Improving Education Provided to Patients on the Interaction of Sugammadex and Hormonal Contraceptives

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Table of Contents

Abstract	3
Background and Significance	5
Purpose	8
Review of Current Evidence	8
Theoretical Framework	13
Translational Framework	15
Project Implementation	18
Data Analysis	21
Results	21
Discussion	22
Conclusion	25
References	26
Appendices	
Appendix A: Data Collection Form	32
Appendix B: Age of Participants	33
Appendix C: Demographic Profile Matrix	34
Appendix D: Statical Analysis	35
Appendix E: Patient Responses	36
Appendix F: Patient Responses that Remembered Education	37

Abstract

Background: Sugammadex is a medication used to rapidly reverse the effects of rocuronium and vecuronium by encapsulating and physiologically inactivating it. Although sugammadex has a high affinity for rocuronium and vecuronium, it can also encapsulate progesterone and estrogen, thereby decreasing the effectiveness of progesterone hormonal contraceptives and increasing the risk of unintended pregnancy. It is recommended that patients on hormonal contraceptives use a non-hormonal birth control backup method for seven days after receiving sugammadex. Approximately 65% of women of reproductive age in the United States are currently using some form of hormonal contraception (CDC, 2020). The percentage of ambulatory surgical cases specifically performed on women also increased by 1.1% between the years 2000 and 2014 (CDC, 202). This increase in the utilization of sugammadex and increase in female surgical cases suggests that the number of patients affected by this medication interaction will likely continue to increase. Patients on hormonal contraceptives who receive sugammadex perioperatively are provided education on this interaction, however, this education is routinely provided postoperatively, following the administration of anesthesia. Following anesthesia, a patient's memory may be impaired, and they may not remember the instructions provided. Providing patient education preoperatively improves patient recall. **Purpose:** The purpose of this quality improvement project was to improve patient recall of provided education on the interaction of sugammadex and hormonal contraceptives by having anesthesia providers provide this education prior to the administration of anesthetic medications. **Methods:** Patients using hormonal contraceptives that were anticipated to receive sugammadex perioperatively were provided patient education by an anesthesia provider preoperatively in addition to routine postoperative instructions provided by the nursing staff. Patients on hormonal contraceptives that received

sugammadex were contacted postoperatively by phone to assess their recall of provided education. **Results:** Thirty-three percent of patients receiving postoperative instructions only on the interaction of sugammadex and hormonal contraceptives were able to recall receiving that education. In patients also provided this education preoperatively, 23% were able to recall receiving that education. **Recommendations and Conclusion:** Patient education provided preoperatively by the anesthesia provider did not improve patient recall of receiving this education. Further study is recommended to determine the best method(s) of educating patients on the implications of the interaction between sugammadex and hormonal contraceptives.

Key Words: sugammadex, preoperative teaching, hormonal contraceptives

Background and Significance

Sugammadex is a medication used to rapidly reverse the effects of rocuronium and vecuronium by encapsulating and physiologically inactivating it (Nguyen-Lee et al., 2018). Sugammadex is routinely administered in anesthesia practice to reverse the effects of muscle relaxants in surgical procedures requiring muscle relaxation. Sugammadex forms a 1:1 complex with these nondepolarizing neuromuscular blocking agents and is the most predictable and safest reversal agent available (Nguyen-Lee et al., 2018). Sugammadex has fewer adverse effects than other clinically available reversal medications and decreases the incidence of postoperative residual paralysis (Nguyen-Lee et al., 2018). Sugammadex facilitates shorter recovery times and decreases the incidence of residual neuromuscular blockade. Togioka et al. (2020) reported a decrease in postoperative residual neuromuscular blockade of 89% with the administration of sugammadex. Blobner et al. (2010) report a decrease in time until full reversal of neuromuscular blockade from 19 minutes to 1.5 minutes with the use of sugammadex instead of neostigmine.

Prior to the availability of sugammadex for reversal of neuromuscular blocking agents, healthcare providers relied on a combination of anticholinesterase and anticholinergic medications to reverse the effects of nondepolarizing neuromuscular blocking agents (O'Driscoll & Parrott, 2019). The use of sugammadex instead of these alternative medications is associated with shorter post anesthesia care unit (PACU) length of stay, fewer postoperative complications, cost savings, and enhanced patient satisfaction (Kheterpal et al., 2020; Murphy et al., 2020). Murphy et al. (2020) reported a decrease in PACU length of stay from a mean of 110 minutes with neostigmine to a mean of 30 minutes with sugammadex. Kheterpal et al. (2020) report a 30% reduction in pulmonary complications, a 47% reduced risk of pneumonia, and a 55% reduced risk of respiratory failure when sugammadex is used instead of neostigmine. Reductions

in PACU length of stay and patient complications can offer significant potential cost-savings to hospitals. Martinez-Ubieto et al. (2021) reported an estimated annual net savings of € 57.1 million in Spanish hospitals with the use of sugammadex for reversal of neuromuscular blockade, attributed to reductions in post-operative pulmonary events such as pneumonia and atelectasis

There has been a significant increase in the use of sugammadex in clinical practice. Krijtenburg et al. (2024) report an increase in the percentage of surgical cases where sugammadex was administered from 12% to 18% between the years 2015 and 2019. Similarly, according to a verified global market report by Kingpein Market Research (2024), a considerable rise is projected during the forecast period from 2023 to 2031. Bridion recorded total sales of $487 million in the first quarter of 2023, establishing itself as Merck's fifth top-selling drug. This revenue surge reflects a notable 23% increase compared to the same period the previous year in Sugammadex sales (Manalac, 2023). The number of overall surgical procedures and procedures performed specifically on women is also increasing. According to the National Health Statistics Reports (NHSR) from the Centers for Disease Control and Prevention (CDC), the number of inpatient surgical procedures increased from approximately 46.5 million in 2000 to over 51.4 million in 2014 (CDC, 2020). The percentage of ambulatory surgical cases specifically performed on women also increased by 1.1% between the years 2000 and 2014 (CDC, 2020). This increase in the utilization of sugammadex and increase in female surgical cases suggests that the number of patients affected by this medication interaction will continue to increase.

Although its advantages are evident, both healthcare providers and patients need to be aware of potential interactions between sugammadex and hormonal contraceptives containing progesterone (O'Driscoll & Parrott, 2019). Although sugammadex has a high affinity for

rocuronium and vecuronium, it can also encapsulate progesterone and estrogen (O'Driscoll & Parrott, 2019). Sugammadex encapsulates these medications in a similar manner due to similarities in molecular structure (O'Driscoll & Parrot, 2019). This encapsulation interaction decreases the effectiveness of progesterone hormonal contraceptives and increases the risk for an unintended pregnancy (Hartman et al., 2021). All hormonal contraceptives containing progesterone and the synthetic form progestin are affected (O'Driscoll & Parrott, 2019). This includes oral, topical, injectable, and implantable formulations of hormonal contraceptives (O'Driscoll & Parrott, 2019). Consequently, patients using hormonal contraceptives that receive sugammadex must receive education about this potential medication interaction to avoid unintended pregnancy. This includes a recommendation that an alternative contraceptive method is utilized for one week following the administration of sugammadex (Lazorwitz et al.,2020; Merck, 2024).

In the United States, there has been a consistent increase in women aged 15-49 using hormonal contraception (Hilas, 2023). Between 2011 and 2019, the number of women of reproductive age using hormonal contraception increased from 61% to 65% (Hilas, 2023). Oral contraceptives were the most frequently used method at 25.9%, followed by long-acting reversible contraceptives, such as IUDs and other implants at 14.7% (CDC, 2023). Given the concurrent rise in the use of hormonal contraceptives and the use of sugammadex, it is imperative to provide patient education on potential interactions to mitigate the risk of unintended pregnancies.

The consequences of experiencing an unintended pregnancy can be severe, leading to changes in lifestyle habits, financial struggles, and emotional distress for patients and their families (O'Driscoll & Parrott, 2019). Herd et al. (2016) report a strong correlation between

unintended pregnancy and adverse mental health outcomes later in life (Herd et al., 2016). Furthermore, Dieguez et al. (2015) reported that unintended pregnancies contribute to 27.4% of annual delivery costs covered by taxpayers.

Unfortunately, studies indicate that there are existing gaps in patient education practices regarding the interaction between hormonal contraceptives and sugammadex (Lazorwitz et al., 2020). Although postoperative instructions in the form of written materials are frequently provided to postoperative patients, patients still often struggle to retain this information (Tanner & Morgan, 2022).

Purpose

The purpose of this quality improvement project was to improve patient recall of education on the interaction of sugammadex and hormonal contraceptives by having anesthesia providers provide this education preoperatively, prior to the administration of anesthetic medications.

Review of Current Evidence

A literature review was conducted using the PubMed, ScienceDirect, and Cochrane electronic databases. The search terms included "sugammadex," "hormonal," "preoperative," "patient education," and "contraceptives." Articles published in English between 2018 and 2023 were considered for inclusion in this review. Articles that did not specifically address the interaction between sugammadex and hormonal contraceptives or the timing of patient education were excluded. Thirteen relevant articles were identified through this search process and included in this review. Furthermore, information from Merck & Co., the manufacturer of sugammadex, was consulted to gather any additional evidence regarding the drug's interactions

with hormonal contraceptives and their recommendations for women of childbearing age after its administration.

Inadequate Existing Education

Patients using hormonal contraception who were administered sugammadex do not consistently receive appropriate education regarding hormonal interactions (Lazorwitz et al., 2020). Faulk et al. (2021) found that nearly 40% of anesthesiologists using sugammadex do not discuss its potential impact on hormonal contraception with patients before surgery (Faulk et al., 2021). Many healthcare institutions lack a formalized patient education process, and it remains unclear whether anesthesiologists or surgeons take personal responsibility for providing this crucial education to patients (Lazorwitz et al., 2020). In my personal observations, there is no consistent process for educating female patients about the interaction between sugammadex and hormonal contraceptives. This puts patients at risk of unintended pregnancy. A case report from a large academic hospital describes a documented pregnancy attributed to insufficient patient education on hormonal contraceptives and sugammadex (Lazorwitz et al., 2020).

Hospitals that offer education on sugammadex and hormonal contraceptives typically do so through written materials provided to patients after surgery. However, research by Tanner & Morgan (2022) indicates that patients often struggle to retain information given during the postoperative period (Tanner & Morgan, 2022). This difficulty arises because although patients may seem awake and responsive during this time, the effects of analgesics and anesthesia can impair their memory, leading to a lack of recall regarding the provided instructions. The consequences of this memory impairment for these patients are not known. Broderson et al. (2023) suggest that providing discharge instructions both before surgery and immediately before discharge can enhance patient understanding and retention of crucial information (Broderson et

al., 2023). This proactive approach can help patients better remember and act upon important instructions, improving their overall postoperative care outcomes.

To address these challenges, proactive measures such as providing discharge instructions both before and after surgery may enhance patient understanding and retention and improve postoperative outcomes (Broderson et al., 2023). The implementation of standardized procedures for educating female patients about the interaction between sugammadex and hormonal contraceptives may mitigate the risk of unintended pregnancies and enhance patient safety.

Manufacturer's Recommendations

The manufacturer of sugammadex advises that if a patient takes an oral contraceptive on the same day as sugammadex administration, they should use an additional non-hormonal contraceptive or backup method for seven days (Merck, 2023). They also recommend similar precautions for patients using non-oral hormonal contraceptives (Merck, 2023). These recommendations are based on a pharmacokinetic interaction model that demonstrates that sugammadex can form an encapsulated complex with etonogestrel, a common progestogenic component in many hormonal contraceptives (Merck, 2023). In vitro studies revealed that a single dose of sugammadex could decrease etonogestrel exposure by up to 34%, potentially leading to a delay of at least twelve hours in daily contraceptive effectiveness (Merck, 2023). This reduction in exposure may compromise the efficacy of hormonal contraceptives due to unintended decreases in plasma concentrations (Merck, 2023).

Educating Providers

Sugammadex interferes with all forms of hormonal contraceptives: oral, subcutaneous, injectable, implantable, and intrauterine (Dwan et al., 2021). Most anesthesia providers correctly identify that sugammadex interacts with oral hormonal contraceptives (Dwan et al., 2021). Far

fewer, however, correctly identify that sugammadex also interacts with implantable and intrauterine hormonal contraceptives (Dwan et al., 2021). Only 50% of attending anesthesiologists, resident anesthesiologists, certified registered nurse anesthetists, and student registered nurse anesthetists correctly identified that sugammadex interferes with implantable (intramuscular, subcutaneous) hormonal contraception delivery methods (Dwan et al., 2021). Even fewer (44%) correctly identified that sugammadex interferes with levonorgestrel intrauterine contraception (Dwan et. Al, 2021). Stacey et al. (2018) report that more than two-thirds of anesthesia providers that used sugammadex were unaware of either the potential medication interaction or its consequences. As a result, patients are not receiving adequate perioperative counselling because the anesthesia community is unaware of all the hormonal contraceptives sugammadex interferes with (Dwan et. Al, 2021; Stacey et al., 2018).

Educating Postoperative Nurses

Post-operative education on the interaction of sugammadex and hormonal contraceptives is not consistently provided to patients because postoperative anesthesia care unit (PACU) nurses do not fully understand the implications of this interaction (O'Driscoll & Parrott, 2019; Hartman et al., 2021). In a survey of 24 PACU nurses, only 16% correctly identified that sugammadex alters serum progesterone levels, and only four were able to correctly indicate the mechanism of action of sugammadex (O'Driscoll & Parrott, 2019). Evidence from Hartman et al. (2021) indicates that only 40% of PACU nurses reviewed the written instructions regarding sugammadex and hormonal contraceptives with patients in the discharge paperwork. Only 38% of PACU nurses in a study conducted by Hartman et. al (2021) report that they were confident enough to provide teaching to women who were on hormonal contraceptives and received sugammadex. This gap of knowledge can be addressed with education of PACU staff (O'Driscoll

& Parrott, 2019). The implementation of additional PACU nurse education was associated with statistically significant increases in provider knowledge and confidence (O'Driscoll & Parrott, 2019). An improvement in providing instructions in the discharge paperwork was also observed (Hartman et al., 2021).

Preoperative teaching

Providing preoperative discharge education prior to the administration of analgesics and anesthesia has been demonstrated to enhance patient retention and satisfaction (Tanner & Morgan, 2022). However, at many hospital facilities, education on sugammadex and hormonal contraceptives is provided by PACU nurses during the postoperative phase (O'Driscoll & Parrott, 2019). Shultz et al. (2023) report that 75.2% of patients rate their postoperative recall as “very poor” (38.4%) or “poor” (36.8%). Brodersten (2023) discovered that preoperative educational interventions lead to reductions in hospital length of stay, reductions in the frequency of postoperative complications, and fewer adverse events. Patients who received preoperative education also reported lower psychological stress and anxiety levels (Brodersen et al., 2023).

Analgesics and anesthesia impair a patient's memory post-surgery (Brodersen et al., 2023; Tanner & Morgan, 2022). Patients who received preoperative discharge instructions often demonstrate improved recall in the PACU, readily answering questions about equipment usage and medication administration upon awakening (Hovsepian et al., 2017). The timing of educational interventions on anesthesia administration also affects patient retention, showing improvement when teaching is provided before administering anesthesia (Hovsepian et al. 2017; Tanner & Morgan 2022).

Combination of teaching and provided literature

Both patients and nurses show a preference for receiving instructions both before and after surgery (Tanner & Morgan, 2022). Notably, patient satisfaction scores for "written instructions for home care" significantly increased following implementation of a program that involved teaching patients postoperative instructions preoperatively (Hovsepian et al., 2017). Engaging patients in preoperative postoperative home care instructions allows them time to ask questions and familiarize themselves with equipment before undergoing sedation and surgery (Hovsepian et al., 2017). Therefore, implementing preoperative teaching alongside discharge instructions is a well-supported approach to enhancing patient satisfaction and understanding of postoperative care. Providing education on sugammadex interactions to patients in both the preoperative and postoperative phases can improve their comprehension of instructions and overall satisfaction with the process.

Nursing Theoretical Framework

The theoretical framework utilized for this quality improvement project was Orem's Self-Care Deficit Nursing Theory (SCDNT). Tanaka (2022) emphasized the utility of Orem's SCDNT in constructing an integrated curriculum for patient education in correctional studies (Tanaka, 2022). Orem's SCDNT provides a structured model for patient education by identifying the gap between self-care with hormonal contraceptives and the impact of sugammadex on contraceptive efficacy. Following the nursing process stages (assessment, diagnosis, plan, implementation, and evaluation), as outlined in the SCDNT, nurses can intervene to ensure women of childbearing ages have the knowledge to seek alternative nonhormonal contraceptives (Guthrie et al., 2001). The final step in Orem's SCDNT involves nurse education and patient evaluation aimed at enhancing self-care practices (Petiprin, 2019).

Orem's SCDNT rests on five foundational assumptions. These assumptions highlight the importance of communication and interaction for human survival and functionality, deliberate decision-making to address needs, engagement in care actions for oneself and others, agency in discovering and transmitting care knowledge, and structured relationships for providing care within groups (Petiprin, 2019).

Orem's philosophy encompasses three interconnected sub-theories: the theory of self-care, the theory of self-care deficit, and the theory of nursing systems. These sub-theories collectively form the SCDT, emphasizing individuals' role in maintaining life, health, and well-being through self-care actions (Meleis, 2011). The theory of self-care underscores the development of skills and agency necessary for self-care maintenance. Individuals initiate and perform activities to sustain life, health, and well-being independently (Petiprin, 2019).

The theory of self-care deficit is central to Orem's ideas, defining nursing as necessary when individuals are unable to provide effective self-care continuously. It outlines five methods of assistance: acting for others, guiding, supporting, providing an environment for personal development, and teaching (Meleis, 2018). The theory of nursing systems delineates how self-care needs are addressed by nurses, patients, or both parties. Orem categorizes nursing systems into wholly compensatory, partly compensatory, and supportive-educative systems to meet patient self-care requisites (Meleis, 2018).

Orem's SCDNT has been widely applied in nursing literature and practice due to its practical framework for identifying and addressing self-care deficits in patients. This theory is particularly relevant in addressing potential unintended pregnancies in women using hormonal contraceptives and receiving sugammadex perioperatively. Orem's philosophy aligns with this quality improvement initiative as it allows clear definition of self-care in contraceptive

administration, identifies deficits in contraceptive efficacy post-sugammadex, and enables anesthesia providers to bridge this gap through patient education on this interaction.

Translation Framework

The Plan-Do-Study-Act (PDSA) cycle was used as the translational framework for this quality improvement project. The PDSA cycle is a structured method consisting of four iterative stages and begins with the planning phase where key stakeholders identify a clinical problem as a priority. The team sets improvement goals, develops intervention strategies, and establishes data collection methods based on evidence-based practices. Subsequently, during the implementation phase, interventions are executed on a small scale to assess feasibility and refine future iterations. The study phase involves analyzing collected data to evaluate intervention effectiveness, identify improvement areas, and understand factors influencing success or failure. Finally, the act phase sees quality improvement (QI) teams refining interventions based on study findings, potentially modifying strategies, scaling up successful approaches, and disseminating lessons learned. This iterative process drives incremental improvements in healthcare delivery.

The identified clinical problem was the lack of patient recall regarding education on the interaction between sugammadex and hormonal contraceptives. The plan involved providing education to patients both before the administration of anesthesia and afterward to ensure comprehensive understanding (Tanner & Morgan, 2022). The intervention was an educational intervention for anesthesia providers and data was collected to assess the effectiveness of patient education pre-and postintervention. The single completed PDSA cycle's aim was to enhance preoperative teaching methods. Results were then shared with the clinical facility site to be used to guide future PDSA cycles.

Plan

This aim of this project was to improve patient recall of education regarding the interaction between sugammadex and hormonal contraceptives. Over a four-week period, the team conducted preintervention phone surveys with patients on hormonal contraceptives that had recently undergone surgery and received sugammadex. Patients were questioned regarding their recall of the education they received on sugammadex. Following this collection of baseline data, a meeting was convened with key CRNA team members to provide an evidence-based educational program. This educational session consisted of a review of the mechanism of action of sugammadex, the evidence on the interaction of sugammadex with hormonal contraceptives, current manufacturer recommendations and the advantages of providing education preoperatively. During this meeting, the team provided the CRNAs with the informational materials that patients routinely receive in the post-operative unit, to ensure consistency of the information provided to patients. The CRNAs were then asked to provide this patient education to patients before administering anesthesia. Post-intervention data collection consisted of repeat patient phone surveys in the same manner as was conducted for baseline data collection. Subsequently, the team analyzed the gathered data to identify areas for improvement in patient education and recall. Throughout this process, the aim was to enhance patient understanding and awareness of the potential interactions between sugammadex and hormonal contraceptives, ultimately improving patient recall.

Formation of a team

The key team members were the chief CRNA at the facility site, the research clinical nurse coordinator, the CRNA staff, and the primary investigator (PI). The Chief CRNA responsibilities were pivotal in orchestrating efforts. They set up the implementation meeting, ensured effective communication between all team members, provided a designated area for data

collection, and managed technical issues that arose throughout the process. The research clinical nurse coordinator facilitated IRB approval at the clinical site. The Certified Registered Nurse Anesthetists (CRNAs) acted as anesthesia providers and played a crucial role in delivering the educational content to patients. The PI identified the initial clinical problem, conducted an extensive review of the literature, shared the current evidence with the key stakeholders at the clinical site, and worked collaboratively to collect and analyze data and disseminate findings.

Population

The target population for this project was a convenience sample of CRNAs that were present for the educational intervention and were willing to participate by providing patient education on the interaction of sugammadex and hormonal contraceptives to patients they planned to administer sugammadex to. These included any female patient of child-bearing age that was currently using hormonal contraceptives. Childbearing age was defined as ages 15 to 55. Hormonal contraceptives were defined as oral or non-oral hormonal contraceptive methods including Mirena IUD, Skyla IUD, deposhot, patches, Nuvaring, implant Nexplanon, creams, and pills). Exclusion criteria were women who elected not to participate, or who underwent surgical procedures for sterilization, or dilation and evacuation. Project participants were identified during a chart review, called one-day post-surgery, and voluntarily verbally consented. No patient identifiers were requested or retained.

Setting

This project was implemented at a level three trauma center located in the southeastern United States. This hospital is a 600-bed academic medical hospital with 20 operating rooms and is located in an urban area. Sugammadex is the medication most frequently utilized at this facility for muscle relaxation reversal.

Project Implementation

The "Do" phase of the PDSA cycle was aimed at improving patient recall of education regarding the interaction between sugammadex and hormonal contraceptives by having the anesthesia provider provide this patient education prior to the administration of anesthesia. This patient education was in addition to the postoperative education routinely provided by the PACU nurse prior to patient discharge. The PI examined the surgical schedule at the clinical facility via the electronic dashboard to identify women within the specified age range for inclusion in the quality improvement project. The electronic medical record was screened for the use of hormonal contraceptives and perioperative administration of sugammadex. Patients that met these criteria were contacted via phone by the PI on the day after their surgery and surveyed to evaluate their recall of receiving patient education. The patient was asked six questions about the education that they received (see Appendix A). These questions included whether they were provided education on the interaction of their hormonal contraceptives and sugammadex, who provided this education, the timing of that education and their level of satisfaction with the education they received. If the patient did not recall receiving education on the interaction between hormonal contraceptives and sugammadex, they were reminded that this information had been included in their written (after visit summary) at discharge instructions. The PI recorded all responses into a password protected Excel spread sheet on the PI's password protected laptop. No identifying data was recorded.

Following this initial data collection period, the PI convened with a convenience sample of fifteen CRNAs at their regularly scheduled monthly meeting. During this session, an evidence-based educational intervention was provided as a slideshow presentation. The educational intervention outlined the mechanism of action of sugammadex, the evidence on the

interaction of sugammadex with hormonal contraceptives, current manufacturer recommendations and the advantages of providing education preoperatively. This educational session took place in the conference room at the site facility and lasted approximately 15 minutes, including time for participants to ask questions after the presentation. Staff participation was voluntary and anonymous, and no data was documented from this meeting. The meeting concluded with a summary and clarification of key points. Subsequently, the Chief CRNA disseminated an email to all CRNA staff, outlining the contents and outcomes of the meeting.

Eight weeks after the educational intervention and implementation of the preoperative patient education by the CRNAs, the PI repeated chart reviews and postoperative patient phone calls to assess for interval change in patient recall.

Tools and Education Material

The educational presentation for the anesthesia providers was created by the PI for this project. It consisted of a slideshow presentation with current evidence compiled from a review of the topic's literature. This educational session encompassed information regarding the interaction between sugammadex and hormonal contraceptives and the effectiveness of preoperative teaching to improve patient recall of patient teaching, along with encouragement for active participation in providing education in preoperative unit.

The survey used for evaluating patient recall was also developed by the PI in collaboration with key stakeholders at the clinical facility site. The survey used for-data collection was structured similarly to a survey employed previously by Phillips and colleagues (2007) to evaluate patient recall of provided education on the interaction of antibiotics and oral contraceptives. This survey included structured questions to evaluate the type of information

communicated to patients, when the advice was given, and whether alternative contraceptive methods were recommended during antibiotic treatment Phillips et al. (2007).

The patient survey used for this project was designed by the PI to assess patient awareness and satisfaction regarding education received on the potential interaction between sugammadex and hormonal birth control. Validity was not evaluated. It had six questions about their recall of their education. These questions included whether they were provided education on the interaction of their hormonal contraceptives and sugammadex, who that education was provided by, when that education was provided, and their level of satisfaction with the education they received. If the patient did not recall being informed of the interaction between hormonal contraceptives and sugammadex, they were reminded that this information was included in their written discharge instructions. Patients were then asked if they recalled receiving any advice given to prevent unintended pregnancy, followed by whether they had followed this advice or used alternative birth control methods. Patients were asked an additional open-ended question to express any additional thoughts or feedback regarding the education they had received.

Data Collection

Data collection began in early November and continued until the end of January the following year. Twenty phone surveys were conducted during this period, with each survey lasting an average of 5 minutes. The responses from each survey were meticulously recorded into an Excel spreadsheet on the primary team member's computer. Subsequently, the gathered data was compiled for thorough analysis. Upon the project's completion, the file containing the data was securely deleted.

Data Analysis

Progress was measured through postoperative patient phone surveys, which gauged the patient's recall of the provided education. Results were then shared with the clinical facility site to be used to guide future PDSA cycles. A Mann-Whitney U test was used to analysis data collected from participants pre-implementation and post-implementation. In addition, descriptive statistics were used to analyze the participants' demographic information, such as age, gender, and any other relevant characteristics.

Results

Evaluate Outcomes

This QI project included a total of 20 female patients (pre-intervention=3; post-intervention=17), with an average age of 31.3±5.1 years (range: 25-40) (see Appendix B). The mean ASA score was 2 (range: 1-3). The average body mass index (BMI) was 45±9.3. Among the surgical procedures conducted, nine were general surgeries (45%), six were gynecological procedures (30%), four were related to gastroenterology (20%), and one was orthopedic (5%). The predominant types of hormonal contraceptives used were eight oral contraceptives (40%), six intrauterine devices (30%), three depo shots (15%), and one each of patch, cream, and Implanon (5% each) (see Appendix C).

In the pre-intervention group (n=3), only one patient (33%) recalled receiving educational information regarding the effects of their hormonal contraceptives. The remaining two patients (67%) reported having no recollection of receiving this education. The patient who recalled receiving this education reported that it was provided by the PACU nurse (see Appendix E).

In the post-intervention group (n=17), a total of four patients (23%) recalled receiving education. Among these, two patients (50%) recalled receiving this education postoperatively, while two patients (50%) recalled receiving it preoperatively (see Appendix F).

A Mann-Whitney U test was performed to assess potential differences between the pre- and post-intervention groups. The findings revealed no significant difference, as evidenced by a z-score of 3.144 and a p-value of 0.95, surpassing the predetermined significance level of 0.05. Based on these results (see Appendix D) it can be concluded that there is no significant difference between the pre- and post-intervention groups.

Discussion

The results of this PDSA cycle revealed a progression of outcomes of preoperative teaching intervention. Although preoperative teaching was not associated with a statistically significant increase in patient recall; two patients were able to articulate the need for alternative contraceptive methods suggesting clinical relevance. In contrast, two patients who recalled receiving teaching in the postoperative phase could only recall that there was a list of alternative methods in their paperwork but could not verbalize the specific methods. These findings highlight that patients retain more detailed information when taught in the preoperative phase rather than the postoperative phase. Without anesthesia medications affecting their cognition, patients can listen more attentively and ask pertinent questions. Repetition of information in the PACU also aids in promoting long-term memory retention.

Postoperative teaching also proved beneficial. One patient recalled receiving postoperative teaching before the implementation of preoperative teaching by anesthesia providers, while two recalled postoperative teaching after the implementation. This underscores the effectiveness of postoperative teaching for certain patients. The method of presenting postoperative teaching includes verbal communication and written documentation, which enables patients to both hear and see the information, enhancing retention. Orem's Self-Care Deficit Nursing Theory (SCDNT) proposes that creating an environment conducive to personal

development in meeting future demands can facilitate self-care (Petiprin, 2019). Verbal and written documentation together provide such an environment for patients to promote future self-care practices.

Most at-risk patients were identified in general surgery cases, particularly during high-volume weekend periods. These consisted primarily of add-on emergent cases of general surgical procedures at the facility. None of the patients involved in emergent surgeries recalled receiving teaching on their birth control and sugammadex. Patients in emergency surgeries are often in distress or pain and may not absorb information effectively during such times. Conducting preoperative teaching before emergency surgeries may not be conducive to patient understanding. In these scenarios, providing teaching and documenting it for reference when patients are receptive to learning aligns with Orem's SCDNT theory, which emphasizes addressing patient needs and making appropriate judgments to support self-care (Nursing-theory.org, 2023). Offering necessary information in written form when patients are receptive to learning reflects good clinical judgment and aids patients in providing self-care during challenging times.

Limitations

There were several limitations encountered during this project. One notable limitation was the small sample size utilized. This was primarily due to time constraints imposed by the project's timeline and the specific time of year when the project was conducted, resulting in limited opportunities to gather sufficient preintervention and postintervention data. Furthermore, the project coincided with major holidays, leading to reduced total surgical procedures being performed and further limiting the sample size.

Another limiting factor was the limited attendance of anesthesia providers at the educational implementation meeting. Although there were over 60 anesthesia staff members employed at the clinical facility, only 15 anesthesia providers attended the presentation. Consequently, not all anesthesia providers received the education provided in-person from the PI. Although they were provided the educational content via their e-mail, it is unknown whether they received it. They may not have reviewed and understood the instructions on performing preoperative teaching, resulting in at-risk patients missing out on crucial education during the preoperative period.

Additionally, ensuring that providers who attended the meeting performed preoperative education for patients posed another challenge. The project was not conducted by an employee of the organization, and there were no mechanisms in place to ensure that the anesthesia providers provided and documented the patient education they provided. The project had to rely on the assumption that all attendees of the meeting would follow through with preoperative teaching. It is unknown how many anesthesia providers provided this education. These limitations collectively impacted the project's results and conclusions.

Conclusion

In conclusion, this study demonstrates promising clinical significance outcomes with two patients, highlighting the beneficial impact of incorporating preoperative teaching to enhance patient recall. However, several barriers, including a smaller sample size, limited time for clinical implementation, and inadequate representation of CRNAs at implementation meeting, were identified. Addressing these challenges is crucial for future PDSA cycles aimed at refining and expanding upon the findings of this improvement project. Future improvement project endeavors should be designed with larger sample sizes, longer periods for clinical implementation, and

comprehensive involvement of key stakeholders such as CRNAs to ensure stronger results that can effectively inform clinical practice and enhance patient outcomes. Additionally, these projects should incorporate mechanisms to ensure thorough documentation of educational interactions.

References

Brodersen, F., Wagner, J., Uzunoglu, F., & Petersen-Ewert, C. (2023). Impact of preoperative patient education on postoperative recovery in abdominal surgery: A systematic review. *World Journal of Surgery*, *47*(4), 937–947. https://doi.org/10.1007/s00268-022-06884-4

Blobner, M., Eriksson, L., Scholz, J., Motsch, J., Della Rocca, G., & Prins, M. E. (2010). Reversal of rocuronium-induced neuromuscular blockade with sugammadex compared with neostigmine during sevoflurane anaesthesia: results of a randomised, controlled trial. *European Journal of Anaesthesiology*, *27*(10), 874–881. https://doi.org/10.1097/eja.0b013e32833d56b7

Buckwalter, K. C., Cullen, L., Hanrahan, K., Kleiber, C., McCarthy, A., Rakel, B., Steelman, V., Tripp-Reimer, T., & Tucker, S. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing*, *14*(3), 175–182. https://doi.org/10.1111/wvn.12223

Carlson, E. A., Staffileno, B. A., & Murphy, M. (2018). Program Evaluation. In *Research for advanced practice nurses* (pp. 251–277). Springer Publishing Company. https://doi.org/10.1891/9780826118394.0004

Centers for Disease Control and Prevention. (2020). National Health Statistics Reports: Number and percentage distribution of inpatient surgical stays by procedure category, 2014. https://www.cdc.gov/nchs/data/nhsr/nhsr102.pdf

Cho, H. E., Huynh, K. A., Corriere, M. A., Chung, K. C., & Cederna, P. S. (2020). Developing strategies for targeted improvement of perioperative education for postbariatric surgery body-contouring patients. *Annals of Plastic Surgery*, *86*(4), 463–468. https://doi.org/10.1097/sap.0000000000002471

Corda, D. M., & Robards, C. B. (2018). Sugammadex and oral contraceptives. *Anesthesia & Analgesia*, *126*(2), 730–731. https://doi.org/10.1213/ane.0000000000002677

Dalton, J., & Van Hasselt, G. (2015). Sugammadex - time of onset: Nine months. *Anaesthesia*, *71*(1), 115–116. https://doi.org/10.1111/anae.13356

Dwan, R. L., Raymond, B. L., & Richardson, M. G. (2021). Unanticipated consequences of switching to sugammadex: Anesthesia provider survey on the hormone contraceptive drug interaction. *Anesthesia & Analgesia*, *133*(4), 958–966. https://doi.org/10.1213/ane.0000000000005465

Faulk, D. J., Austin, T. M., Thomas, J. J., Strupp, K., Macrae, A. W., & Yaster, M. (2021). A survey of the society for pediatric anesthesia on the use, monitoring, and antagonism of neuromuscular blockade. *Anesthesia & Analgesia*, *132*(6), 1518–1526. https://doi.org/10.1213/ane.0000000000005386Guthrie, B. J., Billings, S., Kiel Martyn, K., Oakley, D., & Walker, D. S. (2001). Using cognitive theory to improve nurse practitioners' anticipatory guidance with contraceptive pill users. *Journal of Community Health Nursing*, *18*(4), 223–234. https://doi.org/10.1207/s15327655jchn1804_03

Hartman, E., Funk, E., Dear, G., Wellman, C., & Pereira, K. (2021). Sugammadex effects on hormonal contraception effectiveness: Implementation of uniform postoperative teaching. *Journal of PeriAnesthesia Nursing*, *36*(4), 351–358. https://doi.org/10.1016/j.jopan.2020.10.007

Healthcare Report Analysis 2024. (2024, March 26). *Sugammadex Sodium Market Size & Trends to 2030*. https://www.linkedin.com/pulse/sugammadex-sodium-market-size-trends-2030-e2qkf

Hovsepian, J., McGah, C., & O'Brien, C. (2017). Postoperative instructions preoperatively—evaluating the effectiveness of a teaching model on patient satisfaction regarding instructions for home care. *Journal of PeriAnesthesia Nursing*, *32*(3), 231–237. https://doi.org/10.1016/j.jopan.2015.12.014

Kheterpal, S., Vaughn, M. T., Dubovoy, T., Shah, N., Bash, L. D., Colquhoun, D. A., Shanks, A., Mathis, M. R., Soto, R. G., Bardia, A., Bartels, K., McCormick, P. J., Schonberger, R. B., & Saager, L. (2020). Sugammadex versus Neostigmine for Reversal of Neuromuscular Blockade and Postoperative Pulmonary Complications (STRONGER). *Anesthesiology*, *132*(6), 1371–1381. https://doi.org/10.1097/aln.0000000000003256

Lazorwitz, A., Dindinger, E., Aguirre, N., & Sheeder, J. (2019). Pre- and post-operative counseling for women on hormonal contraceptives receiving sugammadex at an academic hospital. *Journal of Anesthesia*, *34*(2), 294–297. https://doi.org/10.1007/s00540-019-02725-2

Lee, H., & Jung, K. (2020). Advantages and pitfalls of clinical application of sugammadex. *Anesthesia and Pain Medicine*, *15*(3), 259–268. https://doi.org/10.17085/apm.19099

Mechanism of action for bridion® (sugammadex). (2023). Merck. https://www.merckconnect.com/bridion/mechanism-of-action/

Martinez-Ubieto, J., Aragón-Benedí, C., de Pedro, J., et al. (2021). Economic impact of improving patient safety using Sugammadex for routine reversal of neuromuscular blockade in Spain. BMC Anesthesiology, 21(1), 55. https://doi.org/10.1186/s12871-021-01248-2

Meleis, A. (2011). *Theoretical nursing: Development and progress* (5th ed.). Wolters Kluwer Health.

Murphy, G., Avram, M. J., Greenberg, S. B., Bilimoria, S., Benson, J., Maher, C. E., Teister, K. J., & Szokol, J. W. (2020). Neuromuscular and clinical recovery in thoracic surgical patients reversed with neostigmine or sugammadex. *Anesthesia and Analgesia/Anesthesia & Analgesia*, *133*(2), 435–444. https://doi.org/10.1213/ane.0000000000005294

Nguyen-Lee, J., Moreland, N., Sadoughi, A., Borna, R., Salehi, A., & Jahr, J. S. (2018). Sugammadex: Clinical pharmacokinetics and pharmacodynamics. *Current Anesthesiology Reports*, *8*(2), 168–177. https://doi.org/10.1007/s40140-018-0266-5

O'Driscoll, L., & Parrott, J. (2019). Performance-improvement project: Increasing nursing knowledge of the impact of sugammadex in female patients taking steroidal contraceptives. *Journal of PeriAnesthesia Nursing*, *34*(3), 576–586. https://doi.org/10.1016/j.jopan.2018.10.003

Petiprin, A. (2019, August 13). *Dorothea E. Orem - Nursing Theory*. Nursing Theory. https://nursing-theory.org/nursing-theorists/Dorothea-E-Orem.php

Phillips, J., Chokkalingam, P., & McFerran, D. (2007). Advice given to women who are prescribed antibiotics while taking the oral contraceptive pill. *Clinical Risk*, *13*(4), 133–134. https://doi.org/10.1258/135626207781251004

Richardson, M. G., & Raymond, B. L. (2020). Sugammadex administration in pregnant women and in women of reproductive potential. *Anesthesia & Analgesia*, *130*(6), 1628–1637. https://doi.org/10.1213/ane.0000000000004305

Seeman, K. (2019). The importance of quality perioperative patient education. *Journal of Consumer Health on the Internet*, *23*(1), 94–101. https://doi.org/10.1080/15398285.2019.1574525

Shultz, K., Mastrocola, M., Smith, T. K., & Busconi, B. D. (2023). Patients have poor postoperative recall of information provided the day of surgery but report satisfaction with and high use of an e-mailed postoperative digital media package. *Arthroscopy, Sports Medicine, and Rehabilitation*, *5*(4), 100757. https://doi.org/10.1016/j.asmr.2023.100757

Stacey, K., Magee, D., & Chaggar, R. (2018). I am pregnant… it was the anaesthetist! *British Journal of Anaesthesia*, *121*(1), e10. https://doi.org/10.1016/j.bja.2018.02.052

Subramani, Y., Querney, J., He, S., Nagappa, M., Yang, H., & Fayad, A. (2021). Efficacy and safety of sugammadex versus neostigmine in reversing neuromuscular blockade in morbidly obese adult patients: A systematic review and meta-analysis. *Anesthesia: Essays and Researches*, *15*(1), 111. https://doi.org/10.4103/aer.aer_79_21

Tanaka, M. (2022). Orem's nursing self-care deficit theory: A theoretical analysis focusing on its philosophical and sociological foundation. *Nursing Forum*, *57*(3), 480–485. https://doi.org/10.1111/nuf.12696

Tanner, D., & Morgan, H. (2022). An evaluation of timing of discharge instruction and the impact on patient satisfaction. *Journal of PeriAnesthesia Nursing, 37*(1), 29–33. https://doi.org/10.1016/j.jopan.2021.08.003

Tweed, T. T., Woortman, C., Tummers, S., Bakens, M. M., van Bastelaar, J., & Stoot, J. B. (2021). Reducing hospital stay for colorectal surgery in eras setting by means of perioperative patient education of expected day of discharge. *International Journal of Colorectal Disease*, *36*(7), 1535–1542. https://doi.org/10.1007/s00384-021-03948-0

Togioka, B. M., Yanez, D., Aziz, M. F., Higgins, J. R., Tekkali, P., & Treggiari, M. M. (2020). Randomised controlled trial of sugammadex or neostigmine for reversal of

neuromuscular block on the incidence of pulmonary complications in older adults undergoing prolonged surgery. *British Journal of Anaesthesia*, *124*(5), 553–561. https://doi.org/10.1016/j.bja.2020.01.016

Appendix A

Patient Post-Education Data Collection Form

Phone interview Questions

Were you told about the possible interaction between sugammadex and the type of hormonal birth control you are taking? _____ yes _____ no

If no, remind the patient that the information was provided to them in the AVS package they received in discharge.

Do you remember WHO provided you with this education? _____

Were you satisfied with the education provided? ____ yes _____ no

What advice was given to avoid unintended pregnancy? _____

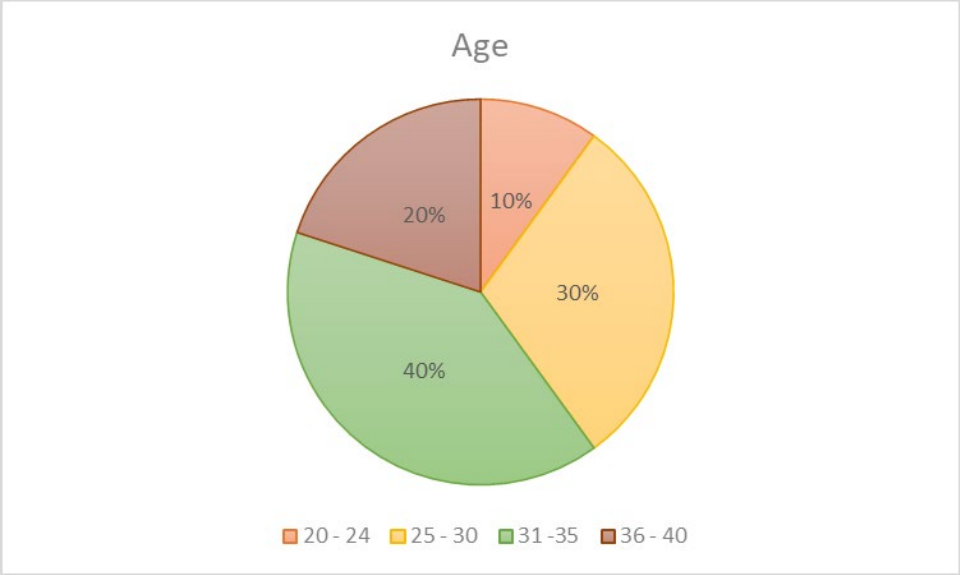
Did you follow the advice (in other words, did you use alternative birth control as advised)? ___ yes ____ no

Is there anything else you would like to say about the education you were provided? (free text their responses).

OBJ

Appendix B

Figure1: Age of Participants



Mean age is 31.3

Appendix C

Demographic Profile Matrix

ASA		
1	5	25%
2	12	60%
3	3	15%
4	0	
5	0	
Contraceptive type		
Oral	8	40%
Implanon	1	5%
Intrauterine device	6	30%
Depot	3	15%
Patch	1	5%
Cream	1	5%
Type of surgery		
Gastroenterology	4	20%
General surgery	9	45%
Orthopaedic surgery	1	5%
Gynaecology	6	30%
BMI		
Normal range (18 – 24)	4	20%
Overweight (25 – 29)	3	15%
Obese I (30 – 34)	5	25%
Obese II (35 – 39)	3	15%
Obese III (≥40)	5	25%

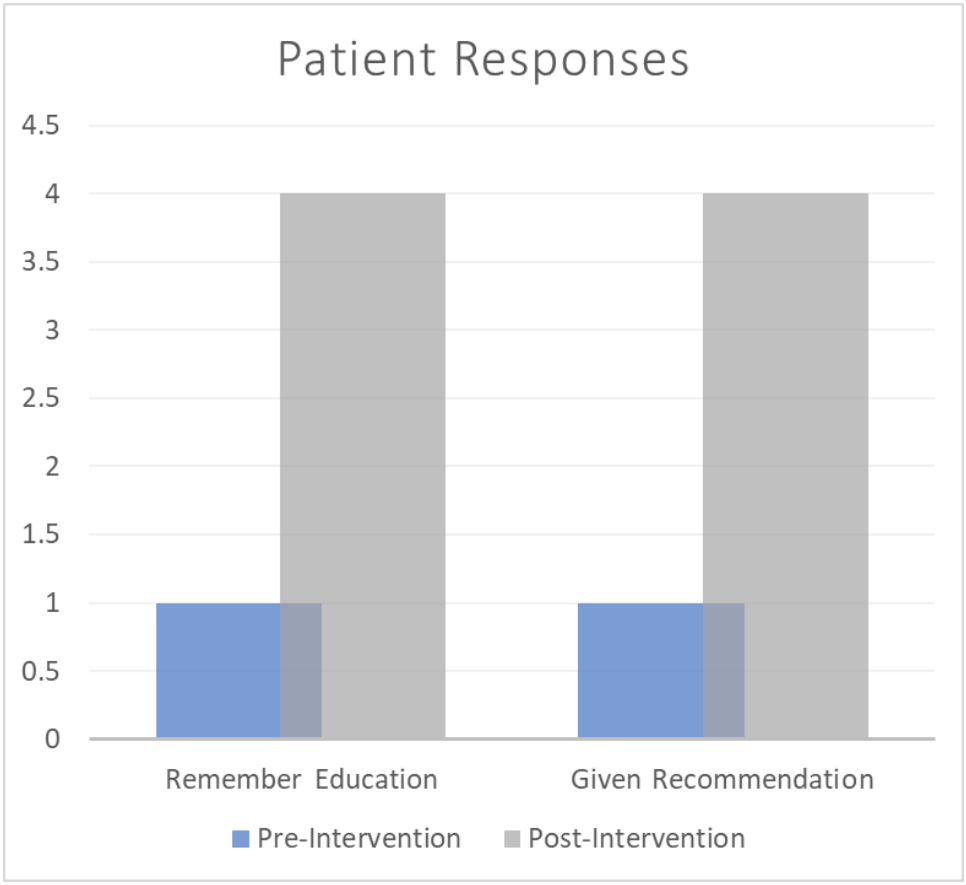
Appendix D

Statistical Analysis

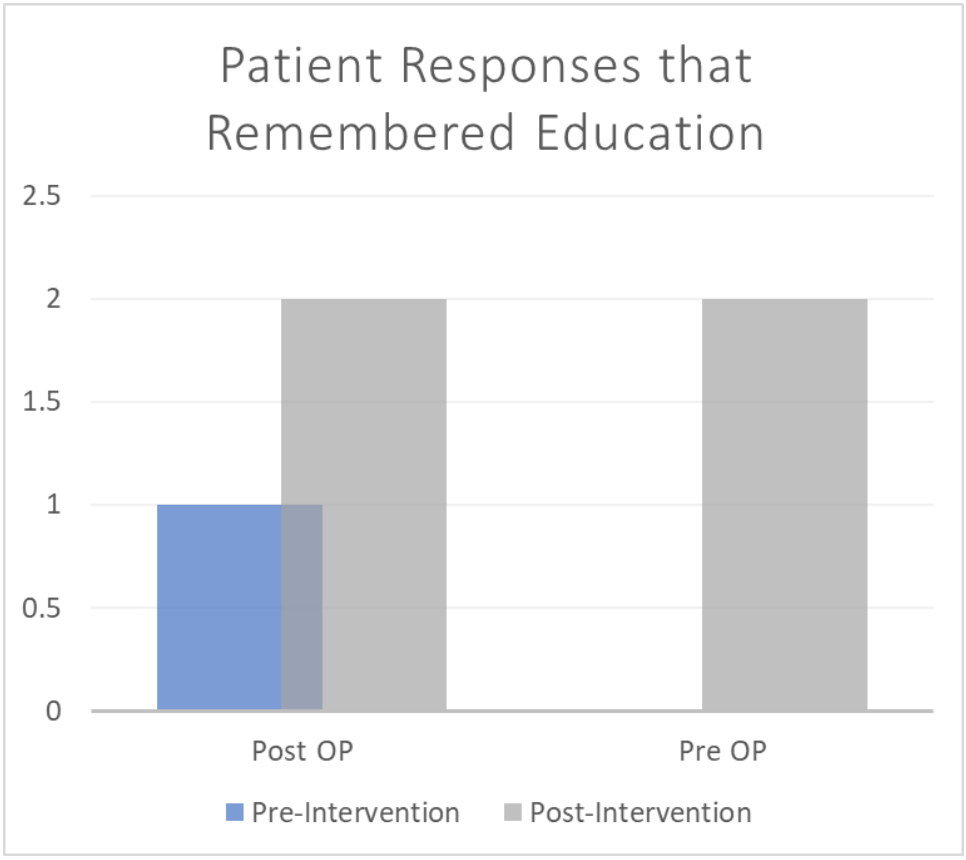
t-Test: Two-Sample Assuming Unequal Variances

	Pre	*Post*
Mean	10.66667	10.47059
Variance	21.33333	21.35846
Observations	3	17
Hypothesized Mean Difference	0	
df	3	
t Stat	0.067785	
P(T<=t) one-tail	0.475111	
t Critical one-tail	2.353363	
P(T<=t) two-tail	0.950222	
t Critical two-tail	3.182446	

Appendix E


Patient Responses
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Remember Education
Given Recommendation
Pre-Intervention
Post-Intervention

Appendix F


Patient Responses that Remembered Education
2.5
2
1.5
1
0.5
0
Post OP
Pre OP
Pre-Intervention
Post-Intervention