The Case for Procedural Capnography

Stewart Wright

Marie-Elena Barry, DNP, Faculty Mentor and Chair
Carolyn Morrisey, DNP, Committee Member
Leon Graham, M.D., Preceptor

Patrick Robinson, PhD, Dean, School of Nursing and Health Sciences

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THE CASE FOR PROCEDURAL CAPNOGRAPHY

Abstract

In health care today, patient safety is a top priority. Regarding procedural sedation, one specific tool that improves patient safety is waveform capnography. The use of capnography can improve patient safety and outcomes. It offers a passive, yet continuous method to monitor a patient’s respiratory status while undergoing nurse-administered moderate sedation. Capnography gives indication much faster as compared to clinician recognition alone of respiratory, as well as, cardiac events. With overwhelming lack of proper training related to new technical devices such a capnography, a sound developmental training program regarding the use of capnography can positively effect patient safety and outcomes. This project attempts to answer the following question. In registered nurses administering procedural sedation (P), how does a nursing education program (I) regarding use of end-tidal CO2 monitoring decrease the occurrence of adverse events or outcomes by nursing staff's use of capnography (C), compared to the absence of end-tidal co2 monitoring (O), over a period of four weeks(T)? The development of an education program regarding capnography for eight registered nurses in an endoscopy unit proves that with the appropriate instructive intervention, nurses can effectively utilize the capnography device as a sixth vital sign. The knowledge gained by the educational initiative provides framework for policy development regarding use of capnography for all procedures that require sedation.

*Keywords: moderate sedation, capnography, respiratory depression, procedural sedation, capnography in endoscopy, etco2, NKCT*
The Case for Procedural Capnography

There is a global need to offer the best available patient care for the most affordable costs. Patient safety is a top priority to every health care institution in America (Agency for Healthcare Research and Quality, 2012). End-tidal carbon dioxide monitoring (etco2), or capnography, can offer health care institutions an additional safety net to prevent negative outcomes when patients undergo procedural sedation. Research supports the need of a standard to require etco2 monitoring for procedural sedation (Okwuone, 2016; Spiegel, 2013; Perry et al., 2012). Nurses, in the endoscopy unit, need guidance and direction to help identify the problem, perform research utilization, promote education, successfully implement, and evaluate the use of capnography using the plan, do, study, act (PDSA) model to promote project (Brown, 2014; Schaffer, Sandau, & Deidrick, 2012).

Clinically, the process of etco2 capnography shows, in real time, the status of patient’s overall condition, which in turn affects safety and outcomes by decreasing episodes adverse events and outcomes by early detection (Carlisle, 2014; Okwuone, 2016). The data collected from capnography can indicate cardiac and respiratory status (Arruda et al., 2009; Orlewicz, 2015). Spiegel (2013) says “inadequate ventilation of the patient- including failure of the anesthesiologist to adequately ventilate- traditionally accounted for the greatest number and most severe anesthesia- related catastrophes” (p. 23-24). It is a fact that any time a person is sedated, there are risks involved (L. Graham, personal communication, January 19, 2016). The risk can be as simple as nausea and vomiting, but can encompass cardiac conditions and respiratory depression (Orlewicz, 2015).
Problem Description

Currently, there is not any standard of care for the use of capnography in patients receiving procedural sedation from non-anesthesia personnel. The only standard monitoring required is non-invasive blood pressure, pulse/heart rate, pulse oximetry, and respiratory rate during procedural sedation. Capnography use has currently been discovered as a valuable tool to nursing, with a need for teaching and educating regarding the use and function to prevent adverse outcomes. The nurses have access to capnography devices in every area of that offers procedural sedation. The nurses have had no education, training or information regarding the devices and indications of use of the waveform capnography. The lack of training creates a knowledge gap that can be narrowed by simple education regarding the indication and use of etco2 monitoring.

The evidence-based, best practice initiative will be initiated in the endoscopy unit in the southeastern region of the United States. The endoscopy unit cares for approximately 8,000 endoscopy patients annually. There are nearly 20 patients daily in endoscopy that receives RN sedation without capnography with the chance for adverse events occurs daily. On a national level, the annual rate of reported avoidable adverse events due to not using capnography in procedural sedation is nearly 8%. This practice gap impacts over one million people per year (Perry et al., 2012).

Rationale

In the late 1970s, capnography was first adopted as a standard of care for anesthesia in the Netherlands (Spiegel, 2013). The use of end tidal carbon dioxide monitoring (etco2), throughout the world, has become the standard of care in anesthesia, but it is not currently a standard of care for nurse administered procedural sedation or moderate sedation.
Butas, & Spurlock, 2015). Capnography provides analysis of inspiratory and expiratory cycles of respiration offers a valuable tool to help determine appropriate treatment of patients receiving anesthesia (Ogg, 2012). With valued numeration and visual waveforms, etCO2 can help to preemptively warn of potential patient compromise.

Capnography is a tool used to detect events in patients undergoing procedural sedation such as hypoventilation, hyperventilation, apnea, perfusion, and pulmonary embolism to name a few. Adverse events can lead to hypoxia and lack of oxygen delivered to the patient. The addition of etCO2 into the advanced care life support (ACLS) algorithm in the past few years warrants its importance (Arruda et al. 2009; Spiegel, 2013).

Hypoxia is a life-threatening event that occurs when a patient is deprived of oxygen for a length of time. It is known is the most common type of adverse event associated with procedural sedation (Amornyotin, 2013). Hypoxia leads to worsening of conditions when it is undetected and allowed to progress. There are numerous studies that prove the frequency that hypoxia occurs in procedural sedation. Nurses need this tool to help prevent adverse events such as hypoxia, which can lead to stroke, heart attack, and even death. Capnography will help prevent these undesirable events from occurring when coupled with procedural sedation (Adams, Butas, & Spurlock, 2015).

In the awake and alert patient, normal capnography waveforms do not vary from person to person; however, in the sedated patient, capnographic waveforms can vary drastically depending on co-morbid conditions such as chronic obstructive pulmonary disease (COPD), heart disease, obstructive sleep apnea (OSA), obesity, patient procedural position, and induced sedative therapy. Capnography has been proven that early detection of respiratory depression is key to preventing life threatening conditions during procedural sedation. In many institutions, it
is not a standard of care for patients receiving procedural sedation to have end-tidal waveform capnography monitoring when non-anesthesia personnel provide sedation. The lack of use of capnography during registered nurse (RN) administered procedural sedation poses a risk for patients. The risk of respiratory depression is greater than 50% of the time when capnography is not implemented (Carlisle, 2014; Speigel, 2013). Respiratory depression and other life-threatening adverse events currently impact an excess of one million patients per year (Perry et al, 2013).

**Available Knowledge**

According to the American Society of Anesthesiologist (ASA), it is a standard of care that utilization of EtCO2 capnography for any patient receiving anesthesia (Spiegel, 2013). This is just cause for the standardization for all patients receiving procedural sedation to be monitored with capnography in addition to standard monitoring parameters. Capnography to prevent respiratory depression by early detection. Early detection can transform patient safety by offering another valuable detection system that alerts providers to a patient’s deteriorating status (Okwuone, 2016). Capnography is not expensive, nor does it require extra personnel to use. Adams et al. says, “capnography, as a tool to provide early warning of respiratory depression or airway compromise, has the potential to further decrease the incidence for serious adverse events due to inadvertent over sedation” (Adams et al., 2015, p. 14).

Studies have shown that in greater fifty percent of the time capnography can prevent adverse events by early detection. This necessitates the fact that capnography monitoring needs to be applied on every patient when being sedated. EtCO2 monitoring offers a definitive measure to assess patient status, and it indicates seventeen times more quickly signs of potential patient compromise than without (Spiegel, 2013; Ogg, 2012).
Within organization, there is a non-existent use of capnography. This presents a mode for an improvement in practice to maintain patient safety. Capnography will help to streamline care and increase safety for the patients. Spiegel goes on to say that “respiratory depression was 17.6 times more likely to be detected during sedation cases using capnography” (Spiegel, 2013, p.24). Adams et al. (2015) says, “capnography, as a tool to provide early warning of respiratory depression or airway compromise, has the potential to further decrease the incidence for serious adverse events due to inadvertent over sedation” (p. 14).

The ASA, recommend that patients receiving procedural sedation should have capnography use as a standard assessment tool to help in the early detection and prevention of adverse events and/or undesirable outcomes. The use of capnography is strongly recommended by the American Society of Anesthesiologists (ASA). In addition, the ASA recommends the use of capnography for all patient’s receiving sedation by non-anesthesia providers (Ogg, 2012; Okwuone, 2016).

Literature shows that hypoxia occurs in nearly seventy five percent of the time when patients undergo procedural sedation. Hypoxia occurs in seven out of every ten patients. Statistics such as this is unacceptable. Adverse events that may occur will be prevented with the use of capnography. Hypoxia is absolutely preventable if nurses are educated and informed about the use of wave capnography. This will be a one of a kind QI initiative. This technology is new to non-anesthesia providers and it will save lives and money.

Capnography is an extremely valuable tool. It is a standard of care for anesthesia providers nationwide, but outside of anesthesia, there is a lack of health care knowledge and education for nurses regarding its indication and use. There is support by various medical groups and societies that make it all the more important to add capnography to the routine monitoring
parameters for procedural sedation. The Anesthesia Patient Safety Foundation (ASPF), as well as the ASA, state a need for education and a quality improvement (QI) initiative related to the use of capnography for procedural sedation (Okwuone, 2016).

Presently, the patient population that presents for procedural sedation routinely suffers from numerous co-morbidities. Health problems include, but are not limited to hypertension, diabetes, thyroid disease, hyperlipidemia, renal disease, cardiovascular disease, cerebrovascular disease, asthma, lung disease, system immunity diseases, as well as obesity. Most patients presenting to the endoscopy unit have a combination of at least two of health problems with many undiagnosed uncontrolled problems such as obstructive sleep apnea. Many patients are not unaware they have any major medical problem, nor do they understand the risks of these problems.

There is a one hundred percent non-compliance rate to the use of capnography within the organization by registered nurses administering procedural sedation. This creates organizational concerns. Excluding anesthesia services, the areas of the hospital that utilize procedural sedation have the equipment and monitors on hand, but have not had the education or knowledge of the indication and need for capnography, nor the policy to enforce the use during procedural sedation.

With the goal of this for a new policy regarding the use of capnography to be developed. Such a policy for procedural sedation using capnography provides an extra safety net of awareness for clinicians to rely on as an adjunct treatment for the prevention of negative patient outcomes.
Specific Aims

This background information supports the need for a quality improvement initiative for registered nurses that administer procedural sedation in a rural endoscopy unit. There is a need to educate this population of nurses to the use and function of waveform capnography as a tool to improve clinical outcomes. The current practice of the nurses who administer procedural sedation does not include capnography. This is the target population for this PDSA QI initiative.

As a QI initiative, the use of the PSDA format best suits this project. The use of PSDA format is designed to help answer questions regarding an imposed intervention to see if the change will be actually give evidence to improvement of a result (Speroff & O'Connor, 2004). Those questions answered are typically as follows: “What is trying to be accomplished? How will we know that a change is an improvement? And what changes can we make that will result in improvement?” (Speroff & O’Connor, 2004, p.18). Speroff & O’Connor go on to say that PSDA defines relationship between in performance and the impact of results (2004).

The goal of this project is to determine if incorporating an educational tool regarding the purpose and use of capnography will increase the use in procedural sedation. This project aims to determine the need for education for nurses who administer procedural sedation. It is the duty of this manuscript to explain, describe, and discuss the use of the Nurses Knowledge about Capnography Tool (NKCT) as a means of measure to determine if educating nurses about capnography increases the use and understanding of the device technology for procedural sedation (Kiekkas, Stefannoplous, Konstantious, Bakalis, & Aretha, 2014).

The purpose of this project and quality improvement (QI) initiative, is to determine that by educating nurses to utilize capnography, policy generation regarding capnography use during procedural will institute a change in practice and improve outcomes. It is a simple tool to learn
that prevents adverse outcomes. It is a best practice measure that will close the practice gap. Okwuone (2016) stresses that best practice supports the need for all patients receiving sedation of any type to be monitored by capnography. This means 1--% of cases involving patients receiving procedural sedation will utilize capnography. To offer nurses the knowledge and confidence to better serve their patients, this QI project will create a policy for a practice change within a healthcare institution that could become a national standard of care.

Within the organization, the Quality Improvement (QI) initiative will provide the data necessary to promote policy creation regarding the use of end tidal capnography in procedural sedation. This policy creation can promote a trend that will be noted at the national level within one to two years. It is so important to express the significance of such a pilot initiative because of the preventive nature capnography has on patient safety. The use of capnography will revolutionize procedural sedation. It will minimize over-sedation and create a safer environment of care for the patients.

**Methods**

**Context**

There were a total of 8 participants all (100.0%) identified as female. The average age was 46.13 (SD = 12.124) years old with the most senior being 66 and the most junior being 32 for an age range of 34 years. Most participants (n = 5, 62.5%) identified as Non-Hispanic White followed by Black or African American (n = 2, 25.0%) and Biracial (n = 1, 3.2%). Many participants had an associate’s degree (n = 7, 87.5%) and one (12.5%) had a bachelor’s degree. For job title or license, most were a registered nurse with an Associate’s Degree in Nursing (n = 7, 87.5%) and the other was a registered nurse with a Bachelor’s of Science in Nursing (n = 1, 12.5%). Two participants reported certifications in ACLS/IVCS.
was 19.25 ($SD = 11.781$) years for a range of 35 years. Length of time in current position was 7.63 ($SD = 6.391$) years. None of the participants had prior education in capnography.

**Intervention**

Data collection derived from quantitative methods. Initially questionnaires were given out to the nurses involved in the administration of procedural sedation. Both the pre-test and post-test were obtained and reprinted with permission and copyright requirements were followed. Both demographic information and nurses knowledge regarding capnography was recorded. The demographic portion of the questionnaire looked at race, gender, work experience, educational level, and previous use of capnography.

The Nurses Knowledge about Capnography Test (NKCT) was utilized after validation and reliability were both verified (Kiekkas et al., 2014). The NKCT was given at both pre-intervention and post-intervention. The thirty question NKCT was written verbatim from the original work of Kiekkas et al., 2014. The questions were not altered from the original form. Prior permission to reuse the NKCT was obtained and copyright notice was given on each test sample. The Covidien Capnostream 20p device was utilized due to the institutional possession of these devices prior to this project initiation. It was discussed with the operating endoscopists and agreed upon that the only cases nurses were using the capnography on was colonoscopies.

**Study of the Intervention**

Eight nurses in the endoscopy unit were given a prescreening survey tool to access the knowledge, skills, and ability on the risks and/or benefits that capnography will offer the clinicians by improving patient safety and outcomes. This tool with was used with permission. It is known as the Nurses Knowledge about Capnography (NKCT) tool. It has validation and reliability. Collected data would be used to guide the development of an education plan. This
survey tool along with demographic data will be utilized to support the education and use of capnography in endoscopy.

An introduction and use of the devices in the endoscopy unit to promote learning and time will be provided for questions. The development, history, and current trends related to capnography will be discussed at length. The company representative will be on hand to aid in use and function of the capnography education. The sessions will last from 15-30 minutes daily with time for question and answer. Nurses will have the opportunity to teach back device operation learned from the educational session, to ask questions, and to share ideas. Upon completion of the first four weeks, a completion of the skills to utilize capnography will be assessed. This will be fulfilled by the development of competency checklist.

After week one, nurses will be instructed on the history of capnography and how-to utilize the device. Nurse feedback through question and answer (Q & A) regarding the capnography devices will occur daily. The feedback will be incorporated for goal achievement of a change in practice to use capnography system wide. Any questions asked by staff will be recorded and responded to alike. Education and intervention will be offered on an as needed basis. Education activities/ literature and expert witnessing to inform the nurses about capnography and the relationship of prevention of negative outcomes and early detection by capnography will be discussed.

At week one, Nurses will be utilizing capnography in all endoscopy procedures. This education the endoscopy staff nurses for a time frame of four weeks using supporting literature, open discussion time, and hands on learning. Every nurse utilized the capnography devices. Before and after each endoscopy case, a question and answer time was given to the nurses to allow for clarification on the device usage.
At week two, the act portion of the PSDA format will be followed to close the PDSA cycle. The development of a collaborative plan by way of policy and procedure will take place and team members will participate in formulating a plan for policy creation within the department.

At week four, the use of et CO2 capnography was noted at department wide with nurses utilizing and relying on the devices during procedural sedation. During this project, there was a 100 percent usage of the device in all procedures that required sedation in the endoscopy lab. The staff of the GI unit was greatly thanked for their hard work and perseverance through this project. There was a great passion in regards to learning about capnography. The staff voiced appreciation for the time and devotion to this project and they were personally thanked for participating.

**Measures**

The Nurses Knowledge Capnography Test (NKCT) was given at both pre-intervention and post-intervention. The tests consisted of four subscales and each item was scored as correct or incorrect and then added up for a percentage of correct items. When samples are related and the dependent variable is ratio, then a paired samples *t*-test is used (Freedman, Pisani, & Purves, 2011). Four paired samples tests were used on each pre/post subscale. The results indicated that there was a significant mean difference of 37.5 points on the Principles of Capnography Function from pre-intervention ($M = 38.88$, $SD = 13.280$) to post-intervention ($M = 76.38$, $SD = 7.120$) at $t (7) = -7.329$, $p < 0.001$. This means that the intervention raised knowledge of the principles of capnography function. Next, there was a significant mean difference of 42.18 points on the Conditions Affecting End Tidal CO2 Pressure from pre-intervention ($M = 9.37$, $SD = 12.938$) to post-intervention ($M = 51.56$, $SD = 8.100$) at $t (7) = -10.420$, $p < 0.001$. This means that the intervention raised knowledge of the conditions affecting end tidal CO2 pressure.
Then, there was a significant mean difference of 41.07 points on the Conditions Affecting Capnography Waveform from pre-intervention ($M = 25.00, SD = 27.266$) to post-intervention ($M = 66.07, SD = 15.152$) at $t(7) = -3.451, p = 0.011$. This means that the intervention raised knowledge of the conditions affecting capnography waveform. Finally, there was a significant mean difference of 22.91 points on the Indications for Capnographic Use from pre-intervention ($M = 64.58, SD = 27.368$) to post-intervention ($M = 87.50, SD = 11.785$) at $t(7) = -2.434, p = 0.045$. This means that the intervention raised knowledge of the indications for capnographic use. There was not a single adverse event noted during this time of the project. This is owed to the addition of capnography.

**Analysis**

Quantitative measures were used to validate the before and after test. As previously noted, the purpose to educate nurses regarding the use and function of capnography was proved by means of the NKCT. With the results of this project in mind, it should be noted that there is literary support that validates the findings. It should also be noted that patient safety and outcome will be improved through the education of nurses and the initiation of capnography during procedural sedation.

**Ethical Considerations**

With appreciation and acknowledgement of the administration, nurses, and endoscopists involved, many thanks were extended for participating. As described in this manuscript, it is universally noted that observation of a patient’s health status while under the effects of procedural sedation is very important. It is also acknowledged that the cooperation of physicians and nurses alike contribute to the positive outcomes in all patient care. With this in mind, the use of pulse, blood pressure, pulse oximetry, and respiratory rate were determined to be standard
monitoring parameters within the institution for procedural sedation. The addition of capnography was viewed in a negative connotation until proper education was taught to the nurses. All concerns were addressed prior to implementation of this project with the institutional ethics board and the IRB process.

**Results**

Within the endoscopy suite, initially there was a 0% usage rate of capnography during nurse administered procedural sedation. It was the goal to have a 100% use of capnography by nurses. With an 8% occurrence rate of negative outcomes annually, there is room for improvement of adverse events and outcomes. This will be achieved by the implementation of etCO2 capnography. Oridion (n.d.) claimed greater than 50 percent of negative respiratory incidents can be prevented using capnography (p. 2, para. 2). There is not a recognized national standard or mandate regarding the use of capnography, and nurses do not understand the full role and purpose of capnography; however, with the introduction of this project and promotion of capnography, adverse outcomes can be reduced (Arudda, 2009; Okwuone, 2016; Spiegel, 2013).

During the four week project initiative, the use of capnography was trended. A daily regimented hands-on learning and teaching was used. Appropriate literature, hands on training, and active bedside monitoring was employed to encourage use and familiarity for the nursing personnel. A field technician and representative of the capnography device company (Covidien) were actively available for support etCO2 capnography use. The results were unanimous that educating nurses about capnography increases use of the device. Literature supports the notion that adding capnography will improve patient safety.
Discussion

Summary

Nurses provide great care for patients; however, the stresses of the professional and subjectivity of patient assessments made by nurses can be different depending on the level of knowledge a nurse. It is also understood that it is human nature to be resistant to change and such an initiative will create resistance; however with the instruction component of this project, nurses taught about capnography and hypoxia prevention.

Knowledge varies among nurses regarding capnography. Holly (2014) says anecdotal experiences are relevant and can be used to implement the process. Data obtained by questionnaire, field notes, surveys, and pre and post intervention has been reported. As the final days of the process came to an end, the goal of this initiative, to formulate an interdepartmental policy and use the nurses from endoscopy to help teach other departments, was not met. Due to time constraints, this topic for policy formation would need more time to formulate a policy after institutional IRB review of this project. The final survey results were compared to the initial results was consistent test-retest reliability (Dienz & Alsaffar, 2013). This offers validity to the comparison between the pretest and posttest results regarding the knowledge about capnography.

Interpretation

The change in current practice to incorporate the use of waveform capnography in all cases of procedural sedation will be the result after a full four week period with the final goal of policy formation that mandates the use of capnography for all procedural sedation within the organization. A plan, do, study, act (PDSA) design was followed. This best fits the movement to incorporate the use of etCO2 monitoring in procedural sedation. The PDSA design links the relationship between the process in question and the changes within an organization needed to
institute the appropriate quality improvement (Speroff & O’Connor, 2004). The PDSA should answer the purpose, the change needed, and how to promote the change to gain the improvement. This process is related to problems in real world clinical situations.

The selected area of the endoscopy unit has been chosen for the initial practice initiative to implement etCO2 monitoring during procedural sedation. The high volume of endoscopic procedures, as well as the willingness of the nurses to engage in the subject matter offers the stimulus to start with this group. Stakeholders identified are nurses, physicians, patients, organizational administrators, and vendors of the products being utilized to monitor etCO2. It is very important to involve each of the stakeholders into the action process to better implement the change (Holly, 2014).

The desire of the nurses to offer better care and improve outcomes of the patient receiving procedural sedation is a driving force for this implementation (E. Riddle, personal communication, February 24, 2016). Institutional support for the use and implementation of etCO2 monitoring is great. The use of capnography as a tool to improve patient safety and outcomes gains the respect of physicians and administration. The directors of the Emergency, Endoscopy, Cardiac Catheterization Laboratory, and any other location where procedural sedation is offered.

**Limitations of the Project**

There were potential limitations to implementing this initiative. Staffing concerns regarding teaching and educational time during normal business hours can impede the project as well as the normal workflow and productivity of the respective department. With a busy schedule, not allowing staff to have enough time to achieve a complete understanding can undermine the project. It was the goal to teach each morning a simple aspect of capnography
during the first week of the four-week implementation. The project will continue to prosper throughout the institution.

Technology has revolutionized the ability for healthcare providers to monitor patients who require sedation. When one exhales, carbon dioxide (CO2) is blown out of the respiratory tract into the atmosphere. The ability to detect exhaled air and measure it is called capnography. While it is required for all anesthesia professionals to use capnography, it is only a recommendation for nurses offering procedural sedation in practice areas such as endoscopy, to utilize as a tool for preventing negative patient outcomes such as respiratory depression, respiratory failure, worsening cardiac function, and death.

Knowing and understanding this information helps to arrive at the point of discussion for this initiative. Due to this being the infancy of such a policy origination for the use of capnography, it must be understood the positive impact waveform capnography can have on patient safety and outcomes. This is an absolute ground breaking movement to form new policy as a result of DNP intervention.

**Unexpected Outcomes and Findings**

After the completion of this project, there was a adverse event that occurred in the endoscopy department. This event was caused by undetected respiratory depression and prolonged apnea during procedural sedation. Due to the lack of an official departmental policy requiring the use of capnography, it was not in use on this procedure. It was found to be due to the resistance to change by the nurses involved. With the obvious resistance to change and the occurrence of this event, nursing leadership aggressively responded with a new policy was
created that requires the use of capnography for all patients receiving procedural sedation or endotracheal intubation institution wide. This finding solidifies the need of a standard of care and policy formation regarding capnography in procedural sedation.

Conclusions

Procedural sedation encompasses a large number of cases in the United States. As medical breakthroughs have been made in recent years regarding the safety and security of patient wellbeing, practices have begun to embrace the changes associated with those breakthroughs. Capnographic monitoring has become a topic of discussion among many medical societies. Its use and function in procedural sedation offers faster recognition of life-threatening conditions can arise.

Peer reviewed articles providing hard evidence that capnography can improve healthcare delivery for procedural sedation has been referenced, however, it should be noted that there are only a limited quantity of research articles that address the issue of nurses’ views regarding capnography and its clinical importance. The need for education and staff involvement is a necessity. This offers support for the relevance of the PICOT question in this paper.

Capnography has a clinical relevance in procedural sedation. The intent of this paper has been to distinguish the clinical importance of nurses’ knowledge about capnography and the indicated use of capnography while-administering procedural sedation.

To great depths, many reputable sources of literature have been researched to deliver a better understanding of end-tidal waveform capnography and its clinical relevance during procedural sedation. The results of this project prove that by educating nurses of the importance that capnography plays in procedural sedation, the use of capnography is increased. Evidence has been presented and the postulation of this project has been proven that educating nurses to the
use of capnography will decrease the negative outcomes of patients undergoing procedural sedation. During the implementation of this project, capnography effectively help to prevent multiple episodes of negative outcomes. After the completion of this project, evidence shows the overwhelming need for capnography in all procedural sedation.
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Statement of Original Work and Signature

I have read, understood, and abided by Capella University of Academic Honesty and Integrity (3.01.01) and Research Misconduct Policy (3.03.06), including the Policy Statements, Rationale, and Definitions for these entire processes during my enrollment at Capella.

I attest that this capstone project is my own work. Where I have used the ideas or words of others, I have paraphrased, summarized, or used direct quotes following the guidelines set forth in the APA Publication Manual.

Learner Name and Date:  Stewart A. Wright  5/31/2017

Mentor name, school:  Marie-Elena Barry, Capella University