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Decreasing Cost in the GI Endoscopy Suite by Utilizing Best Sedation Practices

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DECREASING COST IN THE GI ENDOSCOPY SUITE BY

UTILIZING BEST SEDATION PRACTICES

by

Casey Brianne Mancini

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ABSTRACT

DECREASING COST IN THE GI ENDOSCOPY SUITE BY

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Colorectal cancer is a leading cause of cancer death in the United States (Mandel et al., 2008; Siegel, DeSantis, & Jemal, 2014). Because this lethal disease claims lives of many people every year, more patients are undergoing screening colonoscopies, which have greatly aided in decreasing the number of colorectal cancer deaths (Siegel et al., 2014). The most common form of sedation for colonoscopies is moderate sedation with a benzodiazepine and an opioid (Cohen, Hightower, Wood, Miller, & Aisenberg, 2004; Lera dos Santos et al., 2013). However, sedation by anesthesia providers using propofol is becoming more common and may aid in reducing recovery and discharge times from the postoperative anesthesia care unit (PACU) as well as reducing overall costs. A retrospective chart review (N=176; 88 in propofol group and 88 in benzodiazepine and opioid group) was performed to determine if propofol sedation did reduce discharge times and decrease overall costs for the patient. Patients included in this study underwent colonoscopy, were ASA PS I or II, and between the ages of 18 and 55. Exclusion criteria for this project were as follows: ASA PS III or IV, non-English speaking, pregnancy, allergy to eggs, fentanyl, or midazolam, previous neurological deficit, patients scheduled for colonoscopy and EGD in the same day, hospital inpatients undergoing colonoscopy, and patients undergoing emergency procedures. A one tailed independent groups *t*-test was performed on the mean time from procedure end until discharge time in minutes.

The hypothesis that colonoscopy patients sedated with propofol would be discharged faster than patients receiving a benzodiazepine and an opioid for sedation was accepted (group propofol M= 80.99, SD= 15.36 and group benzodiazepine and opioid M= 84.58, SD= 13.42, p= 0.05). A cost analysis revealed that sedation with propofol by anesthesia providers was more costly. While propofol patients are discharged faster, moderate sedation with a benzodiazepine and an opioid may be more cost efficient if the same number of patients underwent the procedure, however the decreased time may permit more revenue via greater number of cases performed. Interviews with providers after presenting the findings revealed future stakeholder strategies for a practice change.

ACKNOWLEDGMENTS

I would like to offer Dr. Bonnie Harbaugh my deepest appreciation. Without her knowledge and guidance, I would not have been able to complete this project. I would also like to thank to my committee members, Dr. Cathy Hughes, Dr. Melanie Gilmore, and Dr. Leon Graham. Their knowledge, support, and guidance helped me to achieve this amazing goal, and I am forever thankful.

DEDICATION

First and foremost, I want to give all the glory to God. Without my Heavenly Father, nothing would be possible. My family has been my biggest supporters during this time of completion of my Doctor of Nursing Practice degree. Their love, support, and encouragement have pushed me to fulfill my dreams. This project is dedicated to my husband, Davin, and two sons, Aiden and Ryker. Davin has been so patient and supportive of my journey through my CRNA program and now with the completion of my DNP. Without his love and support, I would not be where I am today. For my children, Aiden and Ryker, never stop dreaming because someone tells you that you should. Always stay moving forward and fulfill your dreams, regardless of how high they are. I have utmost confidence that both of you will be amazing men one day.

My parents have been incredibly helpful in this journey by caring for my children when I had to be away at class. Thank you to them for that.

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LIST OF ABBREVIATIONS

AANA	American Association of Nurse Anesthetists
APRN	Advanced Practice Registered Nurse
ASA	American Society of Anesthesiologists
CNS	Central Nervous System
CYP 450	Cytochrome P450
DNP	Doctor of Nursing Practice
EBP	Evidence Based Practice
EGD	Esophagogastroduodenoscopy
GABA	Gamma-aminobutyric acid
GI	Gastrointestinal
IHI	Institute for Healthcare Improvement
IT	Information Technology
IV	Intravenous
MAC	Monitored Anesthesia Care
MSBON	Mississippi State Board of Nursing
PACU	Postanesthesia care unit
PICO	Problem, Intervention, Comparison, Outcomes
PONV	Postoperative nausea and vomiting
PS	Physical status
RN	Registered Nurse
USPSTF	U. S. Preventive Services Task Force

CHAPTER I - INTRODUCTION

In the healthcare industry, today cost efficiency is extremely important. Organizations detest wasting time, supplies, and other tangible and intangible resources. Since colonoscopies are one of the most common procedures performed today, utilizing the best sedation practice under which to perform colonoscopies is one-way healthcare providers can increase both financial and time savings for the organization and the patient.

Background and Significance

One of the most prevalent health issues today is colorectal cancer. Colorectal cancer outcomes have improved from being the leading cause of cancer mortality in the late 1940's and early 1950's and the second leading cause of cancer mortality less than 10 years ago to being the third leading cause of cancer mortality today (Mandel et al., 2008; Siegel et al., 2014). Many factors such as diet, lifestyle changes, early detection, and treatment options have contributed to the decreased incidence of this fatal disease (Siegel et al., 2014). Because of the importance of early detection in colorectal cancer, colonoscopies have effectively reduced the number of deaths (Mandel et al., 2008). In 2000, 19% of patients, ages 50 to 75 years, had a routine screening colonoscopy. This percentage dramatically increased to 55% in 2010 among the same age range (Siegel et al., 2014). Although considered a routine procedure, colonoscopies are not without discomfort for the patient (Mandel et al., 2008).

To improve patient comfort and tolerance, colonoscopies and other endoscopic procedures in the gastrointestinal (GI) suite are typically performed while the patient is sedated. In a 2006 survey, more than 98% of colonoscopies in the United States were

performed under sedation (Lera dos Santos et al., 2013). Sedation practices range from mild sedation to moderate (conscious) sedation to deep sedation to general anesthesia (Lera dos Santos et al., 2013; McQuaid & Lane, 2008). Sedation serves several purposes during endoscopic procedures, including keeping the patient comfortable, improving efficiency of the procedure, and obtaining better quality results (Lera dos Santos et al., 2013).

The most commonly utilized sedation regimen is the combination of a benzodiazepine and an opioid for production of anxiolysis and analgesia (Cohen et al., 2004; Lera dos Santos, et. al., 2013). This combination of drugs is used in over 75% of endoscopic facilities in the United States (Lera dos Santos et al., 2013). The short half-life, ability to produce anterograde amnesia, and anxiolytic and sedative properties of midazolam make it the most desirable benzodiazepine for use (Lera dos Santos et al., 2013). Among the opioid drugs utilized for sedation purposes, fentanyl is the most frequently used drug of the opioid class, but meperidine is also useful for sedation (Lera dos Santos et al., 2013). Benzodiazepines and opioids can be administered by either a Registered Nurse (RN) or an anesthesia provider.

A hypnotic agent, propofol, used for the induction of anesthesia, is also used for sedation (Lera dos Santos et al., 2013). The onset of action of propofol is almost immediate, and the half-life is short, making it ideal for rapid recovery (Lera dos Santos et al., 2013). In addition to desirable properties for sedation, such as quicker recovery than other regimens, both patient and physician satisfaction is high with propofol (Lera dos Santos et al., 2013; Sipe et al., 2002). However, propofol, in many states, is limited to administration by anesthesia providers.

PICO/ Project Question

For patients in the GI endoscopy suite undergoing colonoscopy, does the use of propofol for sedation versus the use of a benzodiazepine and an opioid combination decrease the overall cost for patients by decreasing the time until discharge from the post-anesthesia care unit (PACU)? Although the combination of a benzodiazepine and an opioid has been used for many years and is still used in GI sedation procedures today, propofol sedation has a documented quicker induction and recovery time and may actually improve patient movement through the GI endoscopy suite (Cohen et al., 2004). In this project, recovery and discharge times were measured along with performance of a cost analysis to determine which sedation regimen is more cost efficient.

Problem Statement

Colonoscopies are typically performed as outpatient procedures, meaning the patient will be sent home from the GI endoscopy suite as soon as they meet requirements for discharge. Quick recovery from sedation and fast turnovers are highly desirable in settings such as these to increase patient safety and satisfaction, increase revenue, and decrease cost. The optimal sedation regimen has a rapid onset, short duration of action, and minimally affects cognition once sedation is terminated (Watkins et al., 2014). Discharging patients from the recovery area with lingering sedation could cause untoward events once the patient is out of the healthcare provider's care; therefore, sedation with a regimen that has quick induction and recovery times is ideal for outpatient procedures such as colonoscopies. This not only improves patients' satisfaction and safety, but also increases revenue and decreases cost for healthcare organizations due to increased efficiency and avoiding accidental injuries such as falls.

Purpose of the Project

The purpose of this project was to determine if there was a difference in cost due to the difference in discharge times between patients undergoing colonoscopy in the GI endoscopy suite who are administered propofol for sedation versus those who are administered a benzodiazepine and an opioid for sedation. Cohen and Benson (2009) report that three colonoscopies can be performed under propofol sedation versus two performed under midazolam and meperidine sedation in the same time frame. With that level of efficiency, propofol seems to be the superior method of sedation for patients. Quicker recovery time leads to shorter stays in the PACU and decreased costs.

> Most comparative studies have shown that patients prefer sedation with propofol over standard sedation drugs due to the opportunity for painless endoscopy, a very low incidence of post-procedure side effects such as nausea and vomiting, and a rapid return to a clearheaded state upon completion of the procedure (Cohen & Benson, 2009, p. 566).

Needs Assessment

With colorectal cancer being the third most common type of cancer in the United States and the third leading cause of cancer death, many people rely on screening tools for early detection and prevention of this disease (Siegel et al., 2014; USPSTF, 2008). "The USPSTF recommends screening for colorectal cancer using fecal occult blood testing, sigmoidoscopy, or colonoscopy in adults, beginning at age 50 years and continuing until age 75 years" (USPSTF, 2008). Therefore, these procedures are common, and many patients present to the GI endoscopy suite each day for colonoscopies. Different sedation methods are utilized to facilitate completion of

colonoscopies, and significant differences may occur in patient satisfaction and efficiency.

> Although the combination of a benzodiazepine and an opiate is adequate for the large majority of patients, there are drawbacks to the use of these drugs which include the following: a delay of several minutes after injection before the drugs exert their effect, lingering sedative effects that delay discharge, significant cost because of monitoring and prolonged recovery, and morbidity and mortality as a result of respiratory depression (Sipe et al., 2002, p. 815).

Seventy-five percent of GI procedures are completed under benzodiazepine and opioid sedation, but survey data concludes that propofol sedation is increasing (McQuaid & Laine, 2008). Propofol for sedation is an alternative to the common benzodiazepine and opioid combination that has resulted in greater satisfaction and decreased recovery time (Sipe et al., 2002). The increase in popularity of propofol sedation may be due to the fact that providers believe that both sedation and recovery times are decreased and efficiency of the department is improved (McQuaid & Laine, 2008). Additionally, sedation methods have changed due to patients' expectations of a painless procedure, desire of the physician to improve efficiency, and reimbursement from insurance companies for anesthesia services (Cohen & Benson, 2009). Therefore, with superior expectations from all stakeholders, utilization of a sedation routine that is safe, time and cost efficient, and provides the best comfort for the patient is imperative.

At the clinical site where this project was implemented, 2895 colonoscopies were performed in 2015. Several factors such as gastroenterologist preference, comorbidities of the patient, the patient's current medication regimen, and patient preference determine

whether he or she is sedated with propofol or a benzodiazepine and opioid combination. If propofol is found to significantly reduce discharge times and, therefore, costs, a practice change could occur, and all sedation in the GI endoscopy suite could be performed with propofol. Additionally, propofol sedation may improve patient satisfaction and increase revenue for the organization.

Theoretical and Conceptual Framework

Joanne R. Duffy's The Quality-Caring Model is the framework that was used to guide this project. This theory was developed by Duffy in 2003 because of previous experience with nursing care being marginalized since more modern healthcare emphasis was placed on tasks, technology, and cost containment (Duffy, 2015). Quality once referred to excellence of a service, but it has since expanded to include safety and value and includes advanced practice (Duffy, 2013).

The Quality-Caring Model holds nurses accountable for developing a caring relationship with both patients and families (Duffy, 2015). "Caring is a process that involves the person of the nurse relating with the person of the patient" (Duffy, 2013, p. 32). In addition, a collaborative relationship with other healthcare providers is also the responsibility of the nurse so the best interest of the patient and their family is always upheld (Duffy, 2015). This model is an outstanding guide for this project because advanced practice nurses must develop a caring relationship with patients and families while developing a plan of care between providers that maintains and improves the patient's health by utilizing the most cost-efficient sedation regimen. By providing a sedation technique to patients undergoing colonoscopy that enables them to recover

quickly while decreasing costs, both a caring and collaborative relationship has been exhibited.

Adhering to a caring relationship with patients also means that the advanced practice nurse provides cost-efficient care. A cost-effective analysis explores health outcomes in relation to treatment or intervention (Butts & Rich, 2015). Advanced practice nurses are vitally aware that economic decisions not only affect their practice, but also the lives of their patients (Butts & Rich, 2015).

> Any discussion of the situation of healthcare begins with the process of collecting data on soaring costs, calling into question whether higher costs are related to higher quality, and making dire predictions of the consequences of failing to control costs (Butts & Rich, 2015, p. 320).

If patients in endoscopy suites are administered only propofol instead of benzodiazepines and opioids, and their discharge times decrease due to enhanced recovery, costs are decreased, profit is increased for the facility, and satisfaction remains high.

The Quality-Caring Model and cost analysis tie this project together completely because APRNs, such as CRNAs, have the duty to provide care for patients that is both high quality and cost efficient. Many patients deter from preventative services, such as colonoscopies, because they simply cannot afford them. By implementing cost containment while providing high-quality healthcare for patients, ideally more patients will become compliant with healthcare standards, and the overall population will become healthier. The Institute for Healthcare Improvement (IHI) developed the Triple Aim framework that mandates healthcare must be compliant in three dimensions of (1) improving the patient experience (i.e. quality and satisfaction), (2) improving population

health, and (3) reducing the cost of healthcare (IHI, 2017). Duffy's Quality-Caring Model and a cost-effective analysis exude the three dimensions of the Triple Aim framework that the IHI has mandated for modern healthcare.

DNP Essentials

There are eight essential elements to the Doctor of Nursing Practice (DNP) degree (AACN, 2006). Each of those eight essentials was met in the development of this project and are listed as follows:

- Essential I, Scientific Underpinnings for Practice, was met by completing a literature review of the topic, exploring the scientific knowledge previously discovered, and conducting an evidence-based project. "DNP prepared advanced practice nurses bring specific expertise to their work, based on a very particular grounding in the scholarship of application" (Zaccagnini & White, 2014, p. 4).
- Essential II, Organizational and Systems Leadership for Quality Improvement and Systems Thinking, was met because determination of which sedation practice decreases cost effects the entire system of both the patient's experience and the anesthesia provider's care.
- Essential III, Clinical Scholarship and Analytical Methods for Evidence-Based Practice, was met by conduction of a thorough literature review and a quantitative analysis on the subject of sedation practices in the GI endoscopy suite.
- Essential IV, Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care, was met by utilizing the facility's information system and collaborating with the Information Technology (IT) personnel to retrieve data for the project. "The framework for the steps and

skills needed for providing the best patient care in a technology-rich environment includes the ability to use critical thinking and assessment skills to determine what information is needed" (Zaccagnini & White, 2014, p. 141).

- Essential V, Health Care Policy for Advocacy in Health Care, was met because the results of this project will help the organization develop policies to improve the delivery of healthcare by reducing costs in the GI endoscopy suite.
- Essential VI, Inter-professional Collaboration for Improving Patient and Population Health Outcomes, was met by collaborating with other healthcare professionals regarding best sedation practices for the GI endoscopy suite and determination of the best outcomes for colonoscopy patients.
- Essential VII, Clinical Prevention and Population Health for Improving the Nation's Health, was met because colonoscopies are essential to reducing the incidence and fatalities of colorectal cancer. By discovering the best sedation practice for the colonoscopy patient, ideally, more compliance will be attained.
- Essential VIII, Advanced Nursing Practice, was met because certified registered nurse anesthetists (CRNAs) are key stakeholders in this project as they perform sedation in the GI endoscopy suite and require evidence-based information on which to base best practice.

Although advanced practice nurses are not expected to be experts in all areas of nursing, DNP programs provide the preparation that allows their graduates to be experts in their own field of nursing (AACN, 2006) (See Appendix A).

CHAPTER II – REVIEW OF RELATED LITERATURE

A literature search was performed to explore the difference in discharge times of patients sedated with propofol versus patients sedated with a benzodiazepine and an opioid combination for colonoscopy. Several databases including CINAHL with Full Text, Medline, PubMed, Cochrane, and Google Scholar were searched for relevant articles. The following search terms were utilized: *colonoscopy, endoscopy, sedation, propofol, benzodiazepine,* and *opioid.* An initial search with limitations to full text only and publication dates between 2001 and 2016 returned 114 articles after duplications were removed. Upon further review of all databases accessed, 12 articles were selected because they were strongly applicable to this project. A literature matrix is included with information from each of the included articles (See Appendix B).

Sedation Considerations for Colonoscopy

In order for patients to be comfortable during procedures such a colonoscopies, sedation is required. Several factors such as anxiety, abdominal distention during insufflation, and endoscope manipulation cause patients discomfort that can be avoided with sedation (Nagelhaut & Plaus, 2014). Although some patients will tolerate the colonoscopy using moderate sedation without difficulty, others will require deep sedation to be comfortable. However, there are no strict boundaries in sedation as it may progress in depth to the next level without intent from the provider (Nagelhaut & Plaus, 2014). The provider administering sedation must be extremely vigilant in monitoring the patient for progression and be able to rescue the patient from each depth should the need arise.

Moderate Sedation

Moderate (conscious) sedation, which is now administered by Registered Nurses (RNs) or Advanced Practice Registered Nurses (APRNs), was once solely administered by anesthesia providers (Caperelli-White & Urman, 2014). The American Society of Anesthesiologists (ASA) defines moderate sedation as

> … a drug induced depression of consciousness during which patients respond purposely to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained (Caperelli-White & Urman, 2014, p. 416).

Administration of moderate sedation to patients is a significant responsibility regardless of the setting or provider. These patients need to be monitored closely because sedation always has the potential to become deeper than the provider intended. The American Association of Nurse Anesthetists (AANA) and the Mississippi Board of Nursing (MSBON) declares that the RN providing conscious sedation to the patient should have no other responsibilities than drug administration and monitoring of the patient during the procedure (Caperelli-White & Urman, 2014; MSBON, 2009). Any other responsibilities or tasks could easily distract the RN, or other provider, from the patient and untoward events occur. Additionally, some institutions and boards of nursing require that professionals administering moderate sedation have additional education and training in the clinical and administrative aspects of sedation (Caperelli-White & Urman, 2014; MSBON, 2009).

Deep Sedation

Progression from moderate sedation to deep sedation causes different physiologic responses to occur. Instead of immediately responding to verbal or tactile stimulation, the patient may require repeated or even painful stimulation to become arousable (AANA, 2016; Obara et al., 2015). In deep sedation, spontaneous ventilation may be inadequate, and intervention may be required to maintain a patent airway; however, cardiovascular function is typically maintained (AANA, 2016; Obara et al., 2015). Rescue from deep sedation requires providers proficient in airway management because respiratory depression and airway obstruction hold a high incidence in patient death for those undergoing sedation for endoscopy (Obara et al., 2015). Furthermore, the incidence of airway emergencies (i.e. airway obstruction, respiratory depression) is twice as high outside the operating room in remote locations, such as GI endoscopy suites (Obara et al., 2015).

Monitored Anesthesia Care

Monitored anesthesia care (MAC) is an anesthetic technique in which an anesthesia provider conducts a preoperative assessment, develops a plan for sedation, administers care during the procedure, and manages the patient postoperatively (ASA, 2013; Miller & Pardo, 2011). "An ideal anesthetic technique would incorporate optimal patient safety and satisfaction, provide excellent operating conditions for the surgeon, allow rapid recovery, and avoid postoperative side effects" (Miller & Pardo, 2011, p. 191). The ASA states that MAC includes varying levels of sedation, analgesia, and anxiolysis, therefore, this technique is limited to anesthesia providers so that conversion to a general anesthetic and airway management is feasible should the need arise (ASA,

2013; Das & Ghosh, 2015). Drugs ideal for sedation should have a rapid onset and clearance, be easy to titrate, and have minimal side effects, especially lacking cardiovascular and respiratory depression (Das & Ghosh, 2015). Propofol produces a more rapid, clear-headed recovery and protects against postoperative nausea and vomiting (PONV) than does midazolam and opioid combinations, making it an ideal drug for sedation (Das & Ghosh, 2015). Even though midazolam has a short elimination half-life, it causes prolonged psychomotor impairment and when used with an opioid, severe cardiovascular and respiratory depression can be seen (Das & Ghosh, 2015).

Mississippi's Position Statement on Sedation

Each state has its own position statement regarding the administration and monitoring of patients under each level of sedation. Mississippi's position statement reads that even though optimal anesthesia care is best provided by anesthesiologists and CRNAs, the high clinical demand for intravenous (IV) sedation permits non-CRNA RNs to administer moderate sedation (MSBON, 2009). RNs are not allowed by the Mississippi State Board of Nursing to administer deep sedation, general anesthesia, or any pharmacologic agents that are used in the administration of general anesthesia (MSBON, 2009). For the RNs providing moderate sedation to patients, the Mississippi State Board of Nursing deems it necessary for those providers to obtain additional education from their facilities in the administration, monitoring, and management of sedated patients (MSBON, 2009). In addition, the anesthesia provider, attending physician, or CRNA who ordered the sedation for the patient must be physically present and immediately available should an emergency arise (MSBON, 2009).

Propofol

Propofol, a sedative-hypnotic, is one of the newest anesthetic induction drugs, first introduced into clinical practice in 1989, and has since become the drug of choice for many anesthesia aspects (Ouellette & Joyce, 2011). The mechanism of action of propofol is exerted primarily by effect on gamma-aminobutyric acid (GABA) receptors (Ouellette & Joyce, 2011). GABA is the primary inhibitory neurotransmitter of the central nervous system (CNS), and activation of GABA receptors by propofol causes an increase of chloride transmembrane conduction causing a hyperpolarization of the cell to occur and inhibition of the neuron (Ouellette & Joyce, 2011). One of the more desirable effects of propofol that makes it different from other anesthesia drugs is a rapid and complete reawakening that occurs because propofol redistributes away from the effect site (brain) to other tissues that are not as well perfused (muscles) (Ouellette & Joyce, 2011). Additionally, the metabolic clearance of propofol exceeds hepatic blood flow, which suggests an extra-hepatic metabolic pathway; pulmonary uptake and elimination of propofol is possibly an extra-hepatic metabolic pathway (Ouellette & Joyce, 2011). Although propofol is metabolized extensively and rapidly by the hepatic system, and renal elimination is dominant, there is no evidence that neither hepatic nor renal dysfunction impacts the rapid redistribution and quick reawakening associated with propofol (Ouellette & Joyce, 2011). Another desirable effect of propofol, regardless of the anesthetic technique, is its anti-emetic properties that decrease the occurrence of PONV (Ouellette & Joyce, 2011).

Fentanyl

Fentanyl is an opioid that provides analgesia by stimulating μ receptors (Ouellette & Joyce, 2011). The rapid onset and short duration of action make fentanyl an ideal drug for use in anesthesia (Ouellette & Joyce, 2011). Pharmacokinetics associated with fentanyl are distribution time 1.7 minutes, redistribution time 13 minutes, and half-life 219 minutes (Ouellette & Joyce, 2011). The onset of action of fentanyl is almost immediate, and the duration of effects typically lasts 30 minutes to one hour (Ouellette & Joyce, 2011). Fentanyl is metabolized in the liver by the cytochrome P 450 (CYP) system, and up to 75% is eliminated in the urine as the original drug (Ouellette & Joyce, 2011).

Meperidine

Meperidine is a synthetic opioid that is used in moderate sedation. Meperidine is a derivative of the phenylpiperidine group with a half-life of 2.5 to 4 hours that is significantly increased by renal failure (Miller & Pardo, 2011). The metabolite of meperidine, normeperidine, also produces analgesia, central nervous system (CNS) excitability, and seizures (Miller & Pardo, 2011; Ouellette & Joyce, 2011). Additionally, the chemical structure of meperidine is similar to atropine, which causes increased heart rate (Butterworth, Mackey, & Wasnick, 2013). Meperidine should not be used in patients with renal failure or CNS disturbances (Ouellette & Joyce, 2011).

Midazolam

Midazolam is a benzodiazepine drug that produces anterograde amnesia from the time of injection and typically lasts through the recovery period (Ouellette & Joyce, 2011). It produces strong sedative effects and quick recovery, making it the most

commonly used benzodiazepine for sedation (Ouellette & Joyce, 2011). The effects of midazolam are exerted by binding to $GABA_a$ receptors, opening the chloride channels for extensive periods, hyperpolarizing the cells, and making the cell less excitable (Ouellette & Joyce, 2011). Of the benzodiazepine drugs in clinical use, midazolam is the best choice because of its higher clearance level (6-8 ml/kg/min) (diazepam or lorazepam-0.2-1 ml/kg/min) (Ouellette & Joyce, 2011). Metabolism of midazolam occurs in the hepatic system due to the CYP 450 system, and it is eliminated by the renal system (Ouellette & Joyce, 2011). The active metabolites of midazolam are quickly conjugated so that no secondary effects of the drug are exhibited; whereas, the effects of diazepam can be seen up to 20 hours after administration (Ouellette & Joyce, 2011). However, midazolam does cause greater respiratory depression than other benzodiazepines (Ouellette & Joyce, 2011).

Comparison of Sedation Regimens

In the past, researchers have studied the difference in recovery and discharge times of patients who were sedated for procedures in the GI endoscopy suite and found that propofol is superior to a benzodiazepine and opioid combination for sedation because it allows improved sedation, faster recoveries, and higher efficiency of department function (Poulos, Kalogerinis, & Caudle, 2013). Poulos et al. (2013) performed a retrospective cohort trial that studied 951 patients undergoing colonoscopy or esophagogastroduodenoscopy (EGD) from 2007 to 2010 that were sedated either with (1) propofol, (2) midazolam, fentanyl, and propofol, or (3) midazolam and fentanyl. After the study was completed, findings indicated that sedation with propofol resulted in quicker inductions, shorter procedures, and faster recoveries than patients who were

sedated with (1) midazolam, fentanyl, and propofol or (2) midazolam and fentanyl (Poulos et al., 2013).

Sipe et al. (2002) published a randomized, blinded, prospective study of 80 patients undergoing colonoscopy under sedation either with (1) propofol or (2) midazolam and meperidine. The mean times until sedation, recovery, and discharge were quicker by an average of 34 minutes in the propofol group (Sipe et al., 2002). In addition to providing more time efficient sedation and recovery, both patient and nurse satisfaction was greater among the propofol group. Nurses involved in this study reported that the level of sedation was adequate in 100% of propofol patients, whereas it was only adequate in 90% of the midazolam and meperidine patients (Sipe et al., 2002). When surveyed, 100% of patients in the propofol group were satisfied with their sedation, whereas five patients from the midazolam and meperidine group reported that their sedation could have been adjusted, either more or less (Sipe et al., 2002).

Synthesis of the Literature

From the literature reviewed for this project, all authors concluded that propofol was superior to other methods of sedation for quicker recovery and discharge times from the PACU. The decrease in time required for recovery may assist to decrease overall costs for patients and increase revenue for organizations, however, other factors such as anesthesia provider cost for administration of propofol versus RN administration of a benzodiazepine and an opioid must be considered. Both methods of sedation are safe and effective; however, patient satisfaction tends to be higher with propofol. Different organizations must conduct their own cost-benefit analysis to determine if the time saved is beneficial even with the cost of anesthesia provider administration of propofol.

CHAPTER III - METHODOLOGY

Target Outcomes

The target outcome of this study was to determine if decreased costs are seen in patients who are administered propofol for sedation rather than a benzodiazepine and opioid combination to facilitate colonoscopy in the GI endoscopy suite. Previous studies have indicated that using propofol for sedation quickens recovery of patients and prepares them for discharge sooner (Poulos et al., 2013; Sipe et al, 2002; Vargo et al., 2002). The outcome was determined by comparing the difference in discharge times, cost for provider administration of sedation (anesthesia provider or RN), and cost of drugs that are administered for sedation between patients who are sedated with propofol and those sedated with midazolam and fentanyl/meperidine in a GI endoscopy suite (See Appendix C and D, Logic Model and SWOT Analysis).

Setting

The clinical setting for this project was a GI endoscopy suite at a 215-bed acute care facility in rural Mississippi. This was an optimal setting to study the difference in discharge times between patients sedated with propofol versus the patients sedated with a benzodiazepine and opioid combination because, on a daily basis, many patients are seen in this particular GI endoscopy suite and are sedated with propofol or a benzodiazepine and opioid combination. At this clinical site, both EGDs and colonoscopies are performed daily, but for this project, only colonoscopies were studied.

Population and Sample

This project utilized a retrospective chart review of patients ASA physical status (PS) I or II and ages 18 to 55 (See Appendix E, ASA PS Classification). Based on a G-

Power Analysis, for a moderate effect size, a total of 176 charts were needed with 88 in each group (Buchner, Erdfelder, Faul, & Lang, 2007). These charts were selected from cases January 1, 2015, through December 31, 2015, in the GI endoscopy suite at the acute care facility mentioned above. Exclusion criteria included the following: ASA-PS III or IV, non-English speaking, pregnancy, allergy to eggs, fentanyl, or midazolam, previous neurological deficit, patients scheduled for colonoscopy and EGD in the same day, hospital inpatients undergoing colonoscopy, and patients undergoing emergency procedures. Sampling for this project was achieved by a convenience sample retrospective chart review of previous colonoscopies where all patient criteria had been met.

Barriers

A potential barrier to this project was disinterest of the gastroenterologists and GI endoscopy suite staff where this project took place. Without the interest and support of the providers who administer the daily bedside care, gaining approval for this project from administration would not have been possible. Educating the physicians and staff that the results of this project could help to improve efficiency and thereby reduce costs in the future were explained to help gain their interest. The goal of this project was to determine which sedation regimen is most cost-effective and provides quicker discharge times for patients as well as the potential for increased throughput in the department.

Statistical Analysis

For patients in the GI endoscopy suite undergoing colonoscopy, does the use of propofol for sedation versus the use of a benzodiazepine and an opioid combination decrease the overall cost for patients by decreasing the time until discharge from the post-

anesthesia care unit (PACU)? The null hypothesis was that there were no significant differences between the two groups on discharge times after completion of the colonoscopy. The hypothesis was that the propofol group would be discharged significantly quicker than the benzodiazepine and opioid combination group. Significance was set apriori at less than or equal to 0.05. For this study, a one-tailed independent *t*-test was used to determine statistical significance. An independent *t*-test is used for statistical analysis when two different groups (people, things, etc.) are being compared on the same dependent variable (Frey, 2016). A one-tailed *t*-test was used because of the directionality of the hypothesis. In this project, two different groups of patients were studied, and the particular interest was the difference in mean discharge times from PACU after sedation for colonoscopy. A chi-square test was performed to examine whether demographic data differences from each group may explain *t*-test results. Chi-square tests compare the occurrences in each category to the hypothesized outcome (Frey, 2016).

Collection of Data

In this project, the independent variable was the method of sedation, both propofol and benzodiazepine and opioid combination. The dependent variable was the discharge time from PACU, with the resulting cost associated with provider cost for administration of sedation, and cost of drugs used for sedation. Data collected were ASA PS, age, gender, type of sedation, time of sedation start and end, time of procedure start and end, time until discharge from PACU in minutes, cost of provider administration of sedation, and cost of each drug used for sedation. The time of procedure end to discharge from the PACU in minutes was the time that was analyzed. Once data were collected and

the statistical analysis was performed, results were presented to anesthesia providers in the facility where the project was conducted. An informal interview was conducted with anesthesia providers to gain their insight on results of this project and how to ensure the GI endoscopy suite can become both time and cost efficient.

CHAPTER IV – RESULTS

Analysis of Data

For this DNP project, 3595 charts were reviewed and 176 were included in this study per recommendation of the G power analysis previously performed by the researcher. The 176 charts were chosen by a convenience sample on a first come, first serve basis beginning with records from January 2015, until 88 charts meeting the inclusion criteria were in each group. Patients included in this project were ASA PS I or II with a minimum age of 18 years, a maximum age of 55 years, and a mean age of 45.9 years. There were 115 females and 61 males who met inclusion criteria. Of the 176 total patients included, 161 were ASA PS II and 15 were ASA PS I.

Table 1

Demographical Data

	Propofol group	Benzodiazepine and opioid group	Total
Gender			
Male	32	29	61 (34.7%)
Female	56	59	115 (65.3%)
ASA			
ASA PS I	4	11	15 (8.5%)
ASA PS II	84	77	161 (91.5%)
Age (in years)			
Minimum	18	20	
Maximum	55	55	
Mean	44.4	47.3	

A one-tailed independent sample *t*-test was utilized to determine differences between the two different methods of sedation since the researcher hypothesized that sedation with propofol would render faster discharge times from PACU. There were no significant outliers or missing data, and all data were both valid and reliable (i.e. no

incorrect data were transposed into statistical analysis). A statistically significant difference was found between the discharge times in minutes of the two different groups of patients (group propofol M= 80.99, SD= 15.36 and group benzodiazepine and opioid M= 84.58, SD= 13.42) ($p= 0.05$). The results of this analysis accept the hypothesis that propofol sedation for patients undergoing colonoscopy in the GI endoscopy suite renders quicker discharge times than does sedation with a benzodiazepine and an opioid.

Table 2

Mean Sedation, Procedure, and PACU Times

	Propofol	Benzodiazepine and opioid
Sedation time	23.53 minutes	9.16 minutes
Procedure time	16.93 minutes	23.59 minutes
PACU time	75.5 minutes	81.26 minutes

A chi-square (χ^2) test was performed on the demographical data of patients included in this project to ensure that differences in demographics did not affect results of the analysis. The demographical data included in the chi-square test were age, gender (male and female), and ASA PS (I and II) classification. Results of this test confirmed the null hypothesis that no statistically significant differences in demographical data were present that may have affected the difference in discharge times between the two sedation groups ($\chi^2(4)= 3.87$, $p< 0.05$).

Cost Analysis

A cost analysis was performed on variables of this DNP project including the cost of PACU time in minutes, cost of administration of sedation by anesthesia providers versus RNs, and cost of common drugs used for sedation. The costs included in Table 3 and Table 4 are the major costs but are only part of what is billed to patients after having

a colonoscopy. Additionally, CRNA salaries are higher than salaries of RNs, which can be a major cost to the facility. The visual cost analysis confirmed that administration of propofol by anesthesia providers is more costly ($640.38) than moderate sedation with a benzodiazepine and an opioid administered by a RN (414.77 to $415.77).

Upon further investigation of reimbursement for colonoscopies, the mean collected monies at the facility where this project was performed are $939.92 regardless of which type of sedation was provided. Even though the total dollar amount billed to the patient is more for anesthesia provided sedation with propofol ($640.38), the same amount is collected on colonoscopies with either type of sedation. Therefore, since propofol is more time efficient, there is potential that increased throughput of patients and overall increased number of patients able to be seen could result in increased revenue for the facility.

Table 3

MAC cost—provided by anesthesia providers

Variable	Cost per unit	Meantime/dose	Total mean cost
MAC	$250.00 flat fee then $50.00/15 minutes	9.16 minutes	$280.53
Propofol 10mg/ml (50ml)	$76.35	210mg	$76.35
PACU	$283.50 (indefinitely)	---	$283.50
Total Cost			$640.38
Average reimbursement for colonoscopies for both types of sedation is $939.92			

Table 4

Moderate sedation cost—provided by RNs

Variable	Cost per unit	Meantime/dose	Total mean cost
Moderate Sedation	$20.00/ 15 minutes	23.53 minutes	$31.37
Midazolam 2mg/2ml (2ml)	$16.65	7.01mg	$66.60
Meperidine 50mg/ml (1ml)	$17.15	69.55mg	$34.30
Fentanyl 50mcg/ml (2ml)	$16.65	130mcg	$33.30
PACU	$283.50 (indefinitely)	---	$283.50
Total Cost			$414.77 or $415.77
Average reimbursement for colonoscopies for both types of sedation is $939.92			

For moderate sedation either midazolam and meperidine or midazolam and fentanyl are given together.

Presentation of Results to Anesthesia Providers

After the statistical and cost analyses, results were informally presented to anesthesia providers in the facility where this project was performed. Anecdotal feedback provided valuable insight into how project findings were processed by the anesthesia providers. Anesthesia providers agreed that while MAC with propofol is necessary for certain patients, it may not be the most cost effective method of sedation in the GI endoscopy suite. Anesthesia provided sedation costs the facility more than does moderate sedation by RNs (CRNA salary versus RN salary). However, if propofol sedation is going to be delivered, patients should be discharged from PACU when discharge criteria are met so patient throughput is increased. Anesthesia providers agreed that if discharge time for propofol sedation was decreased, by adhering to protocols in place, more patients could be seen, and more revenue could be captured, particularly since reimbursement is the same for both methods of sedation.

Conclusion

The purpose of this DNP project was to determine which sedation regimen was both more time and cost efficient for patients undergoing colonoscopy in the GI endoscopy suite. Results of analyses were found to conclude that while propofol sedation was more time efficient, sedation with a benzodiazepine and opioid was more cost efficient. Although the literature suggested that propofol sedation is more time and cost efficient, there were limitations specific to the clinical site that may have influenced the results of this DNP project. These are presented in the Discussion.

CHAPTER V – DISCUSSION

Limitations

Limitations were present while conducting this project. One limiting factor was that the project was a retrospective chart review that utilized convenience samples of data. Charting errors, illegible handwriting of providers, and coding errors potentially resulted in data reliability issues. Other limiting factors of this project are clinical site-specific procedures. In the acute care facility where this project was conducted, most patients undergoing sedation for GI procedures were kept in PACU for 60 minutes or greater regardless of when discharge criteria were met. Additionally, the gastroenterologist who performed the procedure made rounds on each patient after his or her endoscopy procedure before he or she was allowed to be discharged. After discussion with PACU RNs at this facility, the procedure to keep patients for 60 minutes has changed since this project. Currently, PACU RNs are attempting to discharge patients sedated with propofol within 30 minutes if all discharge criteria are met and he or she has been seen by the gastroenterologist. Moderate sedation patients are still kept in PACU 60 minutes before discharge.

Benefits

Retrospective chart reviews are beneficial because all medical records are readily accessible and data is easily collected. Challenges of performing a prospective project are eliminated with gathering of data from previous cases. No additional costs, resources, time, or procedures were required of the staff in the GI endoscopy suite for facilitation of this project.

Theoretical Model Applied to This Project

The two frameworks that were used to guide this project were Duffy's Quality-Caring Model and cost efficiency. While providing high-quality care is first and foremost when caring for patients, APRNs, such as CRNAs, have to duty to also provide cost efficient care. Safety and value are now included in quality care (Duffy, 2015). In this project, both time and cost efficiency were compared for two different methods of sedation. While one method was found to be more time efficient, and the other method was found to be more cost efficient, the provider must determine which method is most suitable for the patient. Quality care and cost efficiency can be delivered together in most cases. However, there are times that the best plan for the patient is not the least expensive, and times when the most expensive is not the best plan. Each patient has to be evaluated for who he or she is and what he or she needs. Duffy's Quality-Caring Model epitomizes providing individualized care that is of highest quality for each patient. However, cost does affect patients, and performance of a cost-effective analysis allows the CRNA to deliver quality healthcare that is cost effective so that patients can afford to receive care that will facilitate his or her treatment or intervention. Delivery of high-quality, low-cost healthcare is a skill that is made possible with evidence-based practice.

Implications for Future Practice

Future projects should be conducted in this setting to determine if the change in PACU time before discharge, by following new unit protocols significantly impacted and decreased the mean propofol discharge time of 80.99 minutes. Cost of facility operations such as staffing costs (PACU RNs) and throughput of patients, 2.7 versus 1, may be significant enough for the facility to consider utilizing anesthesia providers for MAC for

all patients undergoing colonoscopies in the GI endoscopy suite. Decreased time until discharge with propofol could increase the overall number of patients in one day and increase the revenue gained for the facility. Additionally, examining patient satisfaction between the two sedation methods could be considered. Patient satisfaction drives reimbursement of healthcare facilities today, and increased satisfaction equals increased reimbursement (Berkowitz, 2016).

APPENDIX A – DNP Essentials

Table A1.

DNP Essentials

Essential I	Scientific Underpinnings for Practice	Conduction of a literature review, exploration of previous scientific knowledge, and conducting evidence-based study
Essential II	Organizational and Systems Leadership for Quality Improvement and Systems Thinking	Determination of which sedation decreases costs effects the entire systems of both the patient's experience and the anesthesia provider's care
Essential III	Clinical Scholarship and Analytical Methods for Evidence-Based Practice	Conduction of a literature review and a quantitative analysis
Essential IV	Information Systems/Technology and Patient Care Technology	Utilization of the facility's information system and cooperation with the IT department for retrieval of information
Essential V	Health Care Policy for Advocacy in Health Care	The results of this project will guide new policies in the GI endoscopy suite
Essential VI	Interprofessional Collaboration for Improving Patient and Population Health Outcomes	Collaboration with other healthcare professionals for the best sedation regimen to decrease cost and discharge times for colonoscopy patients in the GI endoscopy suite
Essential VII	Clinical Prevention and Population Health for Improving the Nation's Health	Determination of which sedation practice decreases costs and enhances recovery to gain compliance of

		patients that meet requirements for screening colonoscopies
Essential VIII	Advanced Nursing Practice	CRNAs are APRNs that deliver sedation to patients undergoing colonoscopy in the GI endoscopy suite

(AACN, 2006; Zaccagnini & White, 2014)

APPENDIX B – Literature Matrix

Author/Year/Title	Level/Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
Caperelli-White, L. and Urman, R. D. (2014). "Developing a moderate sedation policy: essential elements and evidence-based considerations."	Level 4/Grade D	Expert opinion/ Commentary	N/A	Policies and procedures should guide how and by whom sedation is performed. Policies should follow practice laws when determining which medications can be administered by whom and the type of monitoring equipment utilized. Pre-procedure assessments must be performed as well as post-procedure recovery plans implemented.	N/A	Each facility must establish their own policies and procedures regarding sedation practice that aligns with evidence-based practice and abides by practice laws for the disciplines.

Author/Year/Title	Level/Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
Cohen, L. B., and Benson, A. A. (2009). "Issues in Endoscopic Sedation."	Level 4/Grade D	Expert opinion/Commentary	N/A	MAC decreases time in the procedure for patients and increases their satisfaction with the procedure. Also, new drugs such as fospropofol and new methods such as computer assisted and patient controlled sedation are options for sedation methods in the GI lab.	N/A	More outcome studies need to be performed with endoscopist-directed sedation using propofol.

Author/Year/Title	Level/Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
Cohen, L. B., Hightower, C. D., Wood, D. A., Miller, K. M., and Aisenberg, J. (2004). "Moderate level sedation during endoscopy: a prospective study using low-dose propofol, meperidine/fentanyl, and midazolam."	Level 2+/ Grade C	Cohort study	100 consecutive patients, who met inclusion criteria, that presented either for EGD or colonoscopy and were sedated with propofol, midazolam, and fentanyl (or meperidine) were studied at intervals to determine the depth of sedation (mild, moderate, deep) that occurred during the procedure and if propofol could be administered without entering deep sedation.	Of the 100 patients studied, 76 colonoscopies and 26 EGDs, the surveyor found that 77% of patients were minimally sedated, 21% were moderately sedated, and only 2% entered deep sedation. They concluded that sedation with low-dose propofol, a narcotic, and midazolam produces moderate sedation.	This study only looked at one group of patients and did not have a comparison group. The study was limited to determine whether the addition of propofol to the sedation regimen of midazolam and a narcotic would actually decrease recovery time while allowing moderate sedation to ensue.	The researchers feel that the addition of propofol to midazolam and an opioid for sedation improves recovery and turnover times without the patient experiencing deep sedation. However, they recognize that randomized, controlled trials need to be performed before making conclusions.

Author/Year/Title	Level/Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
Das, S. and Ghosh, S. (2015). "Monitored anesthesia care: An overview."	Level 4/Grade D	Expert Opinion/Commentary	N/A	MAC is an anesthesia technique that leaves the patient spontaneously breathing and preserves airway reflexes while offering sedation and analgesia for procedures. This articles also provides information on propofol and dexmetatomidine, two popular drugs that are administered during MAC.	N/A	The author recommended that clinicians discern which patients are right for MAC and which are not. Also, research on different techniques for pediatric and geriatric populations needs to performed to offer a recommendation for those populations.

Author/Year/Title	Level/Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
Lera dos Santos, M. E., Maluf-Filho, F., Chaves, D. M., Matuguma, S. E., Ide, E., Luz, G. de O., de Souza, T. F., Pessorrusso, F. C. M., de Moura, E. G. H., and Sakai, P. (2013). "Deep sedation during gastrointestinal endoscopy: Propofol-fentanyl and midazolam-fentanyl regimens."	Level 1+/Grade A	Prospective, single-blind, randomized controlled trial.	200 patients were recruited and were randomly placed into 2 groups. Those 2 groups were sedation with either propofol and fentanyl or midazolam and fentanyl.	In the propofol and fentanyl group, times to induction of sedation, recovery, and discharge were shorter than the midazolam and fentanyl group. Deep sedation occurred in 25% of propofol and fentanyl group and 11% of midazolam and fentanyl group according to OAA/S scale. According to the BIS monitor, 11% of patients in the propofol and fentanyl group were deeply sedation compared to 7% of the midazolam and fentanyl group.	This study included only patients who fall into the ASA I or II class. Those patients are relatively healthy. This limits the validity of the study when discussing patients with comorbidities that make them ASA III or greater.	The recommendations of the authors of this study is that patients ASA I or II can be safely administered propofol and fentanyl for conscious sedation for upper endoscopy. They also state that the presence of an anesthesiologist is not mandatory for the administration of this drug.

Author/Year/Title	Level/Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
Mandel, J. E., Tanner, J. W., Lichtenstein, G. R., Metz, D. C., Katzka, D. A., Ginsberg, G. G., Kochman, M. L. (2008). "A randomized, controlled, double-blind trial of patient-controlled sedation with propofol/remifentanil versus midazolam/fentanyl for colonoscopy."	Level 1++/ Grade A	Randomized, controlled, double-blind trial.	Fifty patients undergoing colonoscopy were randomized to either midazolam and fentanyl group or propofol and remifentanil group administered by patient-controlled sedation.	Induction of sedation and recovery was significantly shorter in the propofol and remifentanil group than in the midazolam and fentanyl group.	Fixed ratios of narcotics and sedatives were used in this study, which allowed single syringe use. However, this does not allow for tailoring drug doses to patients.	The authors state that when applied to other procedures, the efficacy of this form of sedation is not known. However, forming an efficient sedation protocol could increase throughput of patients and decrease costs.

Author/Year/Title	Level/Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
McQuaid, K. R., and Laine, L. (2008). "A systematic review and meta-analysis of randomized, controlled trials of moderate sedation for routine endoscopic procedures."	Level 1-/ Grade A	Systematic review of randomized controlled trials	36 studies, all randomized controlled trials, were reviewed in this study. Databases EMBASE (1980-January 2007) and MEDLINE (1950 to January 2007) were searched for the RCTs.	36 studies were included in this systematic review, and many forms of sedation were reviewed. Sedation and recovery times were shorter with propofol sedation versus sedation with narcotics, benzodiazepines, combination of narcotics and benzodiazepines, or combination of narcotics and propofol.	Design, regimen, and outcome variability and poor methodologic quality (Jadad score <3 in 23/36 trials.	Controlled trials recommended to study lower doses of propofol plus narcotics and benzodiazepines versus propofol alone or benzodiazepines and narcotics.

Author/Year/Title	Level/Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
Obara, K., Haruma, K., Irisawa, A., Kaise, M., Gotoda, T., Sugiyama, M., Tanabe, S., Horiuchi, A., Fujita, N., Ozaki, M., Yoshida, M., Matsui, T., Ichinose, M., and Kaminishi, M. (2015). "Guidelines for sedation in gastroenterological endoscopy."	Level 4/ Grade D	Guideline/ Expert opinion/ Commentary	N/A	Initial guidelines for endoscopy sedation were created in Japan in 1999, updated in 2006, and updated again in 2010. They review the pharmacology of different drugs used for sedation for endoscopic procedures.	Several authors of this study received royalty, lecture fees, scholarships, and study group sponsorships from various pharmaceutical companies; however, no funding was received for this study.	The authors agree that change occurs rapidly in the medical field, so guidelines should be reviewed and changed accordingly every few years.

Author/Year/Title	Level/Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
Poulos, J. E., Kalogerinis, P. T., and Caudle, J. N. (2013). "Propofol compared with combination propofol or midazolam/fentanyl for endoscopy in a community setting."	Level 2+/ Grade C	Retrospective Cohort Study	Data from 951 patients at an outpatient endoscopy center from 2007 to 2010 were studied. Those patients were undergoing colonoscopy or EGD at the time.	Propofol sedation generated less time in the endoscopy unit, faster recovery, and faster discharge than did propofol, midazolam, and fentanyl, or midazolam and fentanyl.	Non-randomized, non-blinded study that utilized a retrospective chart review	This study recommends that various states follow their board of nursing regulations in administration of propofol before making any practice changes. Many BONs do not allow propofol to be administered by anyone not trained in rescue from deep sedation.

Author/Year/Title	Level/Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
Sipe, B. W., Rex, D. K., Latinovich, D., Overley, C., Kinser, K., Bratcher, L., and Kareke, D. (2002). "Propofol versus midazolam/meperidine for outpatient colonoscopy: administration by nurses supervised by endoscopists."	Level 1+/Grade A	Randomized, blinded trial	80 ASA class I or II outpatients undergoing colonoscopy were randomized to receive either propofol or midazolam and meperidine for sedation. All drugs were administered by nurses and supervised by the endoscopist	Patients sedated with propofol for colonoscopies had faster sedation times, deeper sedation, quicker recoveries, and were discharged sooner than patients sedated with midazolam and meperidine. 4 patients in the midazolam and meperidine group developed minor complications (hypotension, bradycardia, tachycardia) and 1 patient in the propofol group desaturated during an episode of epistaxis.	Single center study. Sedation, including propofol, performed by registered nurses supervised by endoscopists. Propofol typically administered by anesthesia providers. Only ASA I or II patients included.	This study recommends that propofol be used for sedation for colonoscopies because patients typically experience less pain than with other sedation methods.

Author/Year/Title	Level/Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
Vargo, J. J., Zuccaro Jr., G., Dumot, J. A., Shermock, K. M., Morrow, J. B., Conwell, D. L., Trolli, P. A., and Maurer, W. G. (2002). "Gastroenterologists-administered propofol versus meperidine and midazolam for advanced upper endoscopy: A prospective, randomized trial."	Level 1+/ Grade A	Prospective, single-blind, randomized controlled trial.	75 patients presenting for ERCP and EUS were randomly selected for sedation by propofol or midazolam and meperidine. All patients were similar in age, sex, BMI, ASA physical status, education, and sedation history.	Patients in the propofol sedation group had shorter recovery times and were quicker to recover to baseline activity and dietary level 24 hours post-procedure. However, the cost to administer propofol was higher than the administration of meperidine and midazolam.	Patients included in this study were ASA I or II and generally healthy. Patients ASA III or higher have more comorbidities and respond to medications differently. Also, in this study, propofol was administered by bolus injections instead of infusion which may cause variability in the plasma levels of the drug and sedation.	The authors of this study recommend further studies of nurse-administered propofol to decrease the cost of propofol sedation for patients. However, the policies of propofol administration must be reviewed carefully.

Author/Year/Title	Level/Grade	Design	Sample/Data Collection	Findings	Limitations	Recommendations
Watkins, T. J., Bonds, R. L., Hodges, K., Goettle, B. B., Dobson, D. A. M., and Maye, J. P. (2014). "Evaluation of postprocedure cognitive function using 3 distinct standard sedation regimens for endoscopic procedures."	Level 1+/Grade A	Prospective, single-blind, randomized trial	96 patients, both male, and female were included in this study. The sample was a convenience sample of patients presenting for colonoscopy at a medical center in Maryland.	This authors of this study concluded that propofol sedation has the least impact on postoperative cognitive dysfunction at both 24 and 48 hours post-procedure than the other methods of sedation studied, propofol plus fentanyl or midazolam plus fentanyl.	Only ASA I and II patients included, patients, were presented with questionnaires both before and after their procedure which could have familiarized them with the questions and answers, and the need to follow up with patients at both 24 and 48 hours post-procedure.	The authors of this study recommend that propofol alone may be optimal for endoscopy procedures when attempting to decrease POCD

APPENDIX C – Logic Model

Input	Activities	Output	Outcome-Short	Outcome-Intermediate	Outcome-Long Term
IT assistance to access colonoscopy charts in GI endoscopy suite from 2015 IRB approval Cost information of medications used for sedation Cost information regarding anesthesia provider administration of sedation Adherence to HIPAA guidelines	Literature review to determine sedation practices in GI endoscopy suite Statistical analysis of different sedation methods to determine of significance is present Presentation to gastroenterologists regarding cost-savings potential by administration of propofol for sedation	Results of statistical analysis of difference in sedation methods Cost savings regarding medication administration Cost of anesthesia provider administration of sedation versus RN administration	Discharge times from PACU after colonoscopy decreased Adaptation of new flow in GI endoscopy suite Change in attitudes of GI staff about sedation practices	Use of propofol exclusively for sedation for colonoscopies in GI endoscopy suite Costs reduced for GI department Costs reduced for patients undergoing colonoscopy	Sedation practice change implemented Propofol implemented for sedation for EGDs in the GI endoscopy suite Budget improved for GI department due to savings from colonoscopy sedation Patient satisfaction improved

APPENDIX D – SWOT Analysis

Strengths	Weaknesses
• No cost for the facility where project will be conducted • Retrospective chart review	• Only patients ASA I or II included • Unable to control variables • Documentation errors may be present
Opportunities	**Threats**
• Increase revenue for the facility • Decrease costs for the patient • Increase patient satisfaction • Improve patient safety • Engage providers in EBP	• Disinterest by gastroenterologists performing colonoscopies • Disinterest by administration of the organization • Cost for administration of propofol by anesthesia providers outweighs savings from decreased time until discharge from PACU

APPENDIX E – ASA PS Classification

Table A2.

ASA Physical Status Classification

ASA PS Classification	Description
ASA I	A normal healthy patient.
ASA II	A patient with mild systemic disease.
ASA III	A patient with severe systemic disease.
ASA IV	A patient with severe systemic disease that is a constant threat to life.
ASA V	A moribund patient who is not expected to survive without the operation.
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes.
E	Emergency surgery

(American Society of Anesthesiologists, 2014)

APPENDIX F – Data Collection Tool

APPENDIX F- DATA COLLECTION TOOL

Identification # _____

Procedure Date _____ Age _____ Sex _____

ASA classification _____

PMH:

Home Medications:

Allergies:

Type of Sedation: Moderate Sedation or MAC

Sedation start time	Sedation end time	Total time (minutes)

Procedure start time	Procedure end time	Total time (minutes)

PACU start time	PACU discharge time	Total time (minutes)

Procedure end time	PACU discharge time	Total time (minutes)

APPENDIX G – Data Collection Tool- Cost Analysis

Cost for sedation procedure: moderate sedation	
Cost for sedation procedure: MAC by anesthesia providers	
Cost of 50ml vial of propofol:	
Cost of 2ml vial of midazolam:	
Cost of 2ml vial of fentanyl:	
Cost of 50mg vial of meperidine:	
Cost of other medication (please specify):	
Cost of other medication (please specify):	
Reimbursement for colonoscopies:	

APPENDIX H – IRB Approval

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 17012502
PROJECT TITLE: Decreasing Cost in the GI Endoscopy Suite by Utilizing Best Sedation Practices
PROJECT TYPE: New Project
RESEARCHER(S): Casey Mancini, MSN, CRNA
COLLEGE/DIVISION: College of Nursing
DEPARTMENT: Systems Leadership and Health Outcomes
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Exempt Review Approval
PERIOD OF APPROVAL: 01/25/2017 to 01/24/2018
Lawrence A. Hosman, Ph.D.
Institutional Review Board

APPENDIX I – Letter of Support

Rush Foundation Hospital

1314 19th Avenue
Meridian, Mississippi 39301

601/483-0011

To Whom It May Concern:

I would like to take this opportunity to express my satisfaction with the work and services provided by Casey Mancini, CRNA at Rush.

Throughout her employment and work at Rush, Mrs. Mancini has demonstrated professionalism, industry knowledge, and the ability to adapt and grow with our facility. This letter will serve as notice to support her for the DNP Capstone Project completion. I confidently make this recommendation regarding her project looking at the use of versed/fentanyl vs. propofol sedation in the G.I. Lab.

Please feel free to contact me for any other questions or comments on this matter. I can be reached at 601-703-9687.

Respectfully,

Andy Wright MSN, CRNA
Director of Anesthesia
Rush Health Systems

Cc: Casey Mancini

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