data Collection Date	Administrations	Compliance percentage of correctional insulin administered within 30 minutes of a CBG.	Min, Q1, Med, Q3, Max (minutes)
2/2 (Pre-Intervention Data)	264	57%	1,10, 24, 42, 90
2/23 (end of 1st Two weeks cycle)	280	76%	0, 8, 14, 28.25, 90
			Z=-4.75
3/9 (end of 2 nd two-week cycle)	307	72%	3, 10, 18, 34, 90
			Z=-3.85
3/23 (end of 3 rd two-week cycle)	227	72%	2, 8, 18, 32, 90
			Z=-3.85

The incidence of blood glucose that was not treated within 90 minutes of CBG collection occurred throughout the entire six-week period, which is excessive time in comparison to even some of the most liberally designed insulin administration quality initiatives and recommendations. The continued occurrence of administrations near the 90-minute threshold prompted discussions with staff members on four occasions to discuss barriers to timely administration of insulin correction doses. These conversations did not allow for qualitative data collection but rather were utilized to provide the organization with further ideas for improvement and elimination of other confounding variables.

Discussion

This QI project focused on improving nursing compliance to a key national blood glucose management metric in peri-operative hospital patients by utilizing nursing staff education and workflow alterations to create long-term meaningful change in nursing practice. Stakeholders for this organization identified a need for improvement in glucose management within their medical/surgical care units. Stakeholders buy-in was essential for this project to be successful as the unit manager was key to dissemination of emails, she attended two of the four education sessions, and remained a strong supporter of the valuable changes this project can make on patient care. Building on previous successful QI initiatives for insulin administration, this project established a primary goal that by the end of the six-week intervention period, there would be a 15-20% increase in compliance of correctional insulin doses administered within 30 minutes of CBG acquisition compared to baseline (Cohen et al., 2024)

The interventional data for this project suggested within the first two weeks after the intervention, effective nursing education of both RN and CNA staff members focused on insulin pharmacodynamics, highlighting national standards and the real-life effects of adequate glucose management can have a profound effect on creating meaningful changes in nursing practice of insulin administration. The statistically significant result between pre- and post-interventional data produced by this QI project closely follows other QI initiatives' previously discovered findings (Muckley, 2021). Building on the QI project by Cohen et al. 2024, staff education was delivered through brief, focused sessions with each shift team. Training occurred four times over one week—twice before day shifts and twice before night shifts. Conducting these sessions in a familiar, low risk setting, such as pre-shift group meetings, allowed staff to ask questions

comfortably and immediately apply strategies in their workflow. This approach supports the development of long-term change (Hagan, 2018; Muckley, 2021; Wilson et al., 2015). It is integral to the success of QI projects and initiatives to incorporate and utilize the expertise of staff members regarding their role and responsibility to ensure an initiative is worth-while and more importantly, realistic and sustainable for the future. The work done by Muckey encourages hospitals to actively involve and support nurse research to improve patient care and outcomes as a primary focus for excellence (Muckley, 2021).

Additionally, this project data suggested that a workflow alteration focusing on utilizing the RN to collect CBG data to allow for timely administration of insulin is a worthwhile, low-cost endeavor for hospitals to use in efforts to improve patient glycemic control in the peri-operative population without adding to the already congested workflow medical/surgical nurses have on shift (Cohen et al., 2024). Workflow changes can be cumbersome and difficult to sustain, especially if they rely on workarounds or compromise the quality of care. During the six-week intervention period, staff voiced considerable understanding of the reason for the workflow change, and consistently regarded this project's change to be one that could create further changes on other medications and cares.

The consistent increase in insulin administration compliance in our project aligns with other QI initiatives that incorporated workflow modifications alongside staff education. These projects emphasized insulin pharmacology, national standards, and the impact of timely insulin administration, educating both RNs and CNAs across night and day shifts (Muckley, 2021; Cohen et al., 2024). Other QI initiatives provided a longer term for data collection and evaluation which suggests that if effective intervention occurs, positive trends are seen as soon as two to

four weeks and do have the chance to persist for up to two years following an intervention, such as those provided by this QI project (Cohen et al., 2024; Rolen et al., 2020).

This project set clear evidence-based expectations for insulin administration through the staff education. While other successful initiatives generally adopt a <60-minute goal administration period, evidence shows that this is not only too long of a period (Cohen et al., 2024; Rolen et al., 2020) but also recommends a clear plan for next implementation steps to reaching the ideal under 30-minute goal (Cohen et al., 2024). The purpose of this QI project was to develop a low-cost, sustainable solution that could be implemented across multiple hospital units, aligning with national standards and supporting best practices to optimize patient outcomes. This QI project shows statistically significant data within the primary metric that examined the proportion of insulin correctional doses administered within 30 minutes or less, and through continued examination of other secondary metrics like mean interval of insulin administration. Education of both RNs and other support staff in addition to workflow alteration can make timely, effective insulin administration possible, and realistic for hospital units caring for medical/surgical patients.

Limitations

Limitations for this project primarily surrounded the DNP student's DNP-S ability to control for other confounding variables that can affect timely insulin administration, such as: provider delays with order updates or changing of medication dosing, from obtaining a CBG data point and the time it needs to update to the EHR, and delays in care due to emergency or other urgent patient care needs. These confounding variables were brought directly to this DNP student by bedside RNs and CNAs. Despite the education and interventional goals of improving

workflow, disruptions still occurred and were brought to the attention of the DNP student. These disruptions resulted in longer administration times and therefore could have affected the results. During the PDSA cycle these opportunities for project improvement presented themselves and will be shared with stakeholders as areas to focus on in subsequent PDSA cycles if necessary. A second PDSA cycle after conclusion of this project would be valuable to help control for and identification of areas needing improvement for sustained high-quality insulin administrations.

Additional limitations of this project surrounded limited ability to mine specific data from the EHR via the data reporting portal, such as who collected the CBG and access to patient outcome metrics such as 30-day readmissions, infections noted on the unit, and the admitting diagnosis for each patient. Acquisition of data surrounding patient presentation would allow for close data monitoring allowing for true evaluation of effect on critical metrics such as 30-day readmissions, infection rate and patient outcomes.

Recommendations

This QI project has brought light to many opportunities for growth in the realm of glucose management. Conversations with staff often highlighted the role providers can play on timely insulin administration, including the possibility of creating hyperglycemia-based insulin protocols, and the importance of creating open communication between the whole care-team. Future QI projects would provide a higher value to the organization, with close examination of provider ordering, pharmacy medication approval, and how this influences insulin administration timing intervals. Additional considerations should be made for improvement in data collection and mining of data surrounding CBG collection such as a data tool that allows for close examination of the who is collecting a CBG and which RN administered the insulin. For further

integration to other units, this project can provide a foundation for further system wide improvements in glucose management such as the value of individual insulin pens for each patient needing insulin therapy.

Conclusions

Timely administration of insulin is a cornerstone to any inpatient glucose management initiative or program. Quality improvement is possible through comprehensive education regarding insulin pharmacokinetics, national standards of care insulin administration, and clearly demonstrating the effects of proper insulin administration on patient outcomes. Thoughtful workflow alteration can create meaningful, sustainable changes in nursing practice that directly translate to improved compliance of key patient care metrics.

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CHAPTER FOUR

ADVANCED NURSING ESSENTIALS REFLECTION

Personal Reflection

Long before I started the journey to obtaining my Doctorate in Nursing Practice (DNP), I always dreamt of becoming an excellent healthcare provider. I often struggled to decide between becoming an advanced practice Nurse Practitioner or a Medical Doctor. When the time came to decide, the guiding ideals of holistic, patient-centered care made becoming a Doctorate-prepared Nurse Practitioner the clear choice, aligning with the care I aim to provide. As I near the end of my DNP program, the time has come to reflect on the essential learning moments of this program and their role in becoming a well-educated and patient-centered provider moving forward. The completion of my Quality Improvement (QI) project and subsequent manuscript has been integral to my understanding of the need for continuous improvement in healthcare. Additionally, I have learned how important quality improvement helps improve not only safety in healthcare, but patient outcomes in more than one way.

Knowledge for Nursing Practice

Becoming a provider is not solely about absorbing new knowledge, but also about sharing knowledge and empowering patients to manage their overall health. While knowledge is key to being an effective provider of healthcare, especially in the advanced practice role, being able to adapt our practices to the latest research and science is more important (Domain 1.1e, Domain 1.1f). I had the valuable experience of precepting under providers who take the responsibility of evidence-based practice (EBP) seriously. These providers have shown me how

to utilize the principles of EBP while providing timely and high-quality care. Providers often fall on opposite ends of the EBP spectrum—either meticulously adhering to current medical research for every decision or resisting the integration of new knowledge into practice.

Many providers lack the time within their week to research and integrate EBP into their workplace through personally driven Quality Improvement (QI) initiatives; however, having a practice that holds multiple persons trained in QI allows for practices to integrate the newest knowledge into their practice. QI initiatives require the ability to uncover, synthesize, and integrate new knowledge into practice—a skill I developed while completing my DNP project. This DNP project included a literature review, dissemination of knowledge, and creation of protocol to integrate this new knowledge (Domain 1.2f, and 1.2h). Dissemination of knowledge and protocol creation requires use of accepted frameworks such as the Plan-Do-Say-Act (PDSA) which create a systematic approach to introducing and evaluating changes in many settings, not only healthcare (Domain 1.2j).

Population Health

I had the unique experience of completing a majority of my clinical training at Riverstone Health, which is a Federally Qualified Health Center (FQHC) which also serves as the County Health Center. Population health is another area of primary and secondary prevention that goes under-utilized in the tertiary-care-focused medical system found in the United States. My experiences in clinical sites such as Riverstone Health allowed me to take time to examine the needs of underserved populations and meet their care needs specifically (Domain 3.1j). Furthermore, through completion of my QI project as a vital component of my DNP curriculum, I feel more prepared to address the needs of my patients and community. I will accomplish this

through collaboration with stakeholders in my community to complete a needs assessment and utilize appropriate, population-specific, evidence-based practice to not only meet the needs of patients but also provide specifically tailored preventative care (Domain 3.1n, 3.3c, and 3.3d).

Interprofessional Partnerships

Collaboration is essential in healthcare and also, an essential of the education of a DNP prepared Nurse Practitioner (Domain 6.2g). Various professionals are involved in creating patient-centered, multi-disciplinary care, including nurses, doctors, medical assistants, certified nursing assistants, and other personnel. These multidisciplinary teams are able to ensure holistic care that helps to improve quality of life through movement, ability to perform activities of daily living, and even communication such as physical, occupational, and speech therapists (Domain 6.2h and 6.3d). Through the DNP curriculum and the QI project, I have learned how essential interprofessional relationships are to ensuring the success of providing high-quality care (Domain 6.4f). The QI project portion of the DNP program allowed me to work with nursing leaders, nurses, and CNAs to identify areas of care that can be improved not only for patients but also allow for improved workflow in the clinical settings (Domain 6.3d). As an Advanced Practice Provider (APP), we often find ourselves requiring the input and care of other providers (e.g., Doctors, and Physician Assistants) to connect our patients with the specialty care they need, making interprofessional communication essential to this role (Domain 6.3a). I was very fortunate during my clinical experiences and had the opportunity to facilitate many conversations with other specialists to connect my patients with care. My fondest memory related to conversations was connecting a sick pediatric patient with a needed emergency flight team, while also seeking clinical advice from and transferring the patient to the care of a pediatric intensivist

in Denver Colorado. This coordination of care created within me a deep understanding of how integral interprofessional communication can be, especially when patient lives are reliant on effective communication and coordination of care

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APPENDICES

APPENDIX A

STAFF CBG REPORTING TOOL

Who Collected the CBG?

RN _____

CNA _____

Time: 08/12/17/HS/ _____

****DO NOT put any PHI on this sheet****

APPENDIX B

DATA QUERY FOR SAMPLE COLLECTION

Date Interval: TBD

Location: Hospital

Medication: Insulin *Aspart*

Clinical Event: Gluc. Glucometer

Event occurring: Before

Time interval: 90 minutes

After data mine completed, data from 2N and 2S specifically was extracted. Further, data was filtered for hyperglycemia correction dose only. *Mealttime boluses were excluded from evaluation.*