

University of New Hampshire

## University of New Hampshire Scholars' Repository

---

Master's Theses and Capstones

Student Scholarship

---

Summer 2022

### Decreasing Delays Within the Perioperative Unit Caused by Cases of Hypoglycemia Through Nursing Continuing Education: A Quality Improvement Project

Jesse Bardis

University of New Hampshire, Durham, jjbardis74@gmail.com

Follow this and additional works at: <https://scholars.unh.edu/thesis>



Part of the [Nursing Commons](#)

---

#### Recommended Citation

Bardis, Jesse, "Decreasing Delays Within the Perioperative Unit Caused by Cases of Hypoglycemia Through Nursing Continuing Education: A Quality Improvement Project" (2022). *Master's Theses and Capstones*. 1606.

<https://scholars.unh.edu/thesis/1606>

This Thesis is brought to you for free and open access by the Student Scholarship at University of New Hampshire Scholars' Repository. It has been accepted for inclusion in Master's Theses and Capstones by an authorized administrator of University of New Hampshire Scholars' Repository. For more information, please contact [Scholarly.Communication@unh.edu](mailto:Scholarly.Communication@unh.edu).

**Decreasing Delays Within the Perioperative Unit Caused by Cases of Hypoglycemia  
Through Nursing Continuing Education: A Quality Improvement Project**

Jesse Bardis

Department of Nursing, University of New Hampshire

Faculty Mentor: Pamela Kallmerten PhD, DNP, RN, CNL

Practice Mentor: Jessica Barrows RN

Date of Submission: August 18, 2022

## Table of Contents

|  |    |
|--|----|
| Abstract.....  | 4  |
| Introduction.....  | 6  |
| Problem Description.....                                   | 6  |
| Available Knowledge.....                                   | 8  |
| Insulin Recommendations.....                               | 9  |
| Oral Noninsulin Antidiabetic Drugs.....                    | 12 |
| Multidisciplinary Approach.....                            | 13 |
| Discussion.....  | 14 |
| Current and Future Quality Improvement Projects.....       | 15 |
| Rationale.....   | 16 |
| Specific Aims.....   | 16 |
| Methods.....   | 17 |
| Context.....   | 17 |
| Intervention(s).....                                       | 19 |
| Study of the Intervention(s).....                          | 19 |
| Measures.....  | 20 |
| Analysis.....  | 20 |
| Ethical Considerations.....                                | 21 |
| Results.....   | 21 |
| Results.....   | 21 |
| Evolution of the Intervention.....                         | 21 |
| Process Measures and Outcomes.....                         | 23 |
| Contextual elements.....                                   | 24 |
| Observed Associations.....                                 | 24 |
| Unintended Consequences.....                               | 29 |
| Discussion.....  | 30 |
| Summary.....   | 30 |
| Key Findings: Nurse Knowledge.....                         | 30 |
| Key Findings: Nurse Confidence.....                        | 31 |
| Particular Strengths of the Project.....                   | 32 |
| Interpretation.....  | 33 |
| Association Between the Intervention and the Outcomes..... | 33 |
| Comparison of the Results.....                             | 34 |
| Impact of the Project.....                                 | 35 |
| Reasons for any Differences.....                           | 35 |
| Costs and Strategic Trade-offs.....                        | 36 |
| Limitations.....   | 36 |
| Limits to the Generalizability of the Work.....            | 36 |
| Factors Limiting Internal Validity.....                    | 37 |
| Efforts made to limit and adjust for limitations.....      | 38 |
| Conclusion.....  | 38 |
| Usefulness of work.....                                    | 38 |

Sustainability.....38

Potential for Spread to Other Contexts .....39

Implication for Practice.....39

Implication for Further Quality Improvement Projects.....40

Suggested Next Steps.....40

Final Thoughts .....41

References ..... 42

Appendix A..... 45

Appendix B ..... 48

### Abstract

**Background:** Diabetes mellitus is a condition that is prevalent within the United States of America (Centers for Disease Control and Prevention, 2022). Hypoglycemia is a complication from diabetes mellitus that can delay surgery within the perioperative environment.

**Local Problem:** The short stay unit of a microsystem has noted the increase in incidence of preoperative hypoglycemia in the previous year, with three cases noted in the past few weeks. These instances require intervention and a possible cancellation in the scheduled procedure. Therefore, a specific aim of increasing the nurse's knowledge and confidence with hypoglycemia and the protocols to treat it by 50 percent was initiated. The goal was to explore the early recognition and treatment of hypoglycemia in the perioperative setting.

**Methods:** To complete this, a pre-test survey on early recognition and treatment of hypoglycemia was administered. Following this, an educational presentation focused on the early recognition of hypoglycemia, as well as the facility protocol for timely intervention. A post-test survey was then administered. To study the intervention, results from the pre-test were compared with the post-test.

**Results:** The pre-test to post-test knowledge scores for early recognition of hypoglycemia and facility protocol increased from 70 percent to 85 percent correct. Knowledge regarding early recognition of hypoglycemia increased from 72 percent to 82 percent overall while the greatest changes were noted for identification of severe symptoms and asymptomatic hypoglycemia. Timely intervention per facility protocol also increased from 69 percent to 88 percent overall with the greatest improvement for infusion of D10W, troubleshooting for no improvement after 15 minutes, and provider notification. Finally, perception of confidence with timely recognition of hypoglycemia showed a decrease with a mean of 4.1 (*SD* 0.74, Range 1-5) prior to the

intervention and a mean of 3.6 1 (*SD* 1.43, Range 1-5) following. The perception of confidence in the treatment of hypoglycemia was unchanged (as the mean prior to the intervention was 3.6 and it was 3.7 following).

**Conclusion:** While the nurse's knowledge did increase from the educational presentation, they did not increase their overall knowledge by 50 percent. The increase seen was 14 percent for knowledge for early recognition and 28 percent for knowledge regarding the facility protocol. Secondly the nurse's confidence did not increase after the educational presentation and did not meet the goal. In fact, the nurses' confidence in their early recognition actually decreased. This may reflect an increased awareness of their knowledge deficit in early recognition. As a result, recommendations for future quality improvement projects include addressing asymptomatic and severe hypoglycemia, as well as troubleshooting and provider notification to increase perioperative nurse confidence in caring for hypoglycemic patients.

Keywords: Hypoglycemia, Perioperative, Education, Pre-/Post-test, Diabetes Mellitus

## Introduction

### Problem Description

Currently the Centers for Disease Control and Prevention (CDC) (2022) estimates that there were approximately 37 million people who had diabetes mellitus (known or unknown) within the United States. Of those people 28.7 million were diagnosed with diabetes which amounts to 8.7 percent of the United States (US) population (CDC, 2022). Undiagnosed cases reached approximately 8.5 million within the adult population (CDC, 2022). These numbers have increased in the last decade with the estimated number of patients with diabetes mellitus was about 26 million (about 19 million diagnosed and 7 million undiagnosed) (CDC, n.d.). Statistics on how many of those patients will enter the perioperative environment is not available for the US. Along with this were about 13 million surgeries between 2019 -2021, which the total number was skewed with many planned surgical procedures cancelled due to the pandemic (Mattingly, 2021).

These are important statistics because there are an abundance of complications that can come from poorly controlled diabetes mellitus within the perioperative environment of a hospital. These problems stem from both types of diabetes mellitus and hyper or hypoglycemic events. The complications that are noted within the postoperative setting include decreased ability to heal, decreased ability to fight off infections, cardiovascular events, delayed extubating, along with many other complications up to and including death (Wukich, 2015). Postoperative complications aren't the only ones that can be seen within the perioperative landscape though. Complications can also appear for the patient even before the surgery starts, within the preoperative time frame. During the preoperative time frame the complications most likely to be noticed are either hyper- or hypo-glycemia. The causes of hypoglycemia that could lead to

symptoms requiring intervention preoperatively include the patient receiving too much exogenous insulin, late afternoon surgery, fasting time was too great, and/or the patient did not ingest sufficient food to manage blood glucose levels. The Short Stay Unit (SSU) of a macrosystem is a unit that has noted the increase in incidence of preoperative hypoglycemia most notable over the last year. While they don't keep specific information on the number of patients having had complications of hypoglycemia, either preoperatively or postoperatively, the nurses in the short stay unit (SSU) have recollections based on the experiences. After interviewing these nurses, it was found, according to the nurse supervisor, that the post-operative complications were difficult to track, and hyperglycemia wasn't tracked preoperatively because it was a common occurrence in the SSU (Anonymous, personal correspondence, April 11, 2022). The surgeons tend to tolerate hyperglycemia in the perioperative setting understanding the effects of physiological stress and proceeded with the surgery. However, hypoglycemia was a bigger challenge in the SSU requiring intervention.

While hypoglycemia within the unit is uncommon, some nurses noted that there have been more cases noticed recently (Anonymous, personal correspondence, April 11, 2022). One nurse said that she saw three cases within a few weeks and that it was typically noticed in clusters (Anonymous, personal correspondence, April 11, 2022). There are many factors explaining this occurrence such as traditional nil per os (NPO) starting at midnight, a lack of diabetic specific protocols for the perioperative setting, and sub-optimal patient control of their diabetes. These complications have led to preoperative patients requiring interventions to improve the blood glucose level and/or canceling the surgery until the blood glucose level is under control. Blood glucose levels in the perioperative/preoperative setting should be around 140 milligrams (mg) per (/) deciliter (dL) or less but greater than 70 mg/dL which would be



indicative of hypoglycemia (Duggan & Chen, 2019; Galway et al., 2021; Kalra et al., 2013). The glycosylated hemoglobin or Hemoglobin A1C is a test reflecting glycemic control for the previous three months. This level looks at the past three months of blood glucose and is a better indicator of diabetes. Chen et al. (2018) found that patients with a preoperative Hemoglobin A1C of seven or greater had a higher rate of complications. While Glycosylated hemoglobin is a better indicator of glycemic control for maintenance, the fasting blood glucose level is used to reflect current state. Peri-operative nurses should be knowledgeable about the recognition and treatment of hypoglycemia.

### **Available Knowledge**

Ten percent of the United States of America population has diabetes mellitus (Galway et al., 2021). In addition, about a third of the other 90 percent have prediabetes (Galway et al., 2021). This could also lead to many problems in the perioperative setting including cardiovascular events, neurovascular events, and other conditions. This is due to the fact that the physiologic changes during surgery are more prominent in those who are resistant to insulin causing complications that could arise more easily and/or be more severe (Galway et al., 2021, Himes et al., 2020). This review of the literature will explore the ways to help mitigate these risks, particularly hypoglycemia in the perioperative environment. It will explore strategies to prevent hypoglycemia such as scheduled start times, hypoglycemic medication administration and interdisciplinary teamwork.

### ***Earlier Start times and Carbohydrate Loading***

Halperin et al (2022) used a modified Delphi process combined with a literature review to acquire the expert opinions of Canadian diabetes specialists. This consisted of a four-step process to gather consensus and build the standards of care. After proceeding through the first

two steps of the process a literature review was completed to try and find evidence of what was gathered from the experts interviewed. After this they found that there was very little evidence to corroborate the notion that the persons with diabetes mellitus should be the first patients going through surgery. What literature was found indicated there was substantial information to support carbohydrate loading with oral carbohydrate beverages that could be administered up to two hours prior to surgery without repercussions to anesthesia. Himes et al. (2020), had the opposite opinion and declared there was not enough research to recommend carbohydrate loading with oral carbohydrate drinks because most of the studies exclude persons with diabetes mellitus in the study. The carbohydrate loading may be detrimental to the patient in the long term because it could lead to hyperglycemia (Himes et al. 2020). What was discussed though, is that the patients should be scheduled earlier in the day, if possible. (Himes et al., 2020). Earlier start time and carbohydrate loading considerations are important for perioperative nurses to know because it can help them advocate for changes to the preoperative guidelines for patients to help prevent hypoglycemia.

### ***Insulin Recommendations***

Halperin et al (2022) also suggested that insulin doses should be adjusted preoperatively to help avoid any complications from arising in all areas of the perioperative landscape. Sreedharan & Abdelmalak (2018) came to the same conclusion, but they were able to expand on that knowledge. They found that for the long-acting basal insulin the doses should be decreased 20-30 percent the day before with 75 percent of the typical dose being shown to be safe the prior night. The day of surgery they found that taking 50 percent of the normal dose was acceptable. Long-acting insulin has a lesser chance of causing hypoglycemia in the preoperative/perioperative setting because it does not have the peak compared to other insulin types. On the

other hand, intermediate acting insulins should be taken as normal the day before, at 50-75% of the dose the evening before and 50% the morning of surgery. While intermediate acting insulin can cause hypoglycemia, short acting insulin types should be avoided on the day of surgery (Sreedharan & Abdelmalak, 2018). Mixed insulins have conditional recommendations including permitting the use of the intermediate acting insulin without the short acting if possible. Alternatively, if insulin is pre-mixed, 50 percent of the dose on the morning of surgery is advised if the blood glucose is greater than 200 mg/dL or held if it is not (Sreedharan & Abdelmalak, 2018). Galway et al. (2021) stand in agreement of the recommendation proposed by Sreedharan & Abdelmalak (2018). The doses given to patients with diabetes typically are enough to cover the anticipated intake as well as any hyperglycemic event that may occur preoperatively (Galway et al., 2021).

Himes et al. (2020) has formed different recommendation for the insulin dosage in their review. They found that Diabetes Mellitus Type I (DMI) and Diabetes Mellitus Type II (DMII) have different needs for insulin, thus causing them to need different amounts before surgery. The recommendations for DMII are similar to what Galway et al. (2021) and Sreedharan & Abdelmalak (2018) found for their recommendations including 75-80 percent the evening prior to surgery for long and intermediate acting, 50 percent the day of for long and intermediate acting, and the usual regular or short acting insulin the day before but not the morning of surgery.

Overall, the recommendation for the use of long-acting insulin is either a full dose or half dose the night before depending on the history of the patient. In addition, the recommendation for the use of intermediate acting insulin had a recommendation of holding if blood glucose is less than 120 milligrams per deciliter the day of surgery (Himes et al., 2020). Insulin doses for

those with DMI were found to be the normal doses for long acting both the night before and the day of surgery, while intermediate acting and short acting were the night before. The intermediate would then be cut back to 50% and the short acting would be skipped the day of surgery (Himes et al., 2020). The history of the patient also plays a factor, with those who have a history of hypoglycemia taking a 50 percent dose both night before and day of for long acting and the intermediate acting being lowered to 70-80 percent the night before (Himes et al., 2020).

Insulin administered via infusion pump must be adjusted differently by the provider.

Himes et al. (2020) found that for DMI and DMII, glycemic control via infusion could be managed as usual with the omission of the short acting agent on the morning of surgery (Himes et al. 2020). Sreedharan & Abdelmalak (2018) found that the only change considered would include decreasing the dose as needed the day of surgery; but that the best way is to consult an endocrinologist in the weeks prior to the surgery.

The current insulin recommendations are important for the perioperative nurse to know because it allows them to better collaborate with the patient and provider for insulin administration preoperatively. Knowing the recommendations will allow the perioperative nurse to better understand what the patient will have to follow prior to surgery in terms of their insulin usage. Along with this understanding it will allow them to be able to teach the patient what must be done the days prior to the surgery so the patient gets the correct dose. It will also help the perioperative nurses to ask targeted questions about the insulin to know when the correct dosing wasn't followed prior to the surgery to aid in early identification for those at risk of hypoglycemia.

### ***Oral Noninsulin Antidiabetic Drugs***

Another major factor to help prevent hypoglycemia that has been found is the control of the oral noninsulin antidiabetic drugs that the patient may be taking to help control the blood glucose levels. These antidiabetic drug classes include alpha-glucosidase inhibitors, dipeptidyl peptidase-4 inhibitors, glucagon-like peptide-1 agonists, meglitinide, metformin, sodium-glucose cotransporter-2 inhibitors, sulfonylureas, and thiazolidinediones (Galway et al, 2021, Himes et al., 2020, Hulst et al., 2021). These drugs have been shown to be safe to continue up until the morning of surgery. All save one should not be taken the morning of surgery due to the heightened chance of hypoglycemic events happening (Galway et al, 2021, Himes et al., 2020, Hulst et al., 2021). The only one that has been found to be safe to be taken the morning of is dipeptidyl peptidase-4 inhibitors due to the low risk for causing hypoglycemia (Himes et al., 2020). Himes et al. (2020) even found that metformin, which was previously found to be contraindicated may be safe to take the morning of as long as there are no renal insufficiency or intravenous contrast use concern. The sodium-glucose cotransporter-2 inhibitors are the only drugs that have been found that should be held for multiple days (3-4) prior to surgery depending on the specific drug due to high risk of diabetic ketoacidosis (Galway et al., 2021, Himes et al., 2020). Hulst et al. (2021) proposed that long-acting glucagon-like peptide-1 agonists may be safe to take prior to surgery. These medications require once a week doses that would need approximately 2 weeks to be successfully stopped (Hulst et al., 2021). Through their research Hulst et al. (2021) found that there is limited scientific studies out on these, but that early indication is that they are safe to be continued as they do not cause hypoglycemia. What both Himes et al. (2020) and Hulst et al. (2021) agree upon was the fact that the medication can be restarted after surgery. As with insulin dosing, knowing these recommendations about

antidiabetic drugs and which one are safe prior to surgery will allow the perioperative nurses to be able to better collaborate with the patient and provider for oral noninsulin antidiabetic drug administration preoperatively.

### ***Multidisciplinary Approach***

There are many authors that talk about how there should be a multidisciplinary approach to preoperative care of the diabetic patient (Galway et al., 2021, Halperin et al., 2022, Page et al., 2020). Halperin et al. (2022) found that clinical specialists may be a difficult to find for integration into that multidisciplinary team. Page et al. (2020) described a diabetes perioperative passport designed to include both the patient and professionals in getting the best experience out of the perioperative setting. This also included a diabetes perioperative nurse specialist that was the liaison for the patient and doctors on subjects like medication changes. Perioperative nurse champions were also found in the surgical areas to help incorporate the information gathered by the nurse specialist. Page et al (2020) used 351 patients (185 in the baseline group and 166 in the intervention group) to test whether these interventions would help patients with diabetes mellitus. They found that several outcomes were significantly impacted including the number of recurrent hypoglycemic events (7.0 percent vs. 0.6 percent) and the average number of hyperglycemic events (3.0 vs 1.7). In addition, they found that the average hemoglobin A1C decreased from 9.8 percent to 7.8 percent (Page et al., 2020). This shows that this pathway may be a viable option to help in the perioperative setting. In this instance the perioperative nurses are a valuable asset to the interdisciplinary team approach. The perioperative nurse at the point of care can advocate for best practice utilizing their knowledge of preoperative hypoglycemia risk factors.

### *Discussion*

There are many areas within the diabetic patient's environment that can be addressed to help prevent hypoglycemia in the perioperative environment (specifically the preoperative environment). Halperin et al. (2022) and Himes et al. (2020) were the only two to discuss the topic of earlier surgical times in persons with diabetes mellitus and differed in their opinions. While Himes et al. (2020) was in favor of this, they also had no evidence to support the statement that the surgical time should be earlier. Conversely Halperin et al. (2022) found that there wasn't much evidence available to support earlier times for surgery, but there was evidence saying that carbohydrate loading was safe to do up to two hours prior to the procedure. Other ways that were found to help prevent hypoglycemia include controlling insulin correctly. This is challenging with two competing recommendations, and it is not in the control of the perioperative nurse without prescriptive authority. For instance, Galway et al. (2021) and Sreedharan & Abdelmalak (2018) suggested having all diabetic patient adjust insulin dosing similarly. On the other hand, Himes et al. (2020) found that recommendations should differ for those with DM1 or DM2. In the end, knowledge about the effects of different interventions is important for the nurse to know so that they can function as an integral part of the team. There was agreement that interdisciplinary teams are important in the preoperative care of diabetes (Galway et al., 2021, Halperin et al., 2022, Page et al., 2020). Halperin et al. (2022) reviewed the challenges of creating an interdisciplinary team, whereas Page et al. (2020) highlighted strategies to create a team to bridge the gap between the interdisciplinary team and the patient. They found that the method they implemented helped patients to lower hemoglobin A1c levels, limit recurrent hypoglycemia, and decrease the overall amount of hyperglycemia.

When looking at all the evidence, one strength that was found included 5 out of the six articles were review articles of level I evidence (Galway et al., 2021, Halperin et al., 2022, Himes et al., 2020, Hulst et al., 2021, Sreedharan & Abdelmalak, 2018). Limitations included insufficient detail to the methodology and depth of previous research (Galway et al., 2021, Himes et al., 2020, Hulst et al., 2021, Sreedharan & Abdelmalak, 2018). When evaluating the study by Page et al. (2020) a limitation was that it was a quasi-experimental study (level III evidence) with a small number of participants at only 351. Overall, inclusion and exclusion criteria limited the identification of pertinent studies for review of the literature. Future opportunities for research include replication of studies exploring surgery timing, carbohydrate loading, and the use of interdisciplinary teams. The implementation of interdisciplinary teams with the perioperative nurses as an integral member is especially important. Despite limited research, this may be a reliable approach to address hypoglycemia in the peri-operative setting (Page et al., 2020).

### ***Current and Future Quality Improvement Projects***

This literature review is foundational to the development of the educational intervention to improve the early recognition and treatment of hypoglycemia in the perioperative setting. Important elements of this intervention include preoperative instructions for the patient with diabetes as well as causative factors for hypoglycemia that may impact readiness for surgery. This leads into what is currently being formulated in that it informs the educational piece on what perioperative nurses need to know. It also set up future research looking at nurses' involvement in interdisciplinary teams.



**Rationale**

The SSU has cared for three cases of hypoglycemia inside of the last month that needed an intervention (Anonymous, personal correspondence, April 11, 2022). This indicated the need of an intervention focused on continuing education for the nurses on the early recognition and treatment of hypoglycemia. This will support the nurses to better recognize patients that have hypoglycemia and are at a need for an intervention. It will also refresh their knowledge of what the protocol is, so that they can rapidly implement said protocol, if needed. Therefore, the Plan-Do-Study-Act (PDSA) model (Institute for Healthcare Improvement, 2022) was used to devise a quality improvement project that focused on the best course of action for the intended outcome, implement that action, then study the data that was gathered. Breaking down the PDSA model, the *Plan* phase encompassed the development of the proposal. This proposal addressed the available knowledge on the causes and potential treatment of hypoglycemia and identified an educational intervention to support the perioperative nurse's knowledge and confidence. The *Do* phase included a plan to survey the nurses about their knowledge and confidence, provide an educational component and resurvey to study the improvement. The *Study* compared the pre- and post-tests extrapolating whether the SSU staff knowledge and confidence level changed after the education, trends that may have appeared, and any unintended outcomes that may have been noticed. The *Act* phase is the final portion where the key findings were discussed, a decision made on whether it worked, implications for change in practice, future directions of other PDSA cycles that could be implemented and for future research that needs to be completed.

**Specific Aims**

The focus of this quality improvement project was to implement strategies to help prevent hypoglycemic events in the preoperative setting. This will help decrease the need for

interventions in the SSU and complications postoperatively in the diabetic patient population. The specific goal is to increase the knowledge and confidence of the SSU nurses in recognition and intervention of hypoglycemic patients by 50 percent by June 30<sup>th</sup>, 2022. This was to be achieved by re-educating the SSU staff on the importance of recognizing the signs and symptoms early, so that there is no delay in the patient care, while also helping the staff feel confident in being able to follow the protocol if intervention is necessary. The goal is aimed at increasing the confidence level in the ability of the nurses to recognize hypoglycemia in patients. This will help by allowing them to recognize the condition and intervene quicker, if necessary. It will also increase their knowledge of what the protocol is concerning hypoglycemia and the intervention in the SSU allowing for decreased time searching for how to intervene. It is expected that having an increased knowledge and confidence level regarding hypoglycemia and the policy on intervention, the nurses will be able to prevent any delays in care.

## **Methods**

### **Context**

The Short Stay Unit (SSU) of Cheshire Medical Center is a nine-bay unit that prepares the patients for the surgical procedure about to be performed. These patients then get transferred into one of five operating rooms (OR). Over the last year the SSU has seen 4100 patients that have needed surgery including urology, podiatry, obstetrics and gynecology, cardiology, orthopedics, ear, nose and throat, cataracts, and general surgical needs. Of these 4100 patients most are outpatient surgeries, and the patient arrives for surgery the same day rather than as an inpatient. The hours of operation are from six in the morning to six at night Monday thru Friday, after which the OR staff uses the space to prepare the patients. Within the that time frame there are seven full time nurses (RN), three per diem RNs, a RN supervisor, one licensed nurse

assistant (LNA), one hospital unit clerk (HUC), and one SSU manager that care directly for the patient in the unit. Care of the patients is for approximately 90 minutes depending on the time the surgical procedure is scheduled and the timing of the other scheduled surgeries. During this time the RN completes a head-to-toe assessment which includes asking the patient to report when the last time they ate and drank anything, a fall risk assessment, a skin assessment, pain assessment, and an assessment of the mental status. The RNs then transition into a medication reconciliation with the patient to determine the last time medications were taken. Fluid management (lactated ringers), antibiotic(s), and any ordered medication will be administered after the assessment is complete. Due to the decreased length of time spent with the patients, the cost to the hospital is high due to cancellations or delays, when caused by treating hypoglycemia. When these delays occur, other surgeries could be cancelled or postponed to later in the day. Delays to perioperative care as a result of hypoglycemic episodes in the SSU, translate into changes in workflow for all involved including a need for overtime compensation. Prioritization of surgeon evaluation in the perioperative setting causes delays in on-time routine office visits later in the day. In contrast, the benefit of an intervention, better educating employees on how to recognize hypoglycemia in patients and the correct intervention strategy, could avoid these delays. It could also help prevent the previous costs by intervening early so the patient can go to surgery on time. Of course, these changes would come at a cost in the form of needing to re-educate staff on how to recognize hypoglycemia and intervene correctly, but this is offset by using their monthly training to do this. The benefit to this would be that the hypoglycemic state in the patients would be noticed early, leading to an intervention that could be completed early preventing delays.

**Intervention(s)**

The proposed intervention was to educate the interprofessional staff providing care regarding the hypoglycemia protocol guidelines. This was accomplished by administering a pre-test to assess baseline knowledge and providing a presentation with a handout about the facility protocol. This reeducation included information about the signs and symptoms of hypoglycemia, the importance of managing hypoglycemia in a timely manner, and how to follow the facility policy correctly. The test consisted of 15 questions regarding these topics and the confidence level in following the protocol. The information for the topics was drawn from a review of the literature and the policy/protocol of the hospital. The pre-test was given one week before and a post-test was given one week following the presentation to study the impact of the intervention. To do this, *Qualtrics*<sup>TM</sup> was used as the platform on which the pre- and post-test was created and used to synthesize the data to be evaluated. The presentation was delivered at the unit's monthly education meeting, the handout was emailed the same day. The pre-test was to be emailed to the ten SSU RNs, the SSU RN supervisor, and the SSU LNA the week prior to the education and the post-test was to be emailed the week after the education. These professionals were involved because they prepare the patients for surgery thus allowing them to recognize hypoglycemia quicker and more accurately, as well as being able to intervene in a correct and swift manner when there is a hypoglycemic event.

**Study of the Intervention(s)**

The impact of the intervention was studied through a pre- and post-test. The pre- and post-test focused on the staff's knowledge of the policy for hypoglycemia, as well as recognition and intervention within the preoperative timeframe. The pre-test was given one week before and the post-test one week after an educational presentation on the topic, with a handout available to

show the main points. The desired outcome includes an assessment of how well the intervention did in teaching the main points regarding hypoglycemia and how it relates to the signs and symptoms., in addition, a desired outcome included an assesement of early recognition and intervention for a hypoglycemic event in the preoperative setting per facility protocol.

### **Measures**

The measure chosen for studying the process and outcomes of the intervention are a pre- and post-test survey, to understand if the educational presentation influenced the knowledge and confidence of those it was geared towards. The survey included five questions related to various sign and symptoms, including early, severe, and asymptomatic hypoglycemia. It also included eight questions related to the treatment of hypoglycemia per facility protocol. It concluded with two questions rating the confidence level of the professionals in their ability to both recognize hypoglycemia and intervene in situation where the patient has the condition. The operational definition for hypoglycemia is a blood glucose monitor level less than 70 mg/dL (A.K. Copeland personal correspondence, February 18, 2022). The pre- and post-test was created by the project lead and no psychometric testing that was conducted. The approach used to assess the contextual elements within the study was to first to ask the SSU staff's perception regarding a need to review the signs and symptoms of hypoglycemia as well as the hypoglycemia protocol. Other data collected included changes to staffing, implementation of the protocol, and other elements. *Qualtrics*<sup>TM</sup> was used to create the survey with an electric link, QR code, and paper survey document creation opportunities to collect the data.

### **Analysis**

Changes to descriptive statistical analysis will be performed for categorical and continuous data. Frequency and percentage will be noted for the test items for knowledge of

hypoglycemia and the treatment per facility protocol. The Likert style items for assessing confidence will be analyzed descriptively with mean, standard deviation, and range noted. The means of the pretest will be compared to the means of the post-test for further analysis. To determine these changes, a frequency table was used that showed the changes in the data for the test and each individual question. A bar graph was used to visualize the continuous type of data for both the pre- and post-test to see how if there was improvement, again, for the test and each individual question.

### **Ethical Considerations**

Upon analyzation of the ethical considerations, the pre- and post-test was the first to be considered. To prevent an unethical situation the participants were educated on what the test will entailed and what it was gathering for information, after which the participant was asked, prior to starting, whether they consented to the test. Within the education on what the test was and what it was for, there was a section explicitly saying that the response would remain confidential and anonymous. This allowed for the partakers to give informed consent to participating in the testing without fear of their answers being associated to them. Finally, this proposal was submitted to and reviewed by the UNH Department of Nursing Quality Review Committee. This allowed the proposal to be judged on whether it meets the criteria for a quality improvement project, and if so, it will be exempt from IRB approval.

## **Results**

### **Results**

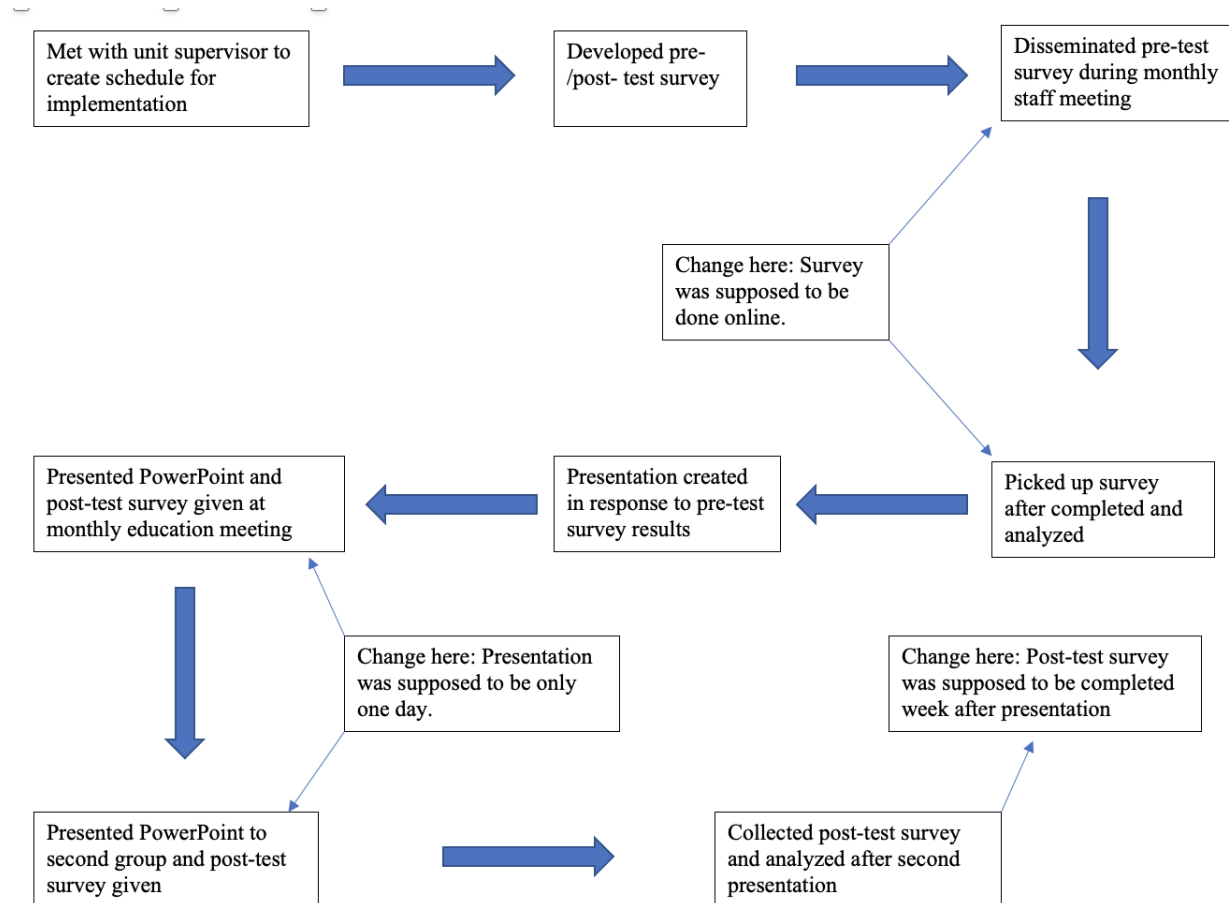
#### ***Evolution of the Intervention***

Over the course of the project, 10 nurses completed both the pre- and post- test survey as well as attended the educational presentation. The course of the intervention stayed primarily

within the confines described previously. There were a few changes that had to be made with how the intervention was planned (Figure 1).

**Figure 1**

*Evolution of the Intervention*



The changes to the original plan were made for many reasons including increasing participation and changes in schedules. These changes included moving the pre/post survey from an online platform to a paper survey. The pre/post survey was changed because the unit supervisor stated that people don't check their email and would be more able to respond to a paper survey. The presentation was changed from one day to two days to reach the most nurses on the unit allowing all nurses who took the pre-test survey to take the post-test survey. Finally,

the post-test survey changed to being given after the presentation and picked up the following day to accommodate changes in schedules.

### ***Process Measures and Outcomes***

After the first meeting with the clinical site, it was determined that giving the pre-test survey and the informed consent the week prior to the presentation in paper form would have the best result of gaining participation from the nurses (Appendix A and B). The pre- and post-test survey included five questions on the knowledge of mild, severe, and asymptomatic hypoglycemia, eight questions on the facility protocol on hypoglycemia treatment, and two questions focusing on confidence level of the nurses in the recognition of and intervention for hypoglycemia. This informed consent and pre-test survey were presented to the nurses during their monthly staff meeting the week prior to the presentation and picked up at the end of that week. This allowed for any questions from the nurses to be answered as well as allow the maximum number of nurses to be able to finish the pre-test survey. After collection of the pre-test surveys, the results were analyzed, and a presentation was produced to inform the staff about hypoglycemia and the protocols that are in place within the hospital. This presentation was given to the staff on two different days, one on the unit's monthly education day and the other being the day after for any nurse who was not able to attend the first presentation. This allowed for the greatest number of nurses to be able to attend the presentation. The post-test surveys were then distributed after the presentation and collected after the second day of presentations allowing all nurses who attended to be able to answer it without affecting their work. The full results were then analyzed to see what trends appeared in the data.



### *Contextual elements*

Throughout this intervention the biggest contextual element noted was stakeholder buy in. A few reasons for this included the project being developed in collaboration with the stakeholders with their input. This facilitated a sense of ownership within the nurses in response to the project. An additional facilitating factor was in the rapport that had been developed with the nurses on the unit. This further facilitated a sense of ownership and a desire for success in the intervention and project. The final reason that stakeholder buy in was present was because the intervention was completed during times that had previously been set aside for work related activities. These included a monthly staff meeting and monthly education day. This meant that they didn't have to take more time out of their schedule increasing involvement. Another contextual element that was evident was the time associated with the surveys because the nurses have patients approximately every 90 minutes that they must care for. This could have affected the amount of both pre- and post- surveys that were completed. Finally, participation could have been impacted by the summer vacation schedule increasing the nurses' responsibilities for patient care.

### *Observed Associations*

After the pre-test survey, the results showed the participants scores factored out to be 70 percent correct overall. Examining this further, the participants correctly scored 72 percent correct on the first section identifying correctly early mild symptoms (80%), manifestations in long term diabetes mellitus (90%), and prevalence (80%). They showed deficiencies in knowledge in the areas of identification of severe and asymptomatic hypoglycemia with scores of 40 and 70 percent respectively. Within the second section, which pertained to the facility protocols, the participants scores equaled 69 percent correct. The participants scored well within

the topics of medications (90%), IV bolus for treatment (80%), testing (100%), blood glucose level (100%), and rechecking the blood glucose (90%). There was a knowledge gap in infusion rate (50%), intervention for persistent hypoglycemia (30%), and when to notify the provider (10%). Individual questions and overall scores can be viewed within Table 1 which include the number of correct/incorrect answers and the percentages.

| Questions   | # Correct | % Correct | # Incorrect | % Incorrect |
|---|-----------|-----------|-------------|-------------|
| 1) Early/mild symptoms associated with hypoglycemia include:  | 8         | 80%       | 2           | 20%         |
| 2) Severe symptoms associated with hypoglycemia include:  | 4         | 40%       | 6           | 60%         |
| 3) The phenomenon of Asymptomatic hypoglycemia is?  | 7         | 70%       | 3           | 30%         |
| 4) Hypoglycemia in long term diabetic patients manifests as:  | 9         | 90%       | 1           | 10%         |
| 5) There is an increased prevalence of hypoglycemia in patients with Diabetes Mellitus Type 2 who are managed with: | 8         | 80%       | 2           | 20%         |
| 6) What method should be used to measure blood glucose levels with suspected hypoglycemia?                          | 10        | 100%      | 0           | 0%          |
| 7) What blood glucose level constitutes hypoglycemia?   | 10        | 100%      | 0           | 0%          |
| 8) What medication is given as a first line treatment for hypoglycemia?   | 9         | 90%       | 1           | 10%         |
| 9) What is the initial D10W bolus dose?   | 8         | 80%       | 2           | 20%         |
| 10) What is the initial infusion rate of D10W?  | 5         | 50%       | 5           | 50%         |
| 11) After how many minutes should you recheck blood glucose level after the infusion is complete?                   | 9         | 90%       | 1           | 10%         |
| 12) What should you do if blood glucose level does not improve after the first 15-minute check?                     | 3         | 30%       | 7           | 70%         |
| 13) At which steps of the hypoglycemia protocol should you notify the provider if there is no patient improvement?  | 1         | 10%       | 9           | 90%         |
| Knowledge of Early Identification of Hypoglycemia   | 36        | 72%       | 14          | 28%         |
| Knowledge of the Facility Protocol  | 55        | 69%       | 25          | 31%         |
| Overall Outcomes  | 91        | 70%       | 39          | 30%         |

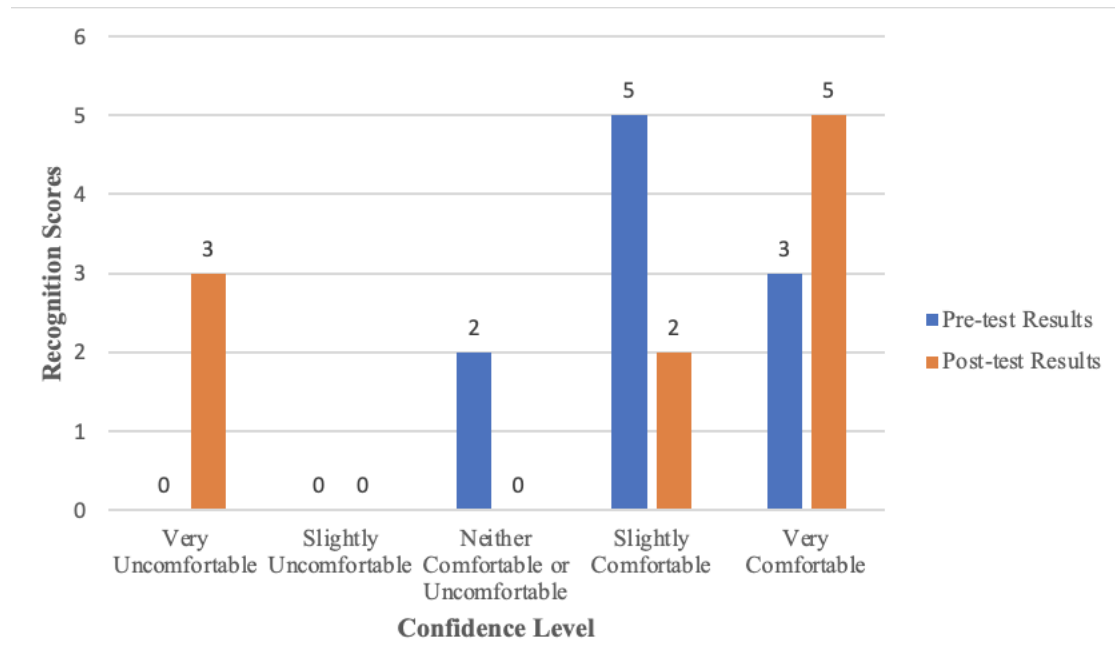
After the presentation on hypoglycemia, the results of the post-test survey showed the participants scores increased to 85.4 percent correct overall. A closer look indicated that the participants correctly scored 82 percent correct on the first section regarding early recognition of hypoglycemia. It was identified that scores for three content areas increased including early/mild symptoms (100%), manifestations in long term diabetes mellitus (100%), and prevalence (90%). It was shown that deficiencies in knowledge of severe symptoms showed minimal improvement with 50 percent now correct, an increase of 10 percent. However, the asymptomatic hypoglycemia question did not improve and stayed at 70 percent correct. The second section for knowledge of the facility protocol showed that the participant scores increase to 88 percent overall. The topics of medication, testing, and blood glucose level all remaining relatively unchanged. The participant correctly chose the correct D10W bolus dose and the time to recheck the blood glucose level at 100 percent. The knowledge of the infusion rate greatly improved from 50 to 100 percent correct. Intervention for persistent hypoglycemia (70%), and when to notify the provider (40%) both increased but there was still a knowledge gap present. Individual questions and overall scores for the post-test can be viewed within Table 2.

**Table 2**  
*Post-test Survey Results*

| Questions   | # Correct | % Correct | # Incorrect | % Incorrect |
|---|-----------|-----------|-------------|-------------|
| 1) Early/mild symptoms associated with hypoglycemia include:  | 10        | 100%      | 0           | 0%          |
| 2) Severe symptoms associated with hypoglycemia include:  | 5         | 50%       | 5           | 50%         |
| 3) The phenomenon of Asymptomatic hypoglycemia is?  | 7         | 70%       | 3           | 30%         |
| 4) Hypoglycemia in long term diabetic patients manifests as:  | 10        | 100%      | 0           | 0%          |
| 5) There is an increased prevalence of hypoglycemia in patients with Diabetes Mellitus Type 2 who are managed with: | 9         | 90%       | 1           | 10%         |

|  |     |      |    |     |
|--|-----|------|----|-----|
| 6) What method should be used to measure blood glucose levels with suspected hypoglycemia?                         | 10  | 100% | 0  | 0%  |
| 7) What blood glucose level constitutes hypoglycemia?  | 10  | 100% | 0  | 0%  |
| 8) What medication is given as a first line treatment for hypoglycemia?  | 9   | 90%  | 1  | 10% |
| 9) What is the initial D10W bolus dose?  | 10  | 100% | 0  | 0%  |
| 10) What is the initial infusion rate of D10W?   | 10  | 100% | 0  | 0%  |
| 11) After how many minutes should you recheck blood glucose level after the infusion is complete?                  | 10  | 100% | 0  | 0%  |
| 12) What should you do if blood glucose level does not improve after the first 15-minute check?                    | 7   | 70%  | 3  | 30% |
| 13) At which steps of the hypoglycemia protocol should you notify the provider if there is no patient improvement? | 4   | 40%  | 6  | 60% |
| Knowledge of Early Identification of Hypoglycemia  | 41  | 82%  | 9  | 18% |
| Knowledge of the Facility Protocol   | 70  | 88%  | 10 | 12% |
| Overall Outcomes   | 111 | 85 % | 19 | 15% |

When examining how confident the participants were in *being able to recognize someone who is suffering and/or at risk for from hypoglycemia*, results showed that 80% (8/10) of the participants were confident and 20% (2/10) were neutral. A deeper evaluation of the results showed that 62.5% (5/8) of the confident group were slightly confident and the other 37.5% (3/8) were very confident. The mean for perception of confidence level in recognition of hypoglycemia prior to the intervention was 4.1 ( $SD=0.74$ , Range 1-5). After the presentation, the results showed that 70% (7/10) of the participants were confident and 30% (3/10) were unconfident in recognition of hypoglycemia. Upon closer inspection of the data 28.57% (2/7) of the confident group were slightly confident and the other 71.43% (5/7) were very confident. 100% (3/3) of the other participants said they were very unconfident in the recognition after the presentation (Figure 2). The mean for perception of confidence level in recognition of hypoglycemia after the presentation was 3.6 ( $SD=1.43$ , Range 1-5).

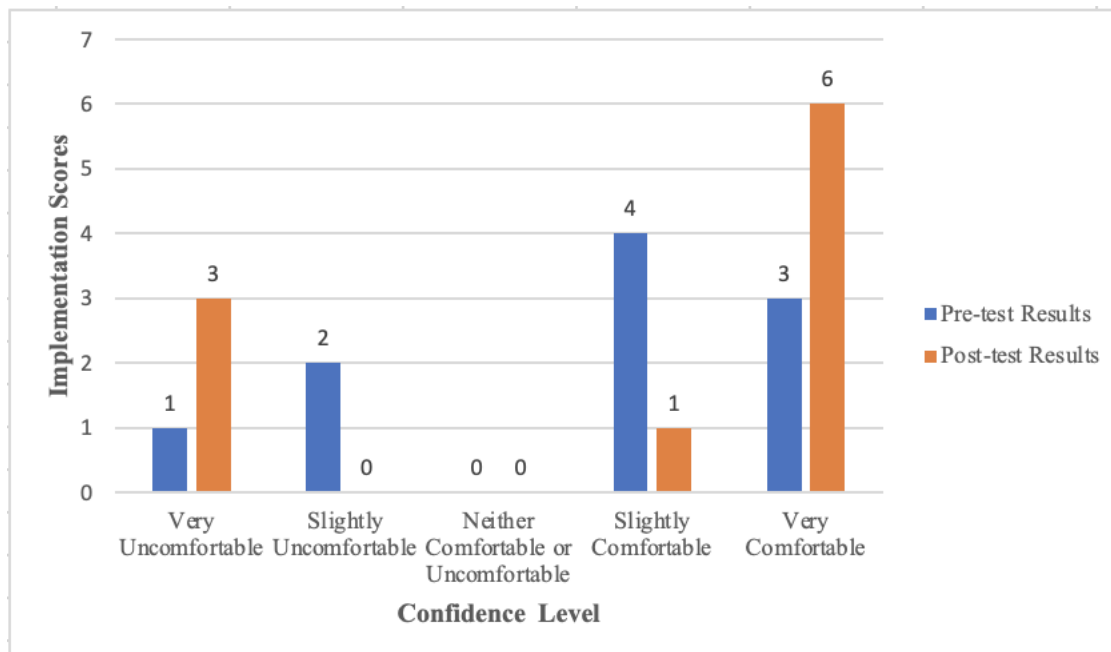
**Figure 2***Level of Confidence in the Recognition of Hypoglycemia*

Examining the confidence level of *implementing and following the hypoglycemia protocol for a patient suffering from hypoglycemia*, results indicated that 70% (7/10) of the participants were confident and 30% (3/10) were unconfident. Upon closer inspection 57.14% (4/7) of the confident group were slightly confident and the other 42.86% (3/7) were very confident. On the other side of the scale 66.7% (2/3) of the participants said they were unconfident and 33.3% (1/3) said they were very unconfident in the implementation. The mean for perception of confidence level in implementation of the hypoglycemia protocol prior to the presentation was 3.6 ( $SD=1.84$ , Range 1-5). After the presentation the results revealed that 70% (7/10) of the participants were confident and 30% (3/10) were unconfident in implementing the protocol. When examining this closer the data indicated that 14.29% (1/7) of the confident group were slightly confident and the other 85.71% (6/7) were very confident. 100% (3/3) of the other participants said they were very unconfident in the implementation (Figure 3). The mean

for perception of confidence level in implementation of the hypoglycemia protocol after the presentation was 3.7 ( $SD=1.89$ , Range 1-5).

**Figure 3**

*Level of Confidence in the Implementation of Hypoglycemia Protocols*



*Unintended Consequences*

There were very few unintended consequences associated with this intervention, with one of the major unexpected benefits being the high stakeholder buy in. This allowed the intervention to move along smoothly without encountering setbacks. There were no unintended failures associated with the intervention due to the previously stated high stakeholder buy in. One unintended problem that appeared with this intervention was time. Due to a shortening of the amount of time available to implement the intervention and collect results, as well as a change in schedule for both the staff and project lead, time became a factor that was not accounted for. The timing ultimately was worked out, and everything was completed in a timely manner very close to how it had been previously described. There were no unintended costs

associated with the intervention. An unintended result found was that the participants confidence level in the recognition of the signs and symptoms associated with hypoglycemia decreased from a mean of 4.1 to a mean of 3.6. This could have been a result of the participants realizing that they didn't remember as much as they thought they did, and the intervention showed them this.

### **Missing Data**

During this intervention all nurses who had participated in the pre-test survey were able to participate in the intervention and ultimately complete the post-test survey (10/10). As a result of this happening, as well as the nurses having the time to fill the surveys out and complete every question that was asked. This meant that there was no missing data found in the analyzation of the results that needed to be reported.

## **Discussion**

### **Summary**

#### ***Key Findings: Nurse Knowledge***

After analyzing the results, many findings important to the quality improvement project were discovered. The important findings started with the scores on the pre-test survey being higher than expected at 9.1 out of 13 or 70 percent correct. This left a smaller margin for increase within the participants, which was part of the specific aim for the project. The overall post-test score did improve to 11.6 out of 13 or 85.4 percent but insufficient to meet the goal of a 50 percent increase in knowledge. An increase was noted in nine of the first thirteen questions comparing the pre-intervention and post-intervention test results showing an increased knowledge in recognition of hypoglycemia and the facility protocol. The exceptions were noted for the questions focused on severe and asymptomatic hypoglycemia as well as methods of detection, blood glucose levels and medications for first line treatment. The questions pertaining

to methods of detection and blood glucose levels were scored correctly by all participants for both the pre- and post-test. There was no change in overall scores for questions focusing on asymptomatic hypoglycemia and medications as first line treatment. Overall improvements in knowledge were noted for most content. For example, when reviewing the overall knowledge scores, they improved from 70 to 85 percent. This is evident within the section on signs and symptoms where it increased from 72 percent to 82 percent. An increase was also noted in the knowledge of the facility protocol where the scores increased from 69 percent to 88 percent. This showed that there was a greater understanding of how hypoglycemia presented along with the protocols that needed to be followed. While the overall knowledge scores did increase one individual question score did not increase which was the one pertaining to asymptomatic hypoglycemia. Finally, there were some areas that would be identified as problem areas and this included recognition of severe hypoglycemia, when to notify the provider and what to do if blood glucose levels don't increase within 15 minutes.

#### ***Key Findings: Nurse Confidence***

The other important findings were in regard to nurse confidence. The first question explored the perceived confidence in the recognition of hypoglycemia. The results showed that prior to the presentation the participant felt confident in being able to recognize someone suffering from hypoglycemia. Their confidence decreased from a mean of 4.1 to a mean of 3.6, likely due to highlighted knowledge gaps. The final question addressed the confidence level in the implementation of the facility protocol, overall, the results stay the same pre-test to post-test at seven out of ten people being confident with a mean score of 3.6 prior to the intervention and a mean score of 3.7 after the intervention.



Overall, the key findings include an increase in the participants knowledge although it was by 22 percent. Comparing this to the benchmark of an increase of knowledge by 50 percent the specific aim of this project was not met. However, knowledge for early recognition (questions 1-5) improved by 14 percent while knowledge for the facility protocol (questions 6-13) increased by 28 percent, thus showing a noticeable improvement. Additionally, while confidence in the facility protocol remained relatively unchanged, confidence in the ability to recognize someone with the signs and symptoms of hypoglycemia was reduced. While the results show that the specific aim was not met there were some highlights that were found. This included the knowledge about the infusion rate of the D10W greatly improving from 50 percent to 100 percent correct. Also the knowledge of the facility protocol rose more than the early recognition of hypoglycemia from 69 percent to 88 percent compared to an increase to 82 percent from 72 percent.

### ***Particular Strengths of the Project***

One strength of this project was that it was the project was very feasible. As a result, the project remained on track with the dates that had to be met. Another strength is that this project had major stakeholder buy in from the nurses on the unit. This allowed the amount of data that needed to be collected to be reached with support from the nurses on the unit because they wanted to see the results for themselves. The next strength, similar to the first, was that the statistical analysis was simpler allowing for more time to analyze the data as well as not contaminating the results with unnecessary analyses. Additionally, the length of the surveys was a strength because they were short, avoiding response fatigue and limiting survey burden. The final strength for this project was the meticulous preparation and planning leading up to the intervention that also allowed it to go as effortlessly as it did. Overall, the strengths of this

project were those that allowed it to run smoothly with the ability to gather and analyze the data efficiently.

## **Interpretation**

### *Association Between the Intervention and the Outcomes*

The nurse's knowledge increased after the quality improvement intervention was implemented. This was not enough to meet the goal within the specific aim which was that the nurses were able to raise their knowledge by 50 percent between the pre-test and post-test. This included both the knowledge in the signs and symptoms and how hypoglycemia presents, along with the protocol that is in place within the hospital. The rise in the knowledge likely occurred because this was a refresher of their knowledge in both the protocol and presentation of hypoglycemia as opposed to new knowledge. The combination of the educational presentation along with the handout provided demonstrated an effective way to increase the nurse's knowledge who were participating in the intervention.

While the perceived confidence level with the implementation of the hypoglycemic protocol showed no change following the intervention, the perception of the confidence with recognizing symptoms or risk was reduced following the intervention. A decrease in scores of the recognition of hypoglycemia could have been from the participants realizing that they were not as prepared or knowledgeable as they thought they were and that impacted their confidence. This contrasted with the scores from the first five questions which showed an increase in knowledge for early identification of hypoglycemia. Examining the confidence level of the implementation of the protocol by the nurses, the overall perception stayed the same after the intervention as they were before. Again, this contrasted with the scores for the second section of the survey, where the scores increased pre- to post. Overall, these findings show that the nurses

confidence level overall was not affected in a positive manner. When examining the confidence level of the nurses, the presentation may have essentially led to some of the nurses perceiving less confidence. This could be because it indicated perceived lapses in their knowledge that they previously did not identify. The presentation may have also confused some of the nurses, which could also decrease their confidence level related to those topics.

### ***Comparison of the Results***

Having the knowledge score increase was a way of showing that the intervention had a positive effect. No research was able to be located to compare these results to in the time frame. That is not saying there is no research to be found to be able to compare these results to, but there could have been other variables preventing their inclusion, for instance a publish date past the cutoff point or a failure of search criteria. Many studies were found on how individual treatment options could affect and/or prevent a patient with diabetes from becoming hypoglycemic. These include the timing of the surgery, carbohydrate loading, insulin usage, usage of other medication to treat diabetes, and multidisciplinary approaches to diabetes care in the perioperative setting. Matthew et al. (2022) discussed how nursing diagnoses are based on a complete picture of the patient and knowing all the information leads to a comprehensive nursing care plan. While the information from Galway et al. (2021), Halperin et al. (2022), Himes et al. (2020), Hulst et al. (2021) and Sreedharan and Abdelmalak (2018) all fit into this perspective. As noted by Page et al. (2020) the most important consideration is the collaboration within the multidisciplinary team which he described with the implementation of a perioperative passport. The nurse is an integral member of this team as they have the background knowledge to be able to understand what is needed while also having the ability to advocate for what the patient needs from a holistic perspective. Overall, having the perioperative nurse be a part of the

interdisciplinary team for patient centered, quality care can potentially decrease the number of case of hypoglycemia thus decrease the cost related to the hospital.

### ***Impact of the Project***

After implementation of this quality improvement project the data suggested that there wasn't an increase in the confidence level of the nurses. Overall, it may not be worrisome because confidence, countless times, comes from practicing the skills. In this case that means the recognition of hypoglycemia and implementation of the protocol for hypoglycemia. Where the impact of this quality improvement project came from was giving the participating nurses the knowledge needed to be able to perform these skills and answer any questions that they had about the topic. This leads them to a refreshed knowledge base which could ultimately lead to cut down response times for patient who are suffering from a hypoglycemic event. In response to the impact on the systems it stems from the questions that were answered during the intervention including where to find the materials to be able to intervene in the case of a hypoglycemic event. It also includes knowing where to find the protocol quickly so that the nurse can have a quick refresher before implementation of the protocol.

### ***Reasons for any Differences***

There were only a few differences between what was anticipated and what was observed in the data. The most relevant being that it was believed that the education provided as the intervention would help the participating nurses feel more confident in their knowledge to be able to recognize hypoglycemia and intervene according to the policy. This was not the case as the results indicated. This could have been due to a few reasons. These include the time of day that it was presented because it was at 6 in the morning, meaning stake holder buy in and/or

attention could have been waning. It could also be because the presentation was not clear and confused some of the nurses.

An additional difference between expected and observed is the beginning knowledge of the nurses particularly for those with severe or symptomatic hypoglycemia. This could be a potential problem due to the fact that while their knowledge of common presentations and treatment is sound, key areas of knowledge deficit have been uncovered.

### ***Costs and Strategic Trade-offs***

This quality improvement intervention was a relatively low-cost endeavor due to the intervention being an educational piece set on a day where there was supposed to be educational material presented. As this was built into the participants schedule already there was no loss of resources needed to present this education PowerPoint. The only real cost was printing out the handouts that were presented to the participants at the end of the presentation as well as the pre- and post-test along with the informed consent. After implementation of this project, the costs associated with delay in recognition of hypoglycemia and the knowledge of early intervention will be able to be decreased due to the greater knowledge that the participants received from the intervention.

### **Limitations**

#### ***Limits to the Generalizability of the Work***

There are many limitations when it comes to the generalizability of this quality improvement project. The nurses were all within the same microsystem that doesn't encounter hypoglycemic events as frequently as nurses in other units. This could lead to devaluation of the educational component. Due to this the current finding may not be able to be generalized to other microsystems beyond a perioperative environment.

The types of patients seen is another limit on how generalizable this project is. This perioperative environment sees stable, non-critical patients, for the most part. This contrasts with other units or hospitals' perioperative units that may see more critical patients. Therefore, frequency of hypoglycemic events is limited. Despite the limited frequency, continued education in early recognition and treatment is essential.

### ***Factors Limiting Internal Validity***

There were numerous limits affecting the internal validity of the quality improvement project that was completed. The most apparent was that the survey did not undergo psychometric testing or check to see if the survey was valid overall. This means that the survey itself could have skewed the results because the questions were not worded correctly. This limitation was minimized by having two separate individuals associated with the project read over and make corrections to the questions to make sure they would accurately represent the knowledge and confidence of the nurses. While this does not take away the limitation it does lessen its impact. The way the information was presented could also affect the internal validity of the current project because information could be missing, or it could be confused or interpreted wrong by the participants. The presentation was reviewed prior to implementation to make sure all key points were included, helping to lessen this limitation. A script/notes was also created to keep the dialogue presented in a logical manner. Having to enter the data into an excel document was an additional limitation to the analysis of this project. If the information is entered incorrectly this can lead to the results being incorrect and not replicable. Reducing this limitation was difficult but obtainable by triple checking each survey response after it was answered. The final limitation is the amount of time between the presentation and the post-test survey. Having it be too close to the presentation could cause the data to be incorrect due to the

participants just remembering what they were just told. To prevent this, the post-test survey was supposed to be completed one week after the presentation. Due to unforeseen time constraints this could not be completed as planned and thus could not be limited. There was no bias or confounding present within the quality improvement project.

### ***Efforts made to limit and adjust for limitations***

Overall, every effort was completed to minimize the limitations of this quality improvement project. Unfortunately, there were some instances where this was not possible either due to the nature of the project that it was or because of time constraints. Those limitations where improvement could be made, did have improvements. In the end, the limitations were a small part of the overall project and did not affect the outcome.

### **Conclusion**

#### ***Usefulness of work***

It was found that within the preoperative unit, staff nurses had limited exposure to the hypoglycemia protocol in the hospital. Many of the staff nurses said they felt confident, but a few did not. This project was useful to help show that the nurses' knowledge for early recognition and treatment could be supported with an educational component. It also helped them to better gain this knowledge that is needed to be able to help their patients when they have a hypoglycemic event.

#### ***Sustainability***

There are many factors that fit into this remaining sustainable for this unit of nurses, the first goal is to remain current on best practice for patients with hypoglycemia. Being able to provide continued education for hypoglycemia and the facility protocol will allow the knowledge to be ingrained deeper into their memory. This will, over time, start building up their confidence

in being able to know what to do. The second factor is whether the nurses will continue to feel invested and to seek other opportunities for continued education. If they can, then they will be able to learn and keep increasing their knowledge of hypoglycemia and the facility protocols. This same methodology could also be used for other events that are seen infrequently within the microsystem as chosen by the unit staff. The final factor is whether the nursing supervisor and manager find that the training is still useful and provide this education on low frequency, high impact situations on a quarterly, biannual, or annual basis. If all these factors continue, then this quality improvement change can be sustainable and successful.

### ***Potential for Spread to Other Contexts***

The results found in this project could potentially be spread to other units and other patient populations within the hospital. This would allow patients to get better care by the prevention or early recognition and intervention of hypoglycemia. It would help the nurses by being able to refresh and build upon the knowledge that they have. Finally, it would help the macrosystem by potentially decreasing the time it takes to respond to hypoglycemic events thus decreasing those cases that could be severe and having patients recover faster.

### ***Implication for Practice***

This quality improvement study shows that the knowledge of staff nurses can be increased on topics that they don't normally have to engage with, in this case hypoglycemia. The implication is that the supervisors and/or managers need to implement training days or times to be able to turn this education into the knowledge the nurses need. Ultimately, this quality improvement project implies that continued education is essential for continual knowledge gain.



***Implication for Further Quality Improvement Projects***

More work needs to be conducted regarding the impact of interdisciplinary teams for enhanced patient care. Looking at this current quality improvement project of educating the SSU staff on the policy on hypoglycemia and signs and symptoms of hypoglycemia, further quality improvement projects are needed to address those areas still in need of attention such as severe and asymptomatic hypoglycemia and specific protocol elements.

Overall, the data indicates the need for more work into the area of continued education for perioperative nurses for low frequency, high impact situations. Regarding this project, more work should be conducted to address the signs and symptoms of severe hypoglycemia, what asymptomatic hypoglycemia is, when to notify the provider, and how to troubleshoot treatment after the fifteen-minute time limit. What is known though is that more projects need to be completed on other low frequency, high impact situations in the perioperative setting.

***Suggested Next Steps***

The results illustrate that there is a need for a refresher on certain aspects of hypoglycemia such as severe and asymptomatic presentations and certain elements of the protocol. There are many projects that could be worked on based of this PDSA cycle. Adding in drills, within a simulation lab, on how to run through the hypoglycemia protocol to increase confidence and adding in more education days on the topic to increase the knowledge missed. They could also take a different approach and work on a system that puts in a diabetes expert to be a liaison, such as collaborating with the diabetes educator that is on staff for the macrosystem. This would be a person to work between the interdisciplinary team and the patient to see if that would help the patient to better control their blood sugars prior to entering the preoperative setting. The next round of Plan, Do, Study, Act cycles quality could continue to focus on the

education, add in the simulation experience to increase the confidence or investigate and implement an interdisciplinary specialist.

### ***Final Thoughts***

Overall, this project showed that there was a need for implementation of an educational presentation on hypoglycemia for the nurses of the Short Stay Unit (SSU), as well as the need to implement hands on training to increase their confidence. Incidence of hypoglycemia may be increasing within the unit based off the population of patients that they treat. This means that a need to continue educating and advocating for changes within the Short Stay Unit will be of the utmost importance in the years to come. Continuing education and providing simulation for the staff will help them to decrease any delays in the perioperative environment that may come from an occurrence of hypoglycemia in a patient.

## References

- Centers for Disease Control and Prevention. (2022, January 18). *National Diabetes Statistics Report*. Centers for Disease Control and Prevention. Retrieved March 5, 2022, from <https://www.cdc.gov/diabetes/data/statistics-report/index.html>
- Centers for Disease Control and Prevention. (n.d.). *Increasing prevalence of diagnosed diabetes - United States and Puerto Rico, 1995–2010*. Centers for Disease Control and Prevention. Retrieved March 5, 2022, from <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6145a4.htm>
- Chen, P., Hallock, K. K., Mulvey, C. L., Berg, A. S., & Cherian, V. T. (2017). The effect of elevated A1C on immediate postoperative complications: A prospective observational study. *Clinical Diabetes*, *36*(2), 128–132. <https://doi.org/10.2337/cd17-0081>
- Duggan, E., & Chen, Y. (2019). Glycemic management in the operating room: Screening, monitoring, oral hypoglycemics, and insulin therapy. *Current Diabetes Reports*, *19*(11), 134–137. <https://doi.org/10.1007/s11892-019-1277-4>
- Galway, U., Chahar, P., Schmidt, M. T., Araujo-Duran, J. A., Shivakumar, J., Turan, A., & Ruetzler, K. (2021). Perioperative challenges in management of diabetic patients undergoing non-cardiac surgery. *World Journal of Diabetes*, *12*(8), 1255–1266. <https://doi.org/10.4239/wjd.v12.i8.1255>
- Halperin, I., Malcolm, J., Moore, S., Houlden, R. L., Cloutier, E., Gagne, S., Garon-Mailer, A., Gilmour, J., Houlden, R. L., Huffman, M., Halperin, I., Lawton, C., MacDonald, D., Malcolm, J., Mercer, B., Moore, S., Ruzycki, S., Segal, P., Shadowitz, S., ... Tran, C. (2022). Suggested canadian standards for perioperative/periprocedure glycemic

- management in patients with type 1 and type 2 diabetes. *Canadian Journal of Diabetes*, 46(1), 99–107. <https://doi.org/10.1016/j.jcjd.2021.04.009>
- Himes, C. P., Ganesh, R., Wight, E. C., Simha, V., & Liebow, M. (2020). Perioperative evaluation and management of endocrine disorders. *Mayo Clinic Proceedings*, 95(12), 2760–2774. <https://doi.org/10.1016/j.mayocp.2020.05.004>
- Hulst, A. H., Polderman, J. A. W., Siegelaar, S. E., van Raalte, D. H., DeVries, J. H., Preckel, B., & Hermanides, J. (2021). Preoperative considerations of new long-acting glucagon-like peptide-1 receptor agonists in diabetes mellitus. *British Journal of Anaesthesia*, 126(3), 567–571. <https://doi.org/10.1016/j.bja.2020.10.023>
- Institute for Healthcare Improvement. (2022). *Science of improvement: Testing changes: IHI*. Institute for Healthcare Improvement. Retrieved March 26, 2022, from <http://www.ihl.org/resources/Pages/HowtoImprove/ScienceofImprovementTestingChanges.aspx>
- Mathew, P., Thoppil, D., & McClinton, T. (2022). *Statpearls*. StatPearls Publishing.
- Mattingly, A. S., Rose, L., Eddington, H. S., Trickey, A. W., Cullen, M. R., Morris, A. M., & Wren, S. M. (2021). Trends in us surgical procedures and health care system response to policies curtailing elective surgical operations during the covid-19 pandemic. *JAMA Network Open*, 4(12), 1–12. <https://doi.org/10.1001/jamanetworkopen.2021.38038>
- Page, E., Allen, R., Wensley, F., & Rayman, G. (2020). Improving the peri-operative pathway of people with diabetes undergoing elective surgery: The ip3d project. *Diabetic Medicine*, 37(12), 2019–2026. <https://doi.org/10.1111/dme.14307>

Sreedharan, R., & Abdelmalak, B. (2018). Diabetes mellitus preoperative concerns and evaluation. *Anesthesiology Clinics*, 36(4), 581–597.

<https://doi.org/10.1016/j.anclin.2018.07.007>

Wukich, D. K. (2015). Diabetes and its negative impact on outcomes in orthopaedic surgery.

*World Journal of Orthopedics*, 6(3), 331. <https://doi.org/10.5312/wjo.v6.i3.331>

## Appendix A



# University of New Hampshire

## CONSENT FORM FOR PARTICIPATION IN A QUALITY IMPROVEMENT PROJECT

### **PROJECT LEAD AND TITLE OF PROJECT**

My name is Jesse Bardis and I am a graduate nursing student at the University of New Hampshire. My quality improvement project is titled "Increasing the Nursing Staffs Knowledge of the Hypoglycemia Protocols, Along with Comfort in Recognizing Signs and Symptoms of Hypoglycemia, within the Preoperative Unit: A Quality Improvement Project".

### **WHAT IS THE PURPOSE OF THIS FORM?**

This consent form describes the quality improvement project and helps you to decide if you want to participate. It provides important information about what you will be asked to do in the project, about the risks and benefits of participating in the project, and about your rights as a participant. You should:

- Read the information in this document carefully, and ask me any questions, particularly if you do not understand something.
- Not agree to participate until all your questions have been answered, or until you are sure that you want to.
- Understand that your participation in this project involves you to answer questions on a test that will last about 15 minutes.
- Understand that the potential risks of participating in this project are anticipated to be minimal but include breach of confidentiality.

### **WHAT IS THE PURPOSE OF THIS PROJECT?**

The purpose of this quality improvement project is to help increase the confidence of the nurse comfortable in recognizing hypoglycemia and the related protocols associated to hypoglycemia to be able to respond, while also making them comfortable with the protocols related to hypoglycemia to be able to respond to a hypoglycemic event with increased efficiency. The anticipated number of participants is approximately 10 nurses.

### **WHAT DOES YOUR PARTICIPATION IN THIS PROJECT INVOLVE?**

You will be asked to fill out both a pre-test before and a post-test after a presentation on the material. The inclusion criteria include being within the profession of nursing (registered nurse) and being on the perioperative unit. The exclusion criteria include being absent for the presentation. The pre-test and post-test will both take approximately 15 minutes to complete each and the presentation is around 45 minutes or less and is scheduled for the education day on the unit.

You should complete the survey twice. The project lead may exclude your data if they determine that you did not meet the eligibility criteria for the project. For questions about eligibility, please contact the project lead (information provided at the end of the form).

**WHAT ARE THE POSSIBLE RISKS OF PARTICIPATING IN THIS PROJECT?**

Your potential risks of participating in this project are anticipated to be minimal but include breach of confidentiality. To mitigate this all surveys will be completed anonymously, and the consent forms will be securely maintained separate from the survey results.

**WHAT ARE THE POSSIBLE BENEFITS OF PARTICIPATING IN THIS PROJECT?**

Your possible benefits of participation within this quality improvement project include a greater knowledge of hypoglycemia, an increased confidence level in recognizing the signs and symptoms of hypoglycemia, an improved knowledge of the protocol associated with hypoglycemia, and an increased confidence level in respond to hypoglycemic events in relation to following the protocol.

**IF YOU CHOOSE TO PARTICIPATE IN THIS PROJECT, WILL IT COST YOU ANYTHING?**

There will be no cost to you.

**WILL YOU RECEIVE ANY COMPENSATION FOR PARTICIPATING IN THIS PROJECT?**

There will be no compensation awarded to you.

**DO YOU HAVE TO TAKE PART IN THIS PROJECT?**

Taking part in this project is completely voluntary. You may choose not to take part at all. If you agree to participate, you may refuse to answer any question. If you decide not to participate, you will not be penalized or lose any benefits for which you would otherwise qualify.

**CAN YOU WITHDRAW FROM THIS PROJECT?**

If you agree to participate in this project and you then change your mind, you may stop participating at any time. Any data collected as part of your participation will remain part of the project records. If you decide to stop participating at any time, you will not be penalized or lose any benefits for which you would otherwise qualify.

**HOW WILL THE CONFIDENTIALITY OF YOUR RECORDS BE PROTECTED?**

I plan to maintain the confidentiality of all data and records associated with your participation in this project.

To help protect the confidentiality of your information, there will be no identifiable information on the surveys. The only people that will have access to this data will be the Project Lead, Jesse Bardis and Pamela Kallmerten PhD, DNP, RN, CNL, Faculty Advisor and I will report the results as an aggregate data set. The results may be used in reports, presentations, and publications.

**WHOM TO CONTACT IF YOU HAVE QUESTIONS ABOUT THIS PROJECT**

If you have any questions pertaining to the research you can contact Jesse Bardis at [jjbardis@wildcats.unh.edu](mailto:jjbardis@wildcats.unh.edu) or Pamela Kallmerten at [pamela.kallmerten@unh.edu](mailto:pamela.kallmerten@unh.edu) to discuss them.

Yes, I, \_\_\_\_\_ consent/agree to participate in this research project.

No, I, \_\_\_\_\_ do not consent/agree to participate in this research project.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



## Appendix B

Questions 1-5 refers to the signs and symptoms of Hypoglycemia

- 1) Early/mild symptoms associated with hypoglycemia include:
  - a) Excessive dryness, elevated temperature, and seizure.
  - b) Tremors, tachycardia, confusion, and anxiety.
  - c) Anxiety, sweating, palpitations, tremors, and pallor.
  - d) All of the above are early/mild symptoms.
  
- 2) Severe symptoms associated with hypoglycemia include:
  - a) dizziness, seizure, blurred vision, delirium, headaches, and coma.
  - b) Weakness, drowsiness, confusion, and anxiety.
  - c) Weakness, sweating, inability to concentrate, and coma.
  - d) All of the above are severe symptoms.
  
- 3) The phenomenon of Asymptomatic hypoglycemia is?
  - a) A non-diabetic patient with a glucose level  $\leq 70$  mg/dL who feels symptoms.
  - b) A diabetic patient with a glucose level  $\leq 70$  mg/dL, who feels no symptoms.
  - c) A non-diabetic patient with a glucose level  $\leq 70$  mg/dL, who feels no symptoms.
  - d) A diabetic patient with a glucose level  $\leq 70$  mg/dL, who feels symptoms.
  
- 4) Hypoglycemia in long term diabetic patients manifests as:
  - a) Symptoms coming on slowly, with enough time for the patient to recognize them.
  - b) Symptoms coming on suddenly and progressing quickly from mild to severe.
  - c) The inability to sense the early symptoms and may develop severe symptoms without any other realization.
  - d) All of the above can happen to patients who have had diabetes over several years.
  
- 5) There is an increased prevalence of hypoglycemia in patients with Diabetes Mellitus Type 2 who are managed with:
  - a) Diet and exercise.
  - b) Insulin, a sulfonylurea, or a meglitinide.
  - c) Metformin, Trulicity, Sitagliptin, or empagliflozin.
  - d) There is no difference in hypoglycemic episode rates among the Diabetes Mellitus Type 2 patients regarding medical management.

## Reference

- Briscoe, V. J., & Davis, S. N. (2006). Hypoglycemia in Type 1 and type 2 diabetes: Physiology, pathophysiology, and management. *Clinical Diabetes*, 24(3), 115–121.  
<https://doi.org/10.2337/diaclin.24.3.115>
- Brutsaert, E. F. (2022, May 23). Hypoglycemia - hormonal and metabolic disorders. Merck Manuals Consumer Version. Retrieved June 10, 2022, from

<https://www.merckmanuals.com/home/hormonal-and-metabolic-disorders/diabetes-mellitus-dm-and-disorders-of-blood-sugar-metabolism/hypoglycemia>

Cryer, P. E. (2021, October 19). Hypoglycemia in adults with diabetes mellitus. UpToDate.

Retrieved June 10, 2022, from <https://www.uptodate.com/contents/hypoglycemia-in-adults-with-diabetes-mellitus#>!

Mathew, P., & Thoppil, D. (2022). Hypoglycemia. StatPearls [Internet].

Questions 6-13 refers to Cheshire Medical Centers Hypoglycemia Protocol for a patient who NPO is and has an IV started

- 6) What method should be used to measure blood glucose levels with suspected hypoglycemia?
  - a) Breathalyzer
  - b) Blood Draw
  - c) FSBS
  - d) All of the above
  
- 7) What blood glucose level constitutes hypoglycemia?
  - a) 80-90 mg/dL
  - b) <70 mg/dL
  - c) 500 mg/dL
  - d) 126 mg/dL
  
- 8) What medication is given as a first line treatment for hypoglycemia?
  - a) D5W
  - b) Normal Saline
  - c) D10W
  - d) Potassium
  
- 9) What is the initial D10W bolus dose?
  - a) 500ml over 15 minutes
  - b) 250ml over 30 minutes
  - c) 125ml over 30 minutes
  - d) 250ml over 15 minutes
  
- 10) What is the initial infusion rate of D10W?
  - a) 999/hr
  - b) 500/min
  - c) 999/min
  - d) 500/hr
  
- 11) After how many minutes should you recheck blood glucose level after the infusion is complete?
  - a) 30 minutes
  - b) 5 minutes
  - c) 20 minutes
  - d) 15 minutes

- 12) What should you do if blood glucose level does not improve after the first 15-minute check?
- a) Notify provider
  - b) Re-administer protocol
  - c) Wait 30 more minutes
  - d) Double check FSBS
- 13) At which steps of the hypoglycemia protocol should you notify the provider if there is no patient improvement?
- a) After obtaining the initial FSBS and following the first bolus
  - b) After obtaining the second FSBS and prior to the second bolus
  - c) After obtaining the second FSBS and prior to the first bolus
  - d) After obtaining the initial FSBS and following the second bolus

### Reference

Ethier, J. (2019, November 26). Hypoglycemia Protocol - Nursing. Keene; Cheshire Medical Center.

- 14) How comfortable are you in being able to recognize someone who is suffering and/or at risk for from hypoglycemia?
- a) Very uncomfortable
  - b) Slightly uncomfortable
  - c) Neither comfortable nor uncomfortable
  - d) Slightly comfortable
  - e) Very comfortable
- 15) How comfortable are you implementing and following the hypoglycemia protocol for a patient suffering from hypoglycemia?
- a) Very uncomfortable
  - b) Slightly uncomfortable
  - c) Neither comfortable nor uncomfortable
  - d) Slightly comfortable
  - e) Very comfortable