Addressing Barriers to Anesthesia Clinicians Utilization of the Perioperative Glycemic Management Guideline in Adult Surgical Patients with Diabetes at a Level 1 Midwestern Trauma Center

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Addressing Barriers to Anesthesia Clinicians Utilization of the Perioperative Glycemic Management Guideline in Adult Surgical Patients with Diabetes at a Level 1 Midwestern Trauma Center

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Abstract

Background and Review of Literature: Diabetes Mellitus (DM) is a complex metabolic disorder characterized by hyperglycemia leading to adverse outcomes. There is an association between dysglycemia and adverse perioperative outcomes. Evidence-based research supports consistent blood glucose (BG) monitoring and narrow glycemic parameters for surgical patients in the perioperative setting. Implementing and adhering to a glycemic guideline can help improve patient outcomes and decrease hospital costs.

Purpose: This quality improvement project (QIP) aims to determine the barriers to anesthesia clinicians implementing the perioperative glycemic management guideline for BG levels greater than 180 mg/dL. Then, develop an educational component to increase anesthesia clinicians’ adherence to the glycemic management guideline.

Methods: Data for the project were obtained from retrospective pre/post-education chart reviews and pre/post-surveys. Quantitative methods were used to measure adherence to appropriate treatment of BG over 180 mg/dL based on Appendices 5, 6, and 7 of the institution’s perioperative glycemic management guideline.

Implementation Plan/Procedure: An educational PowerPoint that provided instruction on Appendices 5, 6, and 7 of the glycemic management guideline and addressed the top three barriers to adhering to the guideline was created and distributed to the department via email. Additional education included roving in-services targeting anesthesia clinicians caring for surgical PWD in the operating room.

Implications/Conclusions: Adherence to Appendices 5, 6, and 7 of the glycemic management guideline is inconsistent by anesthesia clinicians at BJH. While literature may vary on one exact perioperative glycemic management guideline to follow, adhering to an evidence-based targeted
BG range during surgery was found to improve patient outcomes. The QIP determined barriers in place to adhere to Appendices 5, 6, and 7 of the glycemic management guideline and provided education to anesthesia clinicians on utilizing the guideline, where to find them in the clinical protocols, and why they should be consistently followed.

*Keywords*: Anesthesia, Diabetes, Glycemia, Perioperative, Glucose Control, Glucose Monitoring, Surgical Patients with Diabetes, Guidelines, Guideline Adherence, Perioperative Monitoring, Clinician Education
**Addressing Barriers to Anesthesia Clinician Utilization of the Perioperative Glycemic Management Guideline in Adult Surgical Patients at a Level 1 Midwestern Trauma Center**

Hyperglycemia and hypoglycemia during the perioperative period can cause increased morbidity and mortality rates in adult surgical patients with diabetes (PWD). After implementing the System Guideline for Perioperative Management of the Adult Surgical Patient (2022) at a Midwestern Level 1 Trauma Center, there is still a high incidence of unmanaged hyperglycemia in the perioperative phase. Determining the barriers to anesthesia clinicians not fully utilizing Appendices 5, 6, and 7 of the perioperative glycemic management guideline can give insight into possible interventions to achieve better adherence. This can lead to better surgical outcomes, decreased workload for anesthesia clinicians, and decreased hospital costs.

**Background**

Diabetes mellitus (DM) can be diagnosed with any of the three following diagnostic tests: glycosylated hemoglobin (HgbA1c) greater than or equal to 6.5%, a fasting plasma glucose level greater than or equal to 126 mg/dL, or an oral glucose tolerance test with BG after two hours greater than or equal to 200 mg/dL (American Diabetes Association, n.d.). Two types of diabetes (type 1 and type 2) are categorized by their pathogenesis. In type 1 diabetes (T1DM), the pancreas makes little to no insulin to meet the body’s demands, and exogenous insulin is required to survive (Institute for Quality and Efficiency in Health Care, 2020). The more common form, type 2 diabetes (T2DM), is acquired over time and stems from pathological changes that lead to insulin resistance (Lebovitz, n.d.). Healthy BG levels for patients with diabetes (PWD) are in the range of 70-140 mg/dL (Centers for Disease Control and Prevention [CDC], n.d.). Blood glucose levels above 140 mg/dL or below 70 mg/dL are defined as hyperglycemia and hypoglycemia, respectively (CDC, n.d.).
Uncontrolled hyperglycemia can lead to acute ketoacidosis or hyperosmolar hyperglycemic state and long-term complications, including cardiovascular disease, nerve damage, kidney damage, and surgical site infections (Mayo Clinic, n.d.-a.). Hypoglycemia may cause loss of consciousness, seizures, and even death (Mayo Clinic, n.d.-b.). Galway et al. (2021) found that hyperglycemia increased postoperative infection rates, acute renal failure, acute myocardial infarction, 30-day mortality, and length of hospital stays. Not only does the hyperglycemic patient suffer from poor outcomes, but the hospital also may incur the expense of treating an infection that could have been prevented with optimal glycemic control. The current Barnes Jewish Hospital (BJH) glycemic management guideline includes treatment for pre-, intra-, and postop patients. There are 11 Appendices listed in the glycemic management guideline, found online in the clinical protocols section on the anesthesiology intranet at BJH and accessible to all anesthesia clinicians. Algorithms and tables are included with text to aid in the glycemic treatment throughout the perioperative phase. The treatment of hyperglycemia in the guideline is stated as over 180 mg/dL and is detailed in Appendices 5, 6, and 7. Appendix 5 provides instruction for preoperative glycemic management, Appendix 6 provides instruction for intraoperative glycemic management, and Appendix 7 provides instruction for the perioperative use of continuous insulin infusion in PWD (see Appendix A.)

Problem Statement

The problem was identified by perioperative pharmacy team members, who stated that anesthesia clinicians were inconsistent with following the glycemic management guideline in the perioperative phase for surgical PWD. Many factors can influence the development of hyper- and hypoglycemia during the perioperative phase, including the
level of BG control before the surgery, the etiology of glucose dysregulation (T1DM versus T2DM), nutritional status, medications, and type of anesthesia and surgery (Vogt & Bally, 2020). Optimizing the surgical patient’s BG levels can improve outcomes such as reduced morbidity and mortality rates.

**Purpose, Aims, and Objectives**

The purpose of this DNP project was to increase anesthesia clinician’s adherence to Appendices 5, 6, and 7 of the Systems Guideline for Perioperative Management of the Adult Surgical Patient. This project aimed to identify clinicians’ perceived barriers and provide education to improve adherence to Appendices 5, 6, and 7 of the System Guideline for Perioperative Glycemic Management of the Adult Surgical Patient. The first objective was to assess anesthesia clinicians’ perceived barriers to initiating treatment for BG levels over 180 mg/dL through a survey. The expected outcome was to identify the three most common barriers that anesthesia clinicians encounter. This information guided the objective to develop and implement the project's educational component. Creating an educational PowerPoint for anesthesia clinicians allowed for a better understanding of Appendices 5, 6, and 7 of the glycemic management guideline. The expected outcome was an increase of 20% of the baseline adherence to Appendices 5, 6, and 7 for surgical PWD with BG levels higher than 180 mg/dL. Data were collected at two, four, and six-week time points beginning the week the educational intervention was distributed.

**PICOT Question**

For perioperative anesthesia clinicians of adult surgical PWD at BJH in PODs 1-5 (P), does a structured evaluation of perceived barriers to glycemic management guideline adherence and a clinical practice education presentation (I) compared to traditional
education (C) improve clinicians’ guideline adherence to Appendices 5, 6, and 7 of the System Guideline for Perioperative Glycemic Management of the Adult Surgical Patient (O) over a six-week period (T)?

**Significance**

There are currently 34 million Americans who have diabetes (American Diabetes Association [ADA], 2021). In Missouri, there are approximately 546,090 people, 11.4% of the adult population, who have been diagnosed with diabetes, while an additional 139,000 people who have diabetes but are unaware of it (ADA, 2021). Furthermore, the ADA (2021) reports that diagnosed diabetes costs an estimated $6.7 billion in Missouri each year, while the number of people diagnosed continues to increase by 42,469 yearly in the state. Life-threatening complications in this population can include but not limited to heart disease, stroke, amputation, end-stage kidney disease, blindness, and death. An estimated 25% of PWD will require surgery, and post-surgical mortality rates in PWD have been estimated to be up to five times greater than in nondiabetic patients (Loh-Trivedi et al., 2021). Patients with diabetes who have their BG levels under tight control are more likely to have fewer complications and improved outcomes. Figaro et al. (2012) found that PWD stayed longer in the hospital after surgery at 9.08 days compared to 4.76 days for patients without diabetes, and the associated cost difference was $3,674 for the increased length of days required in the hospital. The extent of the problem may be considerable, in part because BJH is the largest hospital in the state of Missouri with 17,231 outpatient surgeries, including 21% with some type of diabetes diagnosis, and 16,488 inpatient surgeries, including 24% with some type of diabetes diagnosis in PODs 1-5 in 2020 (BJH Healthcare, n.d.).
Determining actual baseline rates of practice variance can be approximated through structured observation and analysis. Gandhi et al. (2005) found that in a retrospective study of 409 patients undergoing cardiac surgery, for each incremental change in intraoperative BG by 20 mg/dL above 100 mg/dL, there was an increase of more than 30% in the occurrence of adverse outcomes including infection, pulmonary and renal complications, or death. The average hospital cost for treating a single surgical site infection (SSI) is $13,303, with an increased length of hospital stay averaging 9.6 days (Wainwright et al., 2019). Lax adherence to evidence-based clinical practice guidelines for glycemic management could directly affect a patient’s recovery after surgery.

**Review of Literature**

The review of literature is a critical component in guiding the development of the Doctor of Nursing Practice (DNP) project. The review allows the doctoral student to analyze and summarize current literature in the clinical area of interest. The literature is ranked as the strongest scientific evidence based on the research's level, quality, and strength. Jones (2010) states that the type of research design largely determines the level of evidence, and the quality of the evidence is determined by critical appraisal of execution and study methods. Finally, the strength of evidence is determined by synthesizing the level and quality of evidence that leads to each practice recommendation.

For this project, a literature review was conducted by searching and analyzing the existing evidence to gain knowledge related to the clinical practice concerns in the PICOT question. After synthesizing the literature, the intervention's strengths, weaknesses, and gaps were identified. The literature review evaluated the current available literature regarding the practice problem.
Search Methods

The search for articles included PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Cochrane Library, the American Diabetes Association (ADA), and grey literature on diabetes. PubMed searches articles that are included in MEDLINE and articles that are not yet indexed in MEDLINE. MEDLINE is beneficial since it features an entitled Medical Subject Headings (MeSH), where records are reviewed by an indexer who assigns a MeSH heading to every record (Dang & Dearholt, 2018). This tool helps find more relevant articles the researcher is looking for. Search terms included “treatment, protocols, guideline adherence, barriers, implementation strategies, perioperative, hyperglycemia, and hypoglycemia.” To help determine which data were relevant to the QIP, the inclusion criteria included adult surgical PWD, adult critical care patients, glycemic protocols, diabetes management, and clinician barriers. To ensure the research reflected the facility and population, articles were excluded that were greater than ten years old, included pediatric patients, and used tools that are not currently available at BJH.

Ten studies relevant to the clinical question were selected for appraisal and synthesis. The articles provided current evidence in the clinical management of perioperative glycemic control and potential barriers to clinicians utilizing facility-set guidelines. The identified studies included systematic reviews of randomized control trials (RCT) with and without meta-analysis, retrospective studies, and a qualitative study. The evidence level and quality guide were used from the Johns Hopkins Nursing Evidence-Based Practice Appendix C (n.d.) to grade the evidence in the review of literature. The literature provides evidence of the compliance rates with glucose control guidelines throughout the perioperative period, potential factors that affect the perioperative guideline implementation, and effective strategies for promoting compliance.
Further, the literature addresses the importance of perioperative glucose monitoring and the types of adverse outcomes associated with poor glycemic control. The themes in the literature review are BG management and goals and facilitating guideline adherence.

**Blood Glucose Management and Goals**

The significant findings of this literature review detailed a need for adequate perioperative glycemic control since there is a positive correlation between hyperglycemia and postoperative infections. Wang et al. (2018) found in a meta-analysis of 15 RCTs of 5,053 patients that, when compared to conventional glycemic control (upper limits in the studies varied from 180 mg/dL to 220 mg/dL), tight glycemic control (upper limits varied from 110 mg/dL to 160 mg/dL) immediately after surgery significantly reduced the total postoperative infection rates and short-term mortality. In addition, Wang et al. (2018) found that the risk for total postoperative infection was 9.4% for tight glycemic control versus 15.8% for conventional glycemic control. Strengths included high reliability and precision due to a small p-value, relative risk and confidence intervals less than one. In addition, the methodology used two independently performed quality assessment studies. Weaknesses included a small number of eligible studies. Thus, the results were likely biased, and there was variability in the definition each RCT selected for tight or conventional control.

A systematic review by Hweidi et al. (2021) supported that targeting a conventional glycemic control approach of a BG range of 100-150 mg/dL showed an increase in positive outcomes compared to the studies targeting a BG range of 80-120 mg/dL. Their review also showed that utilizing a conventional glycemic control approach resulted in better glycemic control and a reduction in episodes of hypoglycemia. Conversely, Jin et al. (2020) found in a meta-analysis of six RCTs that, when compared with a moderate glucose target of 140-180
mg/dL, maintaining strict glycemic control below 140 mg/dL in PWD undergoing cardiac surgery was associated with lower risk of atrial fibrillation and sternal wound infection. No benefit was found with having a glycemic control strategy above 180 mg/dL. Despite the discrepancies in these results, they both support treating BG levels over 180 mg/dL to allow for better postoperative outcomes. Hweidi et al. (2021) strengthened their systematic review by assessing the quality of each study’s methodology by two researchers independently before inclusion in the review. Hweidi et al. (2021) shows bias in their systematic review by the lacking representation of low and middle-income countries. The Jin et al. (2020) study had precision due to a small p-value, with relative risk and confidence intervals of less than one. However, a limitation was in the small sample sizes of between 75 to 200 for each study, which limits the generalizability of the results.

Park et al. (2021) found that in a retrospective cohort study of 12,304 patients, preoperative hyperglycemia was associated with increased incidences of myocardial injury after noncardiac surgery ($p < .001$) and 30-day mortality ($p < .001$). In that study, the authors concluded that glucose control immediately preoperatively may be more critical for the success of the surgery than long-term control in patients undergoing noncardiac surgery. The Park et al. (2020) study had strength in its large sample size of 12,304, and all weighted regression tests were two-tailed with small p-values making them statistically significant. Park et al. (2021) showed limitations in the nature of the single-center, observational study where most of the patients were Asian, so ethnic differences could not be considered.

Furthermore, Todd and Vigersky (2021) found that the percentage of study participants, a total of 572 patients, had their glucose recorded preoperatively and 248 patients had glucose recorded postoperatively, with BG values greater than 200 mg/dL in the postoperative period
was 29.4% compared to 12.4% in the preoperative period. Todd and Vigersky (2021) showed strength in their study by using a large sample size of 762 participants and stratifying the analysis where all patients were divided into subgroups according to no diabetes mellitus, pre-diabetes mellitus, T1DM, and T2DM. Todd and Vigersky (2021) was limited in the selection of subjects since a military hospital was used in the study, and Hgb A1C data was not readily available for all patients.

Yoo et al. (2020) discovered that non-diabetic study participants had an increase in morbidity and mortality when they had a more significant variance in their BG levels postoperatively than those who had less variability in their BG levels. Yoo et al. (2020) also showed that the experimental group following a glucose management protocol had less variance in BG levels than the group that did not use a glycemic protocol, supporting the use of a protocol or guideline to maintain BG levels. Yoo et al. (2020) strengthen their research by removing bias from their research through the homogeneity test, which found no significant intergroup difference in sample characteristics. Yoo et al. (2020) limited generalizability by investigating the effects of applying a BG control protocol to only adult surgical patients recovering in a single intensive care unit.

Jackson et al. (2016) found that BG level measurement in the perioperative phase was not adequately assessed in a retrospective cohort study of 247 patients. Blood glucose measurement was performed in the intraoperative period only for 43% of patients, with 50% in the ideal range and 85% in an acceptable range. Jackson et al. (2016) had strengths in their large sample size and stratified analysis, where patients were divided into subgroups for a more thorough comparison. Jackson et al. (2016) were limited in their study with missing Hgb A1C results for some patients, which can result in a hidden or non-response bias in the results.
Facilitating Guideline Adherence

Evidence in the literature review supports using guidelines and protocols to manage BG levels during the perioperative phase. Hweidi et al. (2021) discovered in their systematic review that having a glycemic management guideline in the perioperative phase effectively prevents SSIs. The guideline also made clinicians feel more confident in their decisions to manage diabetic patients properly.

Sathishkumar et al. (2015) utilized AlertWatch. They determined that using a real-time audio-visual guide to glycemic control was associated with a 55% increase in odds of insulin treatment ($p<.001$) and a greater likelihood that anesthesia clinicians would recheck intraoperative BG levels ($p<.002$). Sathiskumar et al. (2015) strengthened their precision and reliability by using a median odds ratio for any clinician variances. Their limitations included the inability to see if the implemented technology was used during every circumstance.

The impact of clinicians’ workloads and workflows were studied related to guideline adherence. Yoo et al. (2020) studied the efficiency of an implemented guideline compared to no guideline. Nursing staff was worried about an increase in workload with implementing a new guideline. However, the study showed that nurses were achieving glycemic control sooner than the non-guideline group leading to fewer BG checks and insulin infusion changes. Also, implementing change with new technology can have great intentions but hinder the current workflow.

Helmle et al. (2017) stated that using new technology, including computerized clinician order entry (CPOE) and clinical decision support (CDS), can improve diabetes care by improving clinical workflow, decreasing the ambiguity of orders, and reducing medication errors. Helmle et al. (2017) found five common themes explaining why the implementation of
new evidence-based practice was not reciprocated by clinicians. These included education, workflow, organizational issues and practices, information technology and usability, and perceived outcomes. Helme et al. (2017) had these themes emerge consistently in the groups, and saturation was achieved, strengthening their research. Although the themes were consistent, a limitation of this study is that the participants were volunteers. Therefore, recruitment bias can exist.

**Patient Population and System Needs**

One of the main strengths of the facility setting is that BJH is a large teaching hospital. The hospital uses research-driven protocols and guidelines. There is abundant evidence supporting the benefits of a glycemic management guideline, but clinician adherence is inconsistent. The project is low risk and has the potential for improved patient outcomes. The hospital is ranked seventh in the nation for diabetes and endocrinology, and the hospital’s research and evidence-based treatment helps to improve patient outcomes (U.S. & World News, 2021). This project has the potential to also improve surgical outcomes in PWD.

The main barrier to achieving optimal BG management in the perioperative setting is compliance with Appendices 5, 6, and 7 of the glycemic management guideline. The anesthesia clinicians must ensure they are consistently following the glycemic management guideline for each surgical PWD. To ensure adequate adherence to the guideline for surgical PWD, each anesthesia clinician needed to be equipped with a glucometer. This may require the hospital to buy additional equipment. The primary strategy to strengthen these perceived weaknesses would be to educate clinicians on the project's benefits. In the long run, patient outcomes may improve with better adherence to the glycemic management guideline and offset the additional equipment cost.
Evidence for the DNP Project

The review of literature demonstrates the importance of keeping BG well controlled during the perioperative phase. The literature varies in the specific parameters of optimal BG control throughout the perioperative setting. Franco et al. (2019) found that developing a consensus on best practice to adopt as standardized care was difficult due to limited and equivocal evidence for appropriate glycemic targets. The literature suggests that identifying barriers to adherence is important to increase provider knowledge and may improve patient outcomes. Ensuring the quick and safe recovery after surgery for all PWD will require identifying these barriers in place.

Theoretical Framework or Evidence-Based Practice Model

The theoretical framework that guided the DNP project included the Theory of Reasoned Action (TRA)/Theory of Planned Behavior (TPB) which was used to explain and predict behavior based on attitudes, norms, and intentions (Appendix B). To construct the theory, the chosen framework looked into behavioral beliefs, evaluations of behavioral outcomes, which lead to attitude, then normative beliefs, and motivation to comply, which leads to subjective norms (Models and Mechanisms of Public Health, n.d.). This framework guided the project by identifying the subjective norms, attitudes, and perceived behavior control anesthesia clinicians have in the perioperative phase that impedes the utilization of the glycemic management guideline. This showed what barriers are in place at this facility and allowed for a comparison of behavioral intention to the actual behavior of anesthesia clinicians. Using this model helped change the behavior of anesthesia clinicians and increase adherence to implementing the appropriate glycemic management guideline in the perioperative phase.
Methodology

The methodology section lays the groundwork for the overall success of the QIP. Cultural considerations were of importance and included inclusive language throughout the education and survey.

Project Design

For the DNP project, an educational intervention was implemented for all perioperative anesthesia clinicians to address the three most commonly identified barriers and increase glycemic management and treatment adherence. Data for the project was obtained from a pre/post-education survey of perceived barriers to guideline adherence and retrospective pre/post-education chart reviews. Quantitative methods were used to measure the level of adherence to appropriate treatment of BG over 180 mg/dL in adult surgical PWD.

Health Promotion/Disease Prevention

Health promotion was implemented by increasing education on health policies and creating a supportive environment for anesthesia clinicians at BJH. The impact of diabetes in this area has continued to rise, with a prevalence of 12.7% in St. Louis (Datausa, 2021). Inconsistencies with compliance with just one clinician could affect hundreds of surgeries a year. Inconsistent adherence to glycemic management could directly affect a patient’s recovery after surgery.

Stakeholders

The DNP included several key stakeholders. The first stakeholder is the Pharmacy Department within BJH. Operationally, the perioperative pharmacist is responsible for checking all medication orders and dispensing medications as quickly as possible. Clinically, the perioperative pharmacist provides education to team members and is responsible for leading the
interdisciplinary and collaborative group of anesthesiologists, endocrinologists, pharmacists, and nurses that developed the current glycemic management guideline. The Pharmacy Department has the role of consulting, approval, and informing.

Another set of intertwined stakeholders are the Washington University in St. Louis School of Medicine Departments of Anesthesiology and Surgery. Anesthesia clinicians in this department utilize the glycemic management guideline to place orders. Anesthesia clinicians are tasked with implementing the guideline in every hyperglycemic case. The Anesthesia Department administrators and clinicians who participate in the project have the role of consult, approval, and inform.

The Operating Room Department is another stakeholder. Staff include preoperative techs and nurses monitoring patient BG levels based on the guideline. This department has the role of consult, approval, and inform. Patients are stakeholders as those who can benefit from improved health outcomes. The Goldfarb School of Nursing (GSON) is the last stakeholder. Student registered nurse anesthetists (SRNA) are provided instruction by the faculty of GSON in partnership with BJH. The GSON has the role of consult, approve, and inform.

Resources

The primary budgeted expense was for personnel. It was expected that data collection and analysis would be conducted by the QIP leaders one day a week for four weeks for eight hours a day. This comes to a total of four days at eight hours each day. The QIP leaders are registered nurses, and the average registered nurse hourly rate in 2021 was $39.78, according to the U.S. Department of Labor Statistics (2021). This hourly rate multiplied by 16 hours is $636.48. The QIP consists of two leaders, so the total amount expended was $1,272.96 and was paid for by the Washington University in St Louis Anesthesia Department.
The data collected throughout the QIP were analyzed using SPSS. A one-month subscription was needed for the aggregate data collected for $99 (IBM, 2022). Microsoft Excel was required to compile data found in the survey. The software cost was $69.99 (Microsoft, 2022). Qualtrics was the last item required for the creation of the survey. The manufacturer offers a 30-day trial, and there was no cost involved (Capterra, 2022). Lastly, material and supplies were limited to one 36 x 48 matte paper poster, which was presented after the QIP. The cost was $69 to have it printed (FedEx Office, 2022). The total cost of the QIP was $2,951.91 (Appendix C).

The benefits to BJH were found in an expected increase in clinicians’ adherence to Appendices 5, 6, and 7 of the glycemic management guideline. This may help to reduce adverse surgical outcomes associated with hyperglycemia, especially SSI. The average hospital cost for treating a single SSI is $13,303, with an increased length of hospital stay averaging 9.6 days (Wainwright et al., 2019). There are many different types of evaluation in the area of cost-effectiveness analysis, including cost-consequence analysis, cost-minimization analysis, cost-effectiveness analysis, cost-utility analysis, the cost to the user, and cost-benefit analysis (Silva et al., 2021). The cost-effectiveness was determined by the cost of time spent by the QIP team members compared to the resulting increase in compliance with Appendices 5, 6, and 7 of the glycemic management guideline.

**Project Site**

The QIP took place in St. Louis, Missouri, at BJH, affiliated with the Washington University in St. Louis School of Medicine. The QIP included five operating room PODs, which are separated into different surgical specialties. POD 1 specializes in pelvic specialties, including gynecology, urology, colorectal, and general surgery. POD 2 specializes in trauma,
reconstructive surgery for orthopaedics, and plastic surgery repairs. POD 3 specializes in cardiac, transplant, vascular, and hepatobiliary surgery. POD 4 specializes in ophthalmology, orthopaedics, ears-nose-throat (ENT), minimally invasive surgery (MIS), plastic surgery, and general oncology. Finally, POD 5 specializes in orthopaedics, spine, neuro, and complex ENT cases. St. Louis, Missouri, has a population of 301,578, with 44% African American and 44% Caucasian (United States Census Bureau, 2020). St. Louis has a poverty level of 21.8% and a median income of $47,000 (Datausa, 2021).

Population

The project participants included all anesthesia clinicians at BJH that manage adult surgical PWD in PODs 1-5 during the perioperative phase. This project excluded pediatric and surgical patients at facilities outside of BJH.

The BJH pharmacy department reported that over two months from June-July 2022, there were 1,460 surgical PWD. Of those, 272 had a BG >180 mg/dL intraoperative and estimated 50 had a BG > 180 mg/dL preoperative. Week two data contains surgeries during the first and second week, week four data contains the third and fourth week, and week six data contains the fifth and six week. The post-education survey was administered two weeks post-intervention and was kept open for four weeks closing at week six. A reminder was sent out at the beginning of the fourth week that the survey was closing.

Ethical Considerations

The approval of the Washington University in St. Louis Institutional Review Board (IRB) was obtained before initiating the DNP project. The official IRB Determination approved the DNP project as a quality improvement project. The Health Insurance Portability and Accountability Act of 1996 (HIPAA) protects patients' health information privacy, and all patient
records in the QIP were protected by HIPAA (HHS.gov, n.d.) The QIP followed the *Standards of Care* of the American Nurses Association (n.d.) for practice in the perioperative setting at BJH. Special care was taken to ensure QIP data did not include any patient identifiers on data collection spreadsheets.

The risks to patients participating in this QIP were no different from the risks of patients receiving standard anesthesia care. Patient record confidentiality was assured by coding the record with an individual identification number. The list of patient records and their identifying numbers were kept in an online locked file that was only accessible to the project leaders. All electronic files containing identifiable information was password protected to prevent access by unauthorized users.

The clinician's pre- and post-survey and all educational material were assessed to ensure that culturally inclusive language was used. Ethical consideration of staff burden was addressed by empowering and engaging staff to take ownership of their current practice.

**Recruitment/Sampling Strategy**

All anesthesia clinicians received the survey through their work email and took the survey voluntarily. Raosoft was used to determine the patient sample size with a confidence interval of 95% and a margin of error of 5%. Raosoft (http://www.raosoft.com/samplesize.html) reported that the sample should include 90 baseline pre-intervention charts and 90 follow-up charts over the three data collection time points, or about 30 charts per time period post-intervention. All the surgeries were listed chronologically over the eight weeks before intervention, and the QIP team members reviewed every second chart, depending on the total number of charts, of those with a BG > 180 mg/dL until at least 90 charts were reviewed. Post-
intervention data were collected in two-week increments at two-, four-, and six-week time points, with each week starting on Wednesday and ending on Tuesday.

**Measurement Instruments**

**Pre-Post Education Survey**

Qumseya et al. (2021) developed a survey to evaluate physician compliance to clinical practice guidelines and was used as a guide for this survey to increase construct validity. In the surveyed-based study, physicians from many specialties participated, where the primary outcome of interest was barriers to guideline adherence. The first section of the survey asked about basic physician demographics, followed by physician attitudes toward practice guidelines and perceived barriers to implementing the guidelines in their daily practice. Validation of the tool was determined by “establishing face, content, and constructs validity” (Qumseya et al., 2021, p. 7592). The survey was presented to three expert physicians to gain feedback before sending it to a larger group of physicians to participate and provide feedback.

All perioperative anesthesia clinicians at BJH received a Likert-type survey (Appendix C) adapted from the Qumseya et al. (2021) survey and developed using Qualtrics (https://qualtrics.com) by email to identify barriers to hyperglycemic management of surgical PWD. The survey was given prior to the education and repeated after education during weeks two through six of data collection. The survey comprises demographic questions, items with a Likert scale ranking of attitudes and barriers to collect quantitative data, and free-text fields to collect qualitative data on barriers to adhering to Appendices 5, 6, and 7 of the glycemic management guideline. Clinician demographic data that were collected include race, age group, gender, clinicians most frequently worked POD(s), the role of the anesthesia clinician (Attending, Fellow, Resident, CRNA, or SRNA), years in a current role, and years in the current
role at BJH. Before project implementation, the survey was reviewed by two anesthesia clinicians, a member of the perioperative pharmacy department, and an educator to increase content validity. The survey was tested before project implementation by being taken twice, one week apart, by five anesthesia clinicians to increase test-retest reliability.

**Electronic Health Record and Tableau**

All retrospective chart reviews were conducted in the EHR via EPIC, which is used throughout BJH. Tableau, an informatic tool, is the program that was used to compile EHR data pertinent to the QIP. Both QIP team members extracted data from the selected patient's chart. They reviewed each patient’s BG levels and insulin orders to determine compliance with Appendices 5, 6, and 7 of the glycemic management guideline.

**Microsoft Excel Spreadsheet**

All survey data and chart data mentioned above were compiled into a single Microsoft Excel spreadsheet with no patient or anesthesia clinician identifying factors (Appendix E). Cross-checking and proofreading were done throughout the reviews to decrease the chance of transcription error while prioritizing accuracy over speed (Medical Transcription Services, 2021). Compliance was documented in a Microsoft Excel spreadsheet by answering whether the anesthesia clinician was compliant or noncompliant to the management of preoperative BG per guideline, initiating the appropriate insulin route per guideline, and insulin infusion adjustment per guideline.

**Data Collection Procedures**

To test for change after a structured evaluation of perceived barriers to Appendices 5, 6, and 7 of the glycemic management guideline and a clinical practice education PowerPoint, the Plan-Do-Study-Act (PDSA) was followed. This quality improvement tool guided data collection
and any further interventions identified. The PDSA cycle is an evidence-based practice implementation tool that allows for continuous data collection and improvement after an intervention (Agency for Healthcare Research and Quality, 2020).

**Plan**

To obtain baseline patient demographic and clinician compliance data, a retrospective chart review using Tableau and the EHR was conducted for two weeks of surgical cases of PWD with a documented BG more than 180mg/dL prior to education. A pre-education electronic survey was sent to every anesthesia clinician that delivers perioperative care in PODs 1, 2, 3, 4, and 5 at BJH through their department email. All anesthesia clinicians received an email reminder after one week and had two weeks to reply to the electronic survey sent out through Qualtrics by an individual coded link, and all results remained anonymous.

**Do**

After collecting data from the survey, the intervention included an educational component utilizing the Theory of Planned Behavior to overcome the three top barriers to guideline adherence identified by the anesthesia clinicians at BJH. Multiple tools were incorporated to help educate anesthesia clinicians on Appendices 5, 6, and 7 of the glycemic management guideline. An educational PowerPoint was developed with screenshots of the EHR to show in detail how to order and initiate an insulin infusion through EPIC, education on Appendices 5, 6, and 7 of the glycemic management guideline, and education on how to overcome the top three barriers in place to utilize the guideline. The PowerPoint with a copy of the insulin order handout and hyperglycemia tip sheet was sent to all anesthesia clinicians via department email. In addition, every third Tuesday for six weeks of data collection, in-person
education was provided by assisting anesthesia clinicians with implementing Appendices 5, 6, and 7 of the glycemic management guideline in real-time in PODs 1, 2, 3, 4, and 5.

**Study**

Post-education chart reviews assessed compliance with guideline adherence at two, four, and six weeks by chronologically listing, by surgery date, adult surgical PWD with a documented BG level greater than 180mg/dL and selecting every second patient. Anesthesia clinician compliance with Appendices 5, 6, and 7 of the glycemic management guideline was measured by three dependent variables: preoperative BG management, insulin initiated (via subcutaneous, bolus, or infusion) per guideline, and insulin infusion management per guideline. The intervention was considered successful if an increase of 20% or more of the baseline anesthesia clinician compliance was noted. From week two to week six of data collection post education, the survey was emailed again to all anesthesia clinicians, with a reminder email at the beginning of week four, to assess if there were any changed attitudes and barriers to the guideline.

**Act**

Results of the QIP were presented, along with recommendations to reduce identified barriers to all stakeholders via a formal presentation. Further actions were based on results of the QIP, and changes to the guideline or further education may be recommended.

**Data Analysis**

Descriptive and inferential statistics were used to analyze the data. Demographic data were described using frequency and percentages (Table 1). Chi-square tests compared the nominal demographic data of the two independent groups, pre-education, and post-education (Table 1). The ordinal survey items were analyzed using Mann-Whitney-U (Table 2). The
multiple dependent outcomes of adherence to Appendices 5, 6, and 7 of the glycemic management guideline were reported as percentages at each pre- and post-education timepoint (Table 3). Line graphs illustrate change in adherence over time (Figure 1). The IBM Statistical Package for the Social Sciences (SPSS) software, Version 27, was used to analyze the data with an alpha set at .05.

**Procedures for Project Implementation**

The QIP team members developed a plan with goals, objectives, and expected benefits of the desired outcome of increased clinician compliance to Appendices 5, 6, and 7 of the glycemic management guideline. A provider survey was developed to identify the perceived barriers to Appendices 5, 6, and 7 of the glycemic management guideline, along with clinician demographics. The survey was sent out to all anesthesia clinicians through the department email. The email provided information on the QIP with instructions on how to take the survey. A hyperlink and QR code to the survey was easily accessible in the email. The complete glycemic management guideline was attached to the email for reference. The survey was open for two weeks with a reminder email to take the survey sent a week later.

Once the survey ended, the QIP team members analyzed the data to determine the top three barriers to implementing the glycemic management guideline. The PDF PowerPoint education included the importance of monitoring BG perioperatively, the top three barriers identified and the proposed solutions, how to access the glycemic management guideline, detailed instructions on Appendices 5, 6, and 7 of the glycemic management guideline, and how to order an insulin infusion in EPIC. The education was sent out to all anesthesia clinicians via department email. QIP team members provided two days of in person education where several copies of all the educational material were available. A total of 40 anesthesia clinicians were
provided instruction during the two-day period. Two weeks after the educational material was emailed, an email was sent out along with the post-education provider survey link. The post-education provider survey remained open for a total of four weeks following education distribution. A final reminder email was sent out on the fifth post-education week.

**Evaluation and Outcomes**

**Results**

The provider survey was used pre- and post-education to identify demographics of anesthesia clinicians and the perceived barriers to Appendices 5, 6, and 7 of the glycemic management guideline. The pre-education survey was sent out through the anesthesia department email and remained open for a total of two weeks. A reminder email was sent out one week following distribution. For the preintervention email there were 46 fully completed and 5 partially completed provider surveys. Of these 51 total surveys, the response rate was 8.5%. The post-education survey had a total of 25 responses, and 5 partially completed provider surveys. The response rate for the post education survey was 4.1%. For the data analysis only the surveys that were completed were included in the results; partially completed surveys were excluded.

The survey identified the demographics of the anesthesia clinicians (Table 1). The clinician demographics included race, age, gender, role, years at current facility, years in current role, and which POD they worked in. Both pre-education and post-education, the clinicians were predominantly young, white/Caucasian CRNAs in training or with less than five years of experience who rotate between all OR PODs.

**Table 1**

*Clinician Demographics*
## Clinician Demographics

<table>
<thead>
<tr>
<th></th>
<th>Preintervention Survey Results</th>
<th>Postintervention Survey Results</th>
<th>Chi Square</th>
<th>P-value</th>
</tr>
</thead>
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<tr>
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<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td><strong>Age</strong></td>
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<td>15</td>
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<td>15</td>
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<td>15</td>
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<td></td>
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<td></td>
</tr>
<tr>
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<td>2.3</td>
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<td>81.8</td>
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<td>90</td>
</tr>
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<td>Hispanic</td>
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<td>2.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
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<td></td>
</tr>
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<tr>
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<td>57.9</td>
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<td>53.3</td>
<td>13</td>
<td>65</td>
</tr>
<tr>
<td>Student Registered Nurse Anesthetist</td>
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<td>15.6</td>
<td>3</td>
<td>15</td>
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<tr>
<td><strong>Years in Role at WUDA</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>Still in Training</td>
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<td>24.4</td>
<td>4</td>
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<td>5 Years or Less</td>
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<td>28.9</td>
<td>6</td>
<td>30</td>
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<td>11-15 Years</td>
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<td>15.6</td>
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<td>15</td>
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<td>16-20 Years</td>
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<td>2.2</td>
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<td></td>
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<td>20 Years Plus</td>
<td>4</td>
<td>8.9</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td><strong>Years Practicing in Role</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Still in Training</td>
<td>10</td>
<td>22.2</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>5 Years or Less</td>
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<td>31.1</td>
<td>6</td>
<td>30</td>
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<td>6-10 Years</td>
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<td>22.2</td>
<td>4</td>
<td>20</td>
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<td>11-15 Years</td>
<td>6</td>
<td>13.3</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>16-20 Years</td>
<td>1</td>
<td>2.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Years Plus</td>
<td>4</td>
<td>8.9</td>
<td>3</td>
<td>15</td>
</tr>
</tbody>
</table>
Table 2 shows the results of testing for pre- to post-education change in survey respondents who agreed or strongly agreed with each question. The top three barriers identified both pre-education and post-education were complexity of the order set, length of the guideline, and short cases.

Table 2

<table>
<thead>
<tr>
<th>POD</th>
<th>POD 1</th>
<th>POD 2</th>
<th>POD 3</th>
<th>POD 4</th>
<th>POD 5</th>
<th>Training/Rotating</th>
<th>Totals</th>
</tr>
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<td>3</td>
<td>6.8</td>
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<td>5</td>
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<td></td>
<td></td>
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<tr>
<td>POD 2</td>
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<td>9.1</td>
<td>3</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POD 3</td>
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<td>22.7</td>
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<td>10</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>POD 4</td>
<td>3</td>
<td>6.8</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>POD 5</td>
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<td>4</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Training/Rotating</td>
<td>19</td>
<td>43.2</td>
<td>10</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Washington University Department of Anesthesia (WUDA)

Note: See Appendix D for questions
There was a total of 90 retrospective chart reviews completed before the educational intervention. After the educational intervention, during weeks one to two, three to four, and five to six there were 30 retrospective chart reviews completed in each two-week time frame. Anesthesia clinician compliance with Appendices 5, 6, and 7 of the glycemic management guideline was measured by three dependent variables: preoperative BG management, insulin initiated intraoperatively (via subcutaneous, bolus, or infusion if outpatient surgery; via infusion if inpatient surgery) per guideline, and insulin infusion management per guideline. Overall compliance was defined as having followed Appendices 5, 6, and 7 of the glycemic management guideline correctly. For adherence to Appendix 5, a BG would need to be checked and the appropriate insulin would need to be administered if the patient’s BG was over 180 mg/dL depending on if they were inpatient or outpatient in the preoperative area. To be in compliance with Appendix 6 and 7 in the intraoperative area, the anesthesia provider would need to check the patient’s BG and administer the appropriate insulin if the patient’s BG was over 180 mg/dL depending on if they were inpatient or outpatient.

The results showed pre-education baseline data collection was a 30-day retrospective chart review that extracted identified PWD undergoing surgery at BJH with a perioperative BG over 180 mg/dL. During a 30-day period between August 6, 2022 to September 6, 2022, there were 140 total cases with a BG over 180 mg/dL. There were 90 pre-education retrospective chart reviews that were selected by using every other chart on the list for randomization. The pre-education results showed that eight of the 90 cases were overall compliant. Table 3 displays the compliance to each of the glycemic management guideline variables for pre-education and weeks two, four, and six post-education intervention; inpatient and outpatient compliance percentages are also included.
Table 3

**Compliance to the Glycemic Management Guideline**

<table>
<thead>
<tr>
<th></th>
<th>Number of Compliant Charts (n)</th>
<th>Total Number of Charts (n)</th>
<th>Compliance (%)</th>
<th>Inpatient Compliance (%)</th>
<th>Outpatient Compliance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-intervention</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preop</td>
<td>55</td>
<td>90</td>
<td>61.1%</td>
<td>60%</td>
<td>68.5%</td>
</tr>
<tr>
<td>Intraop</td>
<td>13</td>
<td>90</td>
<td>14.4%</td>
<td>10.9%</td>
<td>20%</td>
</tr>
<tr>
<td>Insulin Infusion</td>
<td>3</td>
<td>20</td>
<td>15%</td>
<td>11.1%</td>
<td>50%</td>
</tr>
<tr>
<td>Overall</td>
<td>7</td>
<td>90</td>
<td>7.7%</td>
<td>3.6%</td>
<td>14.3%</td>
</tr>
<tr>
<td><strong>2 Week Post-intervention</strong></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Preop</td>
<td>20</td>
<td>30</td>
<td>66.6%</td>
<td>58.8%</td>
<td>76.9%</td>
</tr>
<tr>
<td>Intraop</td>
<td>6</td>
<td>30</td>
<td>20%</td>
<td>11.7%</td>
<td>30.7%</td>
</tr>
<tr>
<td>Insulin Infusion</td>
<td>3</td>
<td>10</td>
<td>30%</td>
<td>28.5%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Overall</td>
<td>4</td>
<td>30</td>
<td>13.3%</td>
<td>5.8%</td>
<td>23%</td>
</tr>
<tr>
<td><strong>4 Week Post-intervention</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Preop</td>
<td>17</td>
<td>30</td>
<td>56.6%</td>
<td>61.1%</td>
<td>50%</td>
</tr>
<tr>
<td>Intraop</td>
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<td>27.7%</td>
<td>41.6%</td>
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<tr>
<td>Insulin Infusion</td>
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<td>11.1%</td>
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</tr>
<tr>
<td>Overall</td>
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<td>16.6%</td>
<td>16.6%</td>
<td>16.6%</td>
</tr>
<tr>
<td><strong>6 Week Post-intervention</strong></td>
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<tr>
<td>Preop</td>
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<td>75%</td>
<td>83.3%</td>
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<td>10</td>
<td>30%</td>
<td>25%</td>
<td>50%</td>
</tr>
<tr>
<td>Overall</td>
<td>6</td>
<td>30</td>
<td>20%</td>
<td>12.5%</td>
<td>50%</td>
</tr>
</tbody>
</table>

The first post-education retrospective chart review of weeks one to two followed the post education distribution. Data was extracted of identified PWD undergoing surgery at BJH with a perioperative BG over 180 mg/dL. This period was between October 5, 2022 to October 18, 2022 and identified 74 total cases with a BG over 180 mg/dL. There were 30 post-education cases selected by using every other chart for randomization. Of the 30 cases, there were four that were overall compliant.
The second post-education retrospective chart review of weeks three to four followed the post education distribution. Data was extracted of identified PWD undergoing surgery at BJH with a perioperative BG over 180 mg/dL. This period between October 19, 2022 to November 1, 2022 identified 67 total cases with a BG over 180 mg/dL. There were 30 post-education cases selected by using every other chart for randomization. Of the 30 cases, there were five that were overall compliant.

The third post-education retrospective chart review of weeks five to six followed the post education distribution. Data was extracted of identified PWD undergoing surgery at BJH with a perioperative BG over 180 mg/dL. This period between November 2, 2022 to November 15, 2022 identified 63 total cases with a BG over 180 mg/dL. There were 30 post-education cases selected by using every other chart for randomization. Of the 30 cases, there were six that were overall compliant.

Figure 1 displays the adherence percentage for pre-education followed by weeks two, four, and six post-education. The overall compliance after education increased every two-week period. The preop and insulin infusion compliance rate decreased in week four compared to week two and six. Intraoperative compliance consistently increased after education in weeks two, four, and six. It was found that all inpatient cases in the preoperative area who required insulin due to a BG over 180 mg/dL would only receive subcutaneous insulin; Appendix 5 states that inpatient cases who require insulin due to a BG over 180 mg/dL should be started on an insulin infusion.
Figure 1

Compliance to the Glycemic Management Guideline for Preop, Intraop, Infusion, and Overall

Discussion of Findings

There is no statistically significant difference between the pre- and post-education provider groups for the demographic variables measured (all $p$-values were $> .05$). Although survey response rates were low, there is a statistically significant difference between pre- and post-education survey responses for questions 8-3 ($p=.05$) and 12-6 ($p=.002$) (see Appendix D and Table 2). Question 8-3 showed an increase in rating for clinician adherence to initiating an insulin infusion intraoperatively when indicated. Question 12-6 showed a decrease in rating for clinicians using clinician judgement that went against the guidelines.

Preoperative pre-education data showed a compliance rate of 61.1% compared to an average overall post-education rate of 66.6%. This was a 9.1% increase in compliance.

Intraoperative pre-education data showed a 14.4% compliance rate compared to an average
overall post-education rate of 32.2%. This was a 123% increase in compliance. Both overall inpatient and outpatient compliance varied over the two, four, and six-week periods compared to the pre-education baseline. The pre-education insulin infusion rate of compliance was 15% compared with an average overall post-education rate of 23.7%. This was a 58% increase in compliance. The pre-education overall compliance rate was 7.7% compared with an average overall post-education rate of 16.6%. There was a 160% overall increase in compliance comparing pre-education to the final six-week post-education timepoint. Ultimately, there was a 115.6% overall increase in compliance from pre- to post-education, when averaging all compliance data points. The goal of an overall increase in compliance of 20% from the pre-education to the final collection period of week-six was achieved. This suggests that electronic delivery of education combined with roving education may be effective methods for delivery of educational content.

**Strengths and Limitations of Findings**

There were multiple strengths of the QIP. One strength was the overall increase in compliance. Another strength is testing between the pre- and post-education provider demographics resulting in no statistically significant differences between the groups. There was a large sample (n=180) of chart reviews, and all anesthesia clinicians in the department were included in the distribution of educational materials. Also, bias was minimized by randomization of charts and having the project leaders review charts independently of each other.

There were three main limitations in the QIP. One being the lack of time to be able to run another PDSA cycle. Along with being able to complete a limited amount of in-person education due to time constraints in the breakroom, and the small response rates to the surveys.

**Evaluation of the Process (includes outside influences)**
The provider survey was 15 questions with some of the questions being select all that apply. It would have been helpful to include additional instructions on the survey detailing that it would take a certain amount of time to complete. There were some surveys that were only partially completed and, if given the time requirements in the instructions, it would have helped clinicians gauge if they had enough time to take it. During the survey multiple research projects were also being conducted so clinicians may have been overwhelmed with the number of surveys being sent out contributing to the low response rate.

During the roving education, educational material was distributed and explained. The roving education worked well and allowed clinicians to ask questions about the guideline. If time allowed for another PDSA cycle, adding more time for questions and answers could help with sustainability and compliance. The QIP team members spoke with several new employees who were thankful for the resources and explanation of Appendices 5, 6, and 7 of the perioperative glycemic management guideline.

System and Practice Impact

Implications for Organizational and Systems Change

This QIP provides a good starting point for increasing compliance to new guidelines produced by the healthcare facility. It served to increase anesthesia clinician’s awareness to the importance of monitoring BG levels and managing PWD in the perioperative phase. This QIP also brought awareness of the existing guideline and its location for implementation. Reminders for glucose monitoring in the EHR also have potential impact on the BJC system.

Recommendations for Nursing Practice

Patients with diabetes should have their BG levels consistently managed throughout the perioperative phase. Preoperative nurses in this facility may benefit from additional education to
Appendix 5 of the glycemic management guideline to help with adherence. It is important that perioperative clinicians are aware of the guideline to manage PWD depending on the patient’s inpatient or outpatient status. Improved communication during handoff throughout the perioperative phase about the patient's diabetes diagnosis and treatment can increase adherence of the all clinicians following the guideline when warranted.

**Sustainability**

To be sustainable, the guideline and educational handouts will need to be easily accessible to all anesthesia clinicians. Due to increasing rates of new hires at this facility, continuous education will need to be structured to remind all clinicians of the guidelines and any updates made to Appendices 5, 6, and 7 directly affecting anesthesia clinicians.

**Summary and Conclusion**

**Project Summary**

Adherence to Appendices 5, 6, and 7 of the glycemic management guideline is inconsistent by anesthesia clinicians at BJH. The goal of the QIP was to determine barriers in place to adhere to Appendices 5, 6, and 7 of the glycemic management guideline and educate anesthesia clinicians on the guideline, where to find them in the clinical guideline, and why they should be consistently followed.

The QIP found the education provided on Appendices 5, 6, and 7 of the glycemic management guideline helped to increase compliance. The pre-education baseline compliance was 7.7% compared to the average overall post-education compliance of 16.6%. This provided for a 114% average overall increase in compliance from pre- to post-education. Overall compliance at the six-week time point was 20%, representing an increase from baseline of 160%.

**Plan for Dissemination**
The plan for dissemination of the QIP includes a PowerPoint presentation of the project that describes the purpose, planning, implementation, and evaluation components. An oral presentation will be presented to all stakeholders involved and is open to the GSON and WUDA communities via a Microsoft Teams meeting on December 15, 2022. The QIP team members will present a poster presentation in the spring of 2023.
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Appendix A

System Guideline for Perioperative Glycemic Management of the Adult Surgical Patient

Appendices 5, 6, and 7.

BJC HEALTHCARE — System Guideline for Perioperative Glycemic Management of the Adult Surgical Patient - Perioperative/Department of Surgery/Guideline

APPENDIX 5: GLYCEMIC MANAGEMENT IN THE PREOPERATIVE AREA (FIGURE 3)

If patient has an insulin pump, refer to Appendix 4; if patient on insulin infusion, refer to Appendix 7

1. Check blood glucose q3h for T1DM or q6h for T2DM
   - Type 1
   - Type 2
   - <70
     - Proceed to surgery with q1h (T1DM) or q2h (T2DM) blood glucose checks
     - Treat per hypoglycemia protocol (See Appendix 11)
   - 70-180
     - Planned outpatient surgery?
       - Yes
         - Consider Lantus insulin subcutaneous 0.05 units/kg x 1
       - No
         - Initiates insulin infusion per protocol with q6h blood glucose checks and proceed with surgery (See Appendix 7)
   - 181-209
     - Planned outpatient surgery?
       - Yes
         - Order BMP and β-hydroxybutyrate or POC ketone
       - No
         - Planned inpatient surgery?
           - Yes
             - Anion gap >12, Bicarb <18, + β-hydroxybutyrate (+) or POC ketone (+)
           - No
             - Initiates insulin infusion per protocol (See Appendix 7)
             - Do not proceed with elective surgery. Initiate "Adult Diabetic Ketoacidosis and HHS Focused" orders in EPIC and call for ICU bed

*Hyperosmolar hyperglycemic state

**Printed copies are for reference only. Please refer to the electronic document to ensure latest version.**
APPENDIX 6: INTRAOPERATIVE GLYCEMIC MANAGEMENT (FIGURE 4)

(If patient has insulin pump refer to Appendix 4; if patient already on insulin infusion refer to Appendix 7)

1. Determine diabetes type
   - Type 1
   - Type 2

2. Check blood glucose q1h for T1DM or q2h for T2DM

3. Intraoperative Glucose value?
   - <70
     - Treat per hypoglycemia protocol (See Appendix 11)
   - 70-180
     - Proceed with monitoring q1h (T1DM) or q2h (T2DM) glucose checks
   - 181-250
     - Outpatient surgery? (yes/no)
     - Yes
       - Initiate insulin infusion protocol with q1h blood glucose checks
       - OR
       - Administer Lispro insulin SQ 0.05 units/kg x 1 with q2h glucose checks
       - OR
       - Administer Regular insulin bolus as a bridge to a longer acting therapy such as Lispro insulin SQ in PACU per correctional slide
     - No
       - Initiate insulin infusion per protocol with q1h blood glucose checks
       - (See Appendix 7)
   - >251
     - Initiate insulin infusion per protocol with q1h blood glucose checks
     - (See Appendix 7)

4. Case complete?
   - No
     - Recheck blood glucose as indicated
   - Yes
     - Patient on insulin infusion? (yes/no)
     - Yes
       - Verify SQ insulin and POCT glucose orders are placed as indicated by Appendix 8, allowing transition off the infusion (as applicable)
     - No
       - Continue insulin infusion through PACU/ICU handoff. Verify SQ insulin and POCT glucose orders are placed as indicated by Appendix 8, allowing transition off the infusion (as applicable)
**APPENDIX 7: PERIOPERATIVE USE OF CONTINUOUS INTRAVENOUS INSULIN INFUSION IN PATIENTS WITH DIABETES OR EQUIVALENT (E.g., PANCREATECTOMY, STRESS HYPERGLYCEMIA)**

- Patients with T1DM or equivalent:
  - Do not discontinue insulin infusion until insulin maintenance regimen is implemented.
  - For all BG < 180 mg/dL, a continuous dextrose infusion +/- bolus should be administered to allow for continuation of insulin therapy.

- NECESSITY OF CONTINUOUS DEXTROSE INFUSIONS IN DIABETIC PATIENTS:
  - Patients with T1DM (or equivalent) should be maintained on a dextrose infusion during and after surgery UNLESS they are acutely hyperglycemic (BG > 180), able to take PO, or are undergoing a small procedure with low concern for hypoglycemia.
  - Patients with T2DM generally do not require maintenance dextrose infusions unless there are extenuating circumstances (e.g., very prolonged periods of carbohydrate restriction).

- When new IV tubing is used, completely prime the tubing. Once primed, waste an additional 20 mL of insulin infusion using the IV pump prior to connecting to the patient.

- Please use clinical judgement to achieve goal blood glucose levels between 101-180 mg/dL, which may necessitate being more or less aggressive than the recommendations in the standard BJC insulin nomogram below.

**APPENDIX 7-PART 1: INSULIN INFUSION INITIATION**

<table>
<thead>
<tr>
<th>TABLE 3</th>
<th>INITIATION of an Insulin Infusion</th>
<th>Initial Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG level (mg/dL)</td>
<td>Initiation Bolus</td>
<td></td>
</tr>
<tr>
<td>&lt; 70 mg/dL</td>
<td>Follow hypoglycemia protocol</td>
<td>None**</td>
</tr>
<tr>
<td>70-100 mg/dL</td>
<td>None**</td>
<td>0.5 unit/hr**</td>
</tr>
<tr>
<td>101-180 mg/dL</td>
<td>None**</td>
<td>0.5 unit/hr**</td>
</tr>
<tr>
<td>181-220 mg/dL</td>
<td>4 units</td>
<td>1 unit/hr</td>
</tr>
<tr>
<td>221-280 mg/dL</td>
<td>4 units</td>
<td>2 units/hr</td>
</tr>
<tr>
<td>281-330 mg/dL</td>
<td>6 units</td>
<td>2 units/hr</td>
</tr>
<tr>
<td>331-380 mg/dL</td>
<td>8 units</td>
<td>3 units/hr</td>
</tr>
<tr>
<td>381-430 mg/dL</td>
<td>10 units</td>
<td>3 units/hr</td>
</tr>
<tr>
<td>&gt; 430 mg/dL</td>
<td>Notify covering MD</td>
<td>Notify covering MD</td>
</tr>
</tbody>
</table>

**Exception, for T1DM (or equivalent) with BG 70-180 mg/dL: initiate D5%/NS at 40 mL/hr plus insulin infusion at 0.5 unit/hr**

**SEE NEXT PAGE FOR INSULIN INFUSION TITRATION GUIDANCE**

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### APPENDIX 7 - PART 2: INSULIN INFUSION MAINTENANCE

#### TITRATION OF INSULIN INFUSION BASED ON BLOOD GLUCOSE TREND

**TABLE 4**

<table>
<thead>
<tr>
<th>Blood Glucose</th>
<th>TITRATION: Blood Glucose Decreased or Same As Last Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 70 mg/dL</td>
<td>Stop insulin infusion** Follow hypoglycemia orders including q15min glucose checks</td>
</tr>
<tr>
<td>70 - 100 mg/dL</td>
<td>Stop insulin infusion** Resume BG q1h</td>
</tr>
<tr>
<td>101 - 160 mg/dL</td>
<td>If BG decreased by greater than or equal to 40 mg/dL, decrease infusion by 50% or stop infusion if current rate less than or equal to 2 units/hr. Resume BG q1h. If BG decreased less than 40 mg/dL, continue same rate</td>
</tr>
<tr>
<td>161 - 200 mg/dL</td>
<td>If BG decreased by greater than or equal to 60 mg/dL, decrease infusion by 50% or stop infusion if current rate less than or equal to 2 units/hr. Resume BG q1h. If BG decreased less than 60 mg/dL, continue same rate</td>
</tr>
<tr>
<td>201 - 250 mg/dL</td>
<td>If BG decreased by greater than or equal to 60 mg/dL, continue same rate. If decreased by less than 60 mg/dL, increase by 1 unit/hr</td>
</tr>
<tr>
<td>251 - 300 mg/dL</td>
<td>Increase by 2 units/hr</td>
</tr>
<tr>
<td>301 - 349 mg/dL</td>
<td>Increase by 2 units/hr</td>
</tr>
<tr>
<td>350 - 400 mg/dL</td>
<td>Increase by 3 units/hr</td>
</tr>
<tr>
<td>&gt; 400 mg/dL</td>
<td>Notify covering MD</td>
</tr>
</tbody>
</table>

**Exception, for T1DM (or equivalent) with BG <101, increase D5%/NS to 80 mL/hr and consider reducing insulin infusion rate by 0.5 to 1 unit/hr from the current rate**

**TABLE 5**

<table>
<thead>
<tr>
<th>Blood Glucose</th>
<th>TITRATION: Blood Glucose Increased Since Last Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 - 100 mg/dL</td>
<td>Hold infusion unless T1DM (or equivalent)**</td>
</tr>
<tr>
<td>101 - 160 mg/dL</td>
<td>Maintain at present rate or restart infusion at 50% of the most recent rate</td>
</tr>
<tr>
<td>161 - 200 mg/dL</td>
<td>Increase by or restart at 1 unit/hr</td>
</tr>
<tr>
<td>201 - 250 mg/dL</td>
<td>Give 4 units insulin IV bolus then increase infusion by 2 units/hr or restart at 50% of the most recent rate</td>
</tr>
<tr>
<td>251 - 300 mg/dL</td>
<td>Give 4 units insulin IV bolus then increase infusion by 2 units/hr or restart at 50% of the most recent rate</td>
</tr>
<tr>
<td>301 - 349 mg/dL</td>
<td>Give 6 units insulin IV bolus then increase infusion by 3 units/hr or restart at 50% of the most recent rate</td>
</tr>
<tr>
<td>350 - 400 mg/dL</td>
<td>Give 6 units insulin IV bolus then increase infusion by 3 units/hr or restart at 50% of the most recent rate</td>
</tr>
<tr>
<td>&gt; 400 mg/dL</td>
<td>Notify covering MD</td>
</tr>
</tbody>
</table>

**Exception, for T1DM (or equivalent) with BG <101, continue D5%/NS at 40 mL/hr (or greater) and continue insulin infusion at present rate**

---

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Appendix B

Theory of Reasoned Action/Theory of Planned Behavior

### Appendix C

#### Budget Table

<table>
<thead>
<tr>
<th>Nature of Expenditure/Item</th>
<th>Cost per Unit</th>
<th># Units</th>
<th>Total Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct Costs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Personnel</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Leaders</td>
<td>Two days x 8 hours a day =16 hours. 16 hours x $39.78 per hour (U.S. Bureau of Labor Statistics, 2021) =$636.48</td>
<td>2</td>
<td>$1,272.96</td>
</tr>
<tr>
<td><strong>Materials and Supplies</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poster</td>
<td>36x48 Matte Paper Poster (FedEx Office, 2022) = $69.00</td>
<td>1</td>
<td>$69</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hardware/Software</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPSS</td>
<td>$99 monthly subscription (IBM, 2022) x 1 month = $99</td>
<td>1</td>
<td>$99</td>
</tr>
<tr>
<td>Microsoft Excel</td>
<td>$69.99 (Microsoft, 2022)</td>
<td>1</td>
<td>$69.99</td>
</tr>
<tr>
<td>Qualtrics</td>
<td>Free 30-day trial (Capterra, 2022)</td>
<td>1</td>
<td>$0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>$2,951.91</strong></td>
</tr>
</tbody>
</table>
Appendix D

Survey

Q1 What is your age?

☐ 25-35 (1)

☐ 36-45 (2)

☐ 46-55 (3)

☐ 56-65 (4)

☐ over 65 (5)

Q2 Race

☐ American Indian or Alaska Native (1)

☐ Asian (2)

☐ Hispanic (3)

☐ African American (4)

☐ Native Hawaiian or Other Pacific Islander (5)

☐ White or Caucasian (6)

☐ Other (7)
Q3 Gender

- Male (1)
- Female (2)
- Non-binary / third gender (3)

Q4 What is your role at Barnes Jewish Hospital/Washington University School of Medicine (WUSM) in St. Louis Department of Anesthesiology?

- Anesthesiologist Attending (1)
- Anesthesiology Resident (2)
- Anesthesiology Fellow (3)
- Certified Registered Nurse Anesthetist (4)
- Student Registered Nurse Anesthetist (5)

Q5 How many years have you been affiliated with the WUSM Department of Anesthesiology in this role?

- I am currently still in training (1-2 year SRNA or resident) (1)
- I am currently still in training (3+ year SRNA or resident) (7)
- 5 years or less (2)
- 6-10 years (3)
- 11-15 years (4)
- 16-20 years (5)
- 20+ years (6)
Q6 How many years have you been in practice in your current role?

- I am currently still in training (SRNA or resident) (1)
- 5 years or less (2)
- 6-10 years (3)
- 11-15 years (4)
- 16-20 years (5)
- 20+ years (6)

Q7 Which area(s) do you work in most frequently? (Select all that apply.)

- Pod 1 (1)
- Pod 2 (2)
- Pod 3/CPC (3)
- Pod 4 (4)
- Pod 5 (5)
- Currently in training and rotating through all areas (6)

End of Block: Demographics

Start of Block: Perceived Adherence

Q8 The remaining questions was focus on specific aspects and appendices of the BJC HEALTHCARE - System Guideline for Perioperative Glycemic Management of the Adult Surgical Patient - Perioperative/Surgery/Anesthesiology Guideline. When indicated the specific appendix was referred to in the question group stem.
With regard to the guideline, Intraoperative Glycemic Management (Appendix 6), I would rate my adherence to..

<table>
<thead>
<tr>
<th>Following the guideline in general (1)</th>
<th>Never (1)</th>
<th>Seldom (2)</th>
<th>Sometimes (3)</th>
<th>Often (4)</th>
<th>Always (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring Q1 or Q2 hour glucose levels intraoperatively for patients with type 1 or type 2 diabetes (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiating an insulin infusion intraoperatively when indicated (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiating an insulin infusion using the ANE Adult Perioperative Insulin Orders set (4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

End of Block: Perceived Adherence

Start of Block: Intraoperative guidelines for patients with diabetes
Q9 With regard to the Intraoperative Glycemic Management (Appendix 6), and Guideline for the Perioperative use of Continuous Intravenous Insulin Infusion in Patients with Diabetes or Equivalent (Appendix 7) I feel that:

<table>
<thead>
<tr>
<th>I am adequately trained in applying the guideline in my daily practice (1)</th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Neutral (3)</th>
<th>Agree (4)</th>
<th>Strongly agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have easy access to the guideline within my practice (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The guideline is evidence-based (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The guideline is easy to read and understand (4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have accessed the guideline in the last 30 days (5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am comfortable initiating an insulin infusion intraoperatively when indicated (6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am comfortable titrating and managing an insulin infusion intraoperatively (Appendix 7 only) (7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q10 In my opinion, the following factors are barriers to using to the Intraoperative Glycemic Management (Appendix 6) and Guideline for the Perioperative use of Continuous Intravenous Insulin Infusion in Patients with Diabetes or Equivalent (Appendix 7):

<table>
<thead>
<tr>
<th>Factor</th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Neutral (3)</th>
<th>Agree (4)</th>
<th>Strongly agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty accessing (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of guideline documents (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complexity of guideline (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of familiarity to the current guideline (4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time constraints due to clinical responsibilities (5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conditional or weak recommendations of the guideline (6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concerns that guideline is not able to be individualized (7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q11 In my opinion, the following factors are barriers to monitoring Q1/Q2 hour blood glucose levels per the guideline intraoperatively:

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Neutral (3)</th>
<th>Agree (4)</th>
<th>Strongly agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of access to supplies (e.g., glucometers) (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time constraints due to clinical responsibilities (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remembering to monitor glucose levels (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling to monitor glucose levels is not necessary (4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q12 In my opinion, the following factors are barriers to initiating an insulin infusion per guideline intraoperatively (Appendix 5, Appendix 6 & Appendix 7):

<table>
<thead>
<tr>
<th>Factor</th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Neutral (3)</th>
<th>Agree (4)</th>
<th>Strongly agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of access to supplies (glucometers, medications, IV tubing) (1)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Placing an order in EPIC to order and document insulin infusion (2)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Surgeon not wanting patient to be on an insulin infusion when indicated (3)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Concern for the PACU's ability to manage an insulin infusion (4)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Concern with delayed discharge following outpatient surgery (5)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Clinician judgment/not wanting to initiate an insulin infusion when indicated (6)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>
Q13 Other barriers to glycemic management guideline adherence:

________________________________________________________________

________________________________________________________________

Q14 The most significant barrier to following the glycemic management guideline is:

________________________________________________________________

End of Block: Barriers to adherence

Start of Block: Comments

Q15 Other comments/concerns:

________________________________________________________________

End of Block: Comments
Appendix E

Excel Spread Sheet For Data Collection

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Provider</td>
</tr>
<tr>
<td>B</td>
<td>Age</td>
</tr>
<tr>
<td>C</td>
<td>Race</td>
</tr>
<tr>
<td>D</td>
<td>Gender</td>
</tr>
<tr>
<td>E</td>
<td>Data Set</td>
</tr>
<tr>
<td>F</td>
<td>Experience</td>
</tr>
</tbody>
</table>

- **Provider:** Different initiators, Multi-Disciplinary as needed
- **Age:** 1: Disagree, 2: Neither Agree, 3: Agree, 4: Strongly Agree
- **Race:** Difficulty as length of go complexity & constraints, conditional & economic, thus I am agenda I have easy & the guidelines in the guideline I have access to feel comfort level controls lack of access. Placing orders, surgeon not INCU
### BARRIERS IN PLACE TO ANESTHESIA CLINICIANS

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Short Answer to Question</td>
<td></td>
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<tr>
<td>2. Other barriers to guideline adherence</td>
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</tr>
<tr>
<td>3. Provider</td>
<td>Answer</td>
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</table>

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Short Answer to Question</td>
<td></td>
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<tr>
<td>2. The most significant barrier</td>
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<td>3. Provider</td>
<td>Answer</td>
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[Excel spreadsheet image]
### BARRIERS IN PLACE TO ANESTHESIA CLINICIANS

<table>
<thead>
<tr>
<th>Column</th>
<th>Data Pulled from Oph- using Tables</th>
<th>Dependent Variables to Access for Compliance</th>
<th>Key</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>Patient</td>
<td>Inpatient/Outpatient/Duration of OPOD/Intra</td>
<td>Inpatient</td>
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<tr>
<td>3</td>
<td>ASA</td>
<td>Preoperative Insulin Use Intra/Compliant/Noncompliant</td>
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<tr>
<td>4</td>
<td>Weight (kg)</td>
<td>Compliant/Noncompliant</td>
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</tr>
<tr>
<td>5</td>
<td>Duration of CTO-2h 3:30-6:30 &amp; 30min</td>
<td>Duration of CTO-2h 3:30-6:30 &amp; 30min (hrs)</td>
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</tr>
<tr>
<td>6</td>
<td></td>
<td>(If Access N/A) Compliant/Noncompliant</td>
<td></td>
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</tbody>
</table>
## Appendix F

### Project Timeline

<table>
<thead>
<tr>
<th>Task</th>
<th>Course 6730 (Month)</th>
<th>Course 6740 (Starting Month)</th>
<th>Course 6740 (Ending Month)</th>
<th>(Month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral presentation of project proposal to team members</td>
<td>August 2022</td>
<td></td>
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<tr>
<td>Proposal approval</td>
<td>August 2022</td>
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<tr>
<td>Baseline data collection &amp; distribution of clinician survey</td>
<td>September 2022</td>
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<tr>
<td>Education intervention sent out via email</td>
<td>September 2022</td>
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<tr>
<td>Post-education data collection #1 (2 weeks following intervention) – chart reviews and post-surveys</td>
<td>October 2022</td>
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<tr>
<td>Post-education data collection #2 (4 weeks following intervention)</td>
<td>November 2022</td>
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<tr>
<td>Post-education data collection #3 (6 weeks following intervention) – chart reviews and post-surveys</td>
<td>November 2022</td>
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<tr>
<td>Analysis &amp; interpretation of outcomes</td>
<td>December 2022</td>
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<tr>
<td>Project Evaluation</td>
<td>December 2022</td>
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<tr>
<td>Finalize QIP paper</td>
<td>December 2022</td>
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<td>Oral presentation QIP findings</td>
<td>December 2022</td>
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<tr>
<td>Dissemination of results</td>
<td>December 2022 – April 2023</td>
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