AN EXPLORATION OF CERTIFIED REGISTERED NURSE ANESTHETISTS’ KNOWLEDGE AND USE OF AROMATHERAPY FOR TREATMENT OF POST-OPERATIVE NAUSEA AND VOMITING

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By

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ABSTRACT

Post-operative nausea and vomiting (PONV) is a common side effect of anesthesia. Despite the current treatment regimen of medications, many patients still suffer from PONV. Therefore, new techniques and treatments for PONV are needed. Aromatherapy offers a potential treatment with a low cost and minimal side effects. To determine the level of knowledge about aromatherapy, and if it is being used in practice, a survey of certified registered nurse anesthetists (CRNAs) was conducted. This study found that only three percent (3%) of the CRNA respondents had received formal education on aromatherapy for PONV. Further, it was determined that although ninety-two percent (92%) of respondents had used inhalation of isopropyl alcohol as a treatment for PONV, only eight percent (8%) of respondents stated that they had used essential oils for relief from PONV. Aromatherapy is an option for treating PONV and CRNAs should have more educational opportunities on aromatherapy for PONV to allow them to feel comfortable providing this safe and minimally invasive treatment option to patients.
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CHAPTER I

Introduction

Post-Operative nausea and vomiting (PONV) is one of the most common complications of general anesthesia. Despite new medications and treatments, studies have shown that this complication continues to prolong post-anesthesia care room stays and decrease patient satisfaction scores.\textsuperscript{1} Studies have shown that aromatherapy may provide relief from PONV.\textsuperscript{2-4}

Research Problem

Aromatherapy has been shown to provide relief from PONV\textsuperscript{4} in lieu of using costly medications that may contribute side effects of their own. Despite the low cost and minimal side effects, Certified Registered Nurse Anesthetists’ knowledge and application of aromatherapy for PONV, remains unknown.

Research Purpose

The purpose of this study is to explore the knowledge and use of aromatherapy for PONV as a potential alternative, or adjunct, to conventional treatments among Certified Registered Nurse Anesthetists.
Research Questions

1. Are Certified Registered Nurse Anesthetists knowledgeable about the use of aromatherapy for treatment of post-operative nausea and vomiting?

2. Do Certified Registered Nurse Anesthetists utilize aromatherapy for post-operative nausea and vomiting?

Definitions

For the purpose of this study, the following terms and definitions were used.

Conceptual Definitions

1. Aromatherapy - the use of essential oils.

2. Knowledge - the fact or condition of knowing something with familiarity gained through experience or association\(^5\)

3. Utilize - to make use of.\(^6\)

Operational Definitions

1. Aromatherapy for Post-Operative Nausea and Vomiting - The use of aromatherapy among Certified Registered Nurse Anesthetists (CRNA) will be measured with questions on the Post-Operative Nausea and Aromatherapy Assessment Survey (PONAAS). Four questions will measure CRNA knowledge regarding aromatherapy as an option for PONV. Eight questions will identify if CRNA’s are utilizing aromatherapy for PONV, and the quality of relief provided by aromatherapy.
2. Knowledge- knowledge will be measured using the PONAAS with questions pertaining to basic essential oil concepts including administration routes, uses, and mechanisms of action. Four questions will also be asked about prior aromatherapy education among CRNAs.

3. Utilize- The utilization of aromatherapy for the treatment of PONV among CRNAs will be measured with questions on the PONAAS. Questions will quantify aromatherapy usage by CRNAs for PONV.
CHAPTER II

Review of Literature

Postoperative nausea and vomiting (PONV) is a common complication of anesthesia. Aromatherapy has been shown to provide relief from PONV. This review summarizes the current research related to the efficacy of aromatherapy for PONV. Aromatherapy, nausea, and vomiting are discussed in detail.

Postoperative Nausea and Vomiting

Nausea and vomiting within the first twenty-four (24) hours of anesthesia is commonly referred to as postoperative nausea and vomiting (PONV). PONV can have deleterious effects on the patient and may significantly impact the patients’ surgical experience. Complications from PONV can include dehydration, aspiration, airway compromise, wound dehiscence, hypertension, increased intracranial pressure, esophageal tears and electrolyte imbalances.\(^7\) PONV occurs in twenty to thirty percent (20%-30%) of the general population undergoing anesthesia and can be as high as eighty percent (80%) in persons deemed high risk.\(^8,9\) PONV increases the duration of post anesthesia care room stays an average of twenty-five to forty-eight (25-48) minutes,\(^10\) therefore increasing costs for providers, hospitals, and patients.\(^1\) New methods of minimizing PONV are needed to keep patients’ safe from complications, maintain comfortability, and control cost peri-operatively. Aromatherapy could prove to be a less invasive and cost-effective way to control PONV and its potentially negative outcomes.
Nausea and Vomiting

Nausea is a subjective, unpleasant sensation that may be a prodrome to vomiting. There are multiple pathways that influence nausea and vomiting. Not every patient that experiences nausea will experience vomiting. The physiology behind nausea is not well understood, but it is believed to follow a similar pathway as vomiting without the expulsion of gastric contents.

The first pathway of nausea and vomiting, the absorption of toxins and drugs into the blood, is the pathway that is most closely related to anesthesia. Once absorbed, these substances are then carried to an area in the brain called the chemoreceptor trigger zone (CRTZ). The CRTZ is located in the area postrema, which is positioned on the inferior portion of the fourth ventricle. In the CRTZ, the brain lacks a blood brain barrier, an endothelial layer of cells designed to prevent passage of toxins into the brain, without which the CRTZ is able to detect toxins in the blood. Detection of emesis-inducing substances, or neurotransmitters including dopamine, serotonin, acetylcholine, and histamines in this area leads to stimulation of the the nucleus tractus solitarius (NTS), in the medulla, to initiate the sequence of vomiting. The specific receptors for the mentioned neurotransmitters within the CRTZ, may be targeted to prevent nausea and vomiting.
Another mechanism that can induce nausea is the ingestion of toxic chemicals into the gastrointestinal (GI) tract. These substances trigger enterochromaffin cells, located within the walls of the GI tract, to release a substance called serotonin (5-HT). Serotonin is released onto vagal and sympathetic afferent nerve endings which travel to the NTS in the medulla, thereby initiating the vomiting reflex.

The final mechanism of activation of the vomiting process is via the nerve endings in the middle ear. This is caused by the perceived or actual rhythm of motion, or rapid change of direction, commonly known as motion sickness. Impulses from the middle ear travel on cranial nerve VIII, the vestibulocochlear nerve, to the CRTZ, and finally to the NTS in the medulla to trigger the feeling of nausea and/or vomiting.
Vomiting is the act by which the body, and specifically the GI tract, eliminates gastric and intestinal contents. At this point the NTS has received impulses via one of the above mechanisms and initiates the sequencing of vomiting. Electrical signals from the NTS in the medulla, travel via cranial nerves V, VII, IX, X, and XII to specific places in the GI tract including the lower esophageal sphincter, the gastric fundus, and the small intestine. These impulses may cause reverse peristalsis in the small intestine, possibly as far as the ileum. This reverse peristalsis fills the stomach and duodenum with gastric contents. Afferent impulses may then be sent to the NTS, which in turn coordinates the sequence of impulses from other subnuclei that each control a specific portion of the gastrointestinal and respiratory centers. This specific sequencing of impulses triggers behaviors and actions including the relaxation of the lower esophageal sphincter, closing of the glottis, lifting of the soft palate, contraction of the abdomen and abdominal walls to increase intra-abdominal pressure, and the forceful contraction of the respiratory accessory muscles to expel gastrointestinal contents.

**Risk Factors for Post-Operative Nausea and Vomiting**

PONV should be viewed as a multifactorial concept rather than a stand-alone process. Anesthetics, along with patient specific characteristics, provide the framework for PONV. Given the annual prevalence of PONV, many studies have focused on identifying and quantifying the risk factors for PONV. There are many risk factors that contribute to PONV including gender, smoking status, history of PONV or motion sickness, post-operative opioid administration, volatile anesthetics, use of nitrous oxide, type of surgery, and duration of surgery.
The strongest risk factor for predicting which patients will experience PONV is gender, with women being at a much higher risk of developing PONV than their male counterparts. The reason for this increased risk is not well understood at this time. For example, studies have shown that the risk for PONV is not affected by hormonal fluctuations during the menstrual cycle or menopause.

While smoking has been universally heralded as detrimental to patients due to a number of increased surgical risk factors, smoking has been shown to provide protection from PONV. Chimbira et al. showed a statistically significant reduction of PONV in smokers on the first day post anesthesia. The mechanism for this effect is unknown but is thought to be due to chronic exposure to cigarette smoke. This chronic exposure to hydrocarbons is postulated to produce microsomal changes in the cytochrome P-450 liver enzymes such as CYP1A2 and CYP2E1. Induction of CYP2E1 can increase the enzyme by up to three times the normal level. Many anesthetic drugs are metabolized by these CYP450 enzymes leading to an increased metabolism of these medications and possibly fewer postoperative complications. Another hypothesis states that acute exposure to substances in cigarette smoke, particularly carbon monoxide, may have an antiemetic effect of their own. One other hypothesis states that it is the upregulation of nicotinic acetylcholine receptors in the brain that help to protect the patient from PONV.

Volatile anesthetics have been shown to be the strongest medications related to PONV. Apfel et al. found that volatile anesthetics were responsible for an increased risk of PONV within the first two hours postoperatively. All volatile anesthetics were implicated by this study which also showed that total intravenous anesthesia with Propofol infusion was responsible for a much lower incidence of PONV.
Post-operative administration of opioids has been implicated as another anesthesia related risk factor for the development of PONV. One theory states that opioids act upon the Mu receptors in the peripheral nervous system, slowing gastric emptying and muscle tone. This in turn leads to an increase in gastric distention and the activation of visceral mechanoreceptors which may initiate PONV. Roberts et al. found a strong correlation between the amount of opioid administered and the risk for developing PONV. This study found that the relationship is not linear but logarithmic. Each time the dose of opioids administered was halved, the risk for the development of PONV decreased by six percent.

Apfel et al. developed a simplified PONV risk assessment tool to be used when assessing patients. This tool, which has been validated by successive studies, gives equal importance to four categories, female gender, non-smoker, history of motion sickness or PONV, and postoperative opioid administration. If the patient has zero or one risk factor the risk of developing PONV is between ten to thirty percent (10-30%). If the patient presents with two of more of these risk factors the risk of PONV increases to between forty and eighty percent (40-80%). In a successive study, Koivuranta et al. added, “duration of anesthesia of more than 60 minutes,” as another risk factor. Nausea and vomiting risk assessment tools like these may be used by providers to stratify the risk of PONV for each patient and individualize PONV treatment accordingly.

Current Management of Nausea and Vomiting

Nausea and vomiting are multifactorial in their origin and thus may be treated in several different manners. Medications are currently the first line treatment for PONV. Most patients are
preoperatively assessed for risk factors and treated prophylactically. The preoperative or intraoperative administration of antiemetics to prevent nausea and vomiting is common among practitioners to reduce the incidence of PONV.

Ondansetron, a serotonin antagonist, is commonly one of the first antiemetics used for prophylaxis and treatment of nausea and vomiting. This medication does not affect dopamine, histamine, acetylcholine or other receptors in the CRTZ. Subsequently, if another one of these receptors is being activated and producing nausea, this medication will not be effective. Ondansetron has been proven to be effective as a prophylactic antiemetic with a twenty percent (20%) reduction in risk of PONV compared to baseline. However, Ondansetron, and all serotonin antagonists, are not useful in motion-induced nausea or in treating PONV that is caused by vestibulocochlear stimulation. Compared to other antiemetic medications, there are fewer side effects with Ondansetron, but this medication is not without significant side effects including headache, diarrhea, and prolongation of the QT interval on electrocardiogram.

Dexamethasone, a glucocorticosteroid, may also be used as a prophylactic antiemetic. The exact mechanism of action is unclear but it is believed to inhibit prostaglandin synthesis and control endorphin release. The efficacy is similar to that of Ondansetron. The side effect profile is minimal with single dose administration, although both diabetic and non-diabetic patients may experience an increase in blood glucose levels of forty to forty-three (40-43) mg/dL, three to four hours after administration. This can have a significant impact on infections and wound healing. Prophylactic treatment with Ondansetron and Dexamethasone may decrease PONV up to forty percent (40%).

Other medications that may be used to treat PONV include, metoclopramide, scopolamine, aprepitant, and droperidol. Metoclopramide is a dopaminergic antagonist, exerting
its effects by stimulating gastric and intestinal motility, and also by exerting its anti-
dopaminergic effects directly onto the CRTZ. Scopolamine is an anticholinergic, it is
hypothesized to work by exerting its effects on the medulla, blocking vestibular impulses from
the inner ear that are known to cause motion sickness. Aprepitant functions as a neurokinin
antagonist (NK-1 receptor), helping to alleviate the emetic effects of substance P. Droperidol is
a butyrophenone, exerting its effects on the dopamine receptors in the CRTZ.

Often when using conventional medications to control nausea, a multimodal treatment is
necessary due to the multitude of triggering receptors. Although these treatments have been
proven effective at treating PONV negative side effects can occur. These treatments can increase
the risks of sedation, hypotension, and effect cardiac conduction.

What is Aromatherapy

Aromatherapy refers to the use of therapeutic fragrant substances, derived from plants,
and used for the treatment of an ailment. Traditionally, aromatherapy is inhaled through the
nose, where it may pass by the olfactory bulb and generate its effects. Aromatherapy is classified
as a form of complementary and alternative medicine that may be used for a variety of ailments
including nausea and vomiting, anxiety, pain, fatigue, stress, and insomnia. Essential oils (EO)
are extracted from fragrant plants using steam distillation or cold pressing and are commonly
used for aromatherapy. EO may be diffused into the air, placed in warm bath water, used on
compresses, or mixed with a carrier oil to be applied topically to the skin.

Previous studies have used a multitude of inhalational devices for administration of
aromatherapy including inhalers like QuseEase™, drops of essential oils on 2”x2” gauze pads,
and seventy percent (70%) isopropyl alcohol (IPA) pads without essential oils. Although IPA is not categorized as aromatherapy, it has been found to be effective as an antiemetic. Isopropyl alcohol is not considered an essential oil because it is not derived from plants. The scent of IPA can be unpleasant and harsh but has been proven effective in treating PONV. The effectiveness of IPA, the accessibility of IPA pads within the hospital, and simplicity of use make this an attractive option for medical providers treating PONV.

The exact mechanism of action of aromatherapy is unknown. Ziemba et al. studied the effects of plant materials on the 5-HT₃A receptor, the same receptor antagonized by the anti-emetic Ondansetron. Ziemba et al. found that gingerols, the active components of ginger, to be a non-competitive antagonist at the 5-HT₃A receptor. Ginger was found to have a very low effect dosing which was in the micromolar range. They also found that citronellol, a component in many essential oils, was equally as effective as gingerols at antagonizing the 5-HT₃A receptor. Gingerol and citronellol are both found in ginger oil and perhaps are the cause of its anti-emetic effects.

There are several hypotheses that have been suggested for the delivery of the volatile EO molecules to the effect site. One of these hypotheses is that volatile EO molecules, once inhaled, are recognized by CN I, the olfactory nerve, and signals are then sent to the brain. More molecules then pass into the blood stream via the lungs and provide effects directly on the brain. Essential oils are lipophilic in nature and some have been found to cross the blood brain barrier. They have very low effect dosing which has been found to be in the micromolar concentration range. Malcom found that lavender oil can have the same anxiolytic effects, on the 5HT₁A receptor in the hippocampus, as escitalopram, a common anxiolytic medication. More studies need to be performed to determine the exact mechanism of action of essential oils. The
mechanism of action of IPA is not known but it has been postulated to work in a similar manner as essential oils.

*Aromatherapy for Post-Operative Nausea and Vomiting*

**Effectiveness**

Over the past few decades aromatherapy has become a very popular treatment option in Europe and the United States for many ailments including nausea and vomiting, however, few studies have been performed to determine the effectiveness of aromatherapy for PONV. Hunt et al. performed a prospective 4-arm placebo clinical trial aimed at examining the effectiveness of two different essential oils, alcohol, and a placebo on PONV. They used a sample size of one thousand and fifty-one (1,151) patients with three hundred and one (301)(26.2%) of those patients reporting PONV. These patients were then randomly placed into one of four groups, each with an oil, alcohol, or placebo. The study found that the patients in the ginger oil and essential oil blend groups had significantly higher reductions in PONV (67.1% and 82.4% respectively) than IPA and the placebo (51.3% and 39.7%).

Another study of the effectiveness of aromatherapy on PONV was performed by Adib-Hajbaghery et al. This study looked at the effects of ginger aromatherapy for post-nephrectomy patients suffering from nausea and vomiting. In this study, one hundred and twenty (120) patients were all anesthetized in a standardized manner, using midazolam two (2) mg, fentanyl one (1) mcg/kg, thiopental sodium four (4) mg/kg, and Isoflurane one percent (1%). Participants were then assigned to one of two study groups, those that received ginger or saline. Two drops of ginger oil
or saline were placed on a 2x2 gauze and attached to the collar of the patient gown. This was repeated every thirty (30) minutes for two subsequent hours and measurements of nausea were taken at each interval. At intervals two through five (2-5) the ginger group was found to have significantly less nausea and vomiting than the placebo group. The placebo group also had significantly more vomiting episodes and thus received higher doses of ondansetron than the group treated with ginger essential oil.32

A study performed by Stallings-Welden et al.33 measured the effectiveness of aromatherapy against the effectiveness of standard antiemetic treatment for PONV, and post discharge nausea and vomiting (PDNV). They used an aromatherapy blend called QueasEASE™, a commercially available blend of peppermint, spearmint, ginger, and lavender oils placed in an inhaler for ease of use, as the aromatherapy treatment. Two hundred and twenty-one patients were enrolled in the study and placed in a standard care group, who received traditional antiemetic medications upon complaint of PONV, or an aromatherapy group. The standard care group was administered medications that the anesthesiologist determined was appropriate for each individual patient. The aromatherapy group received a QueaseEASE™ inhaler upon complaint of PONV. This study found no significant differences in the effectiveness or the timeliness of the treatments for PONV. Of the patients who were found to have PDNV, aromatherapy was found to be one hundred percent (100%) effective while standard care was found to be only sixty-seven percent (67%) effective.33

A 2019 study by Karaman et al.,38 looked at the effectiveness of various EOs on PONV. This four-arm, randomized, placebo controlled study had one hundred and eighty-four (184) participants who had complaints of PONV after general anesthesia. There were no statistical differences in the anesthetic utilized, surgery performed, or opioids used. Upon complaint of PONV, patients were placed in one of four groups including ginger oil, lavender oil, rose oil, and
placebo. An EO or a placebo were placed on a 5cm x 5cm gauze pad by a CRNA in the recovery room. Nausea and vomiting scores were measured at zero (0) min, fifteen (15) min, and forty (40) min. Karaman et al. found a statistically significant reduction in nausea and vomiting in both the ginger and lavender oil groups at both the fifteen (15) and forty (40) minute intervals. Rose oil was not found to be statistically different from placebo.

In a few studies, aromatherapy has been proven to have a significantly faster onset of effectiveness compared to current antiemetic medications. Cotton et al. compared the effectiveness of IPA and intravenous (IV) Ondansetron in seventy-two (72) patients. They found that IPA worked significantly faster than IV Ondansetron. The IPA group had a fifty percent (50%) reduction in the mean nausea score in only fifteen (15) minutes, while the Ondansetron group took an average of thirty-four (34) minutes to reach the same reduction in mean scores. Pellegrini et al. found similar results in their study, a comparison of IPA and promethazine for PONV. When IPA was used, the patients reported a fifty percent (50%) reduction in nausea, significantly faster than when promethazine was administered.

A study by Anderson and Gross in 2004 found differing results in the effectiveness of peppermint oil, IPA, or placebo, on PONV in their three-arm study of thirty-three (33) patients in an outpatient surgery center setting. Anderson and Gross did not utilize a standardized method of anesthetizing study participants. Upon complaint of nausea in the postoperative recovery area, a 2” x 2” gauze pad with peppermint, alcohol, or saline was placed under the patients’ nostrils. Patients were then instructed to take three slow deeps breaths inhaling through the nostrils and exhaling by mouth. All three groups had similar decreases in PONV at the intervals tested. The authors concluded that it may not be the particular aroma that decreased PONV but the conscious control of the patient’s breathing pattern.
It is important to note the close proximity of the nucleus tractus solitarius and the breathing centers around the fourth ventricle in the brain. Miller et al. found that chemically induced lesions, which abolished neuronal vomiting pathways, had a significant impact on spontaneous respirations, indicating a close relationship between the two areas. This information provides credibility to the Anderson and Gross hypothesis that conscious control of the patient’s breathing pattern may reduce PONV. Whether it was the aromatherapy or the conscious controlled breathing pattern, each of these patients would have received an antiemetic medication at the first report of nausea at this surgical center, but only fifty-two percent (52%) of the patients in this study needed rescue antiemetics.3

Side Effects

There have been minimally reported side effects associated with the therapeutic use of essential oils and IPA for aromatherapy. None of the studies reviewed, provided any evidence of a side effect or adverse reaction related to the inhalation of aromatherapy or IPA. However, the oral ingestion of essential oils, specifically ginger, can inhibit platelet aggregation similar to aspirin.41 This lack of side effects is in stark contrast to the side effects that have been reported with antiemetic medications, which may produce significant side effects including headache, drowsiness, and delayed cardiac conduction.27
Cost

As the cost of healthcare continues to climb, hospitals and patients are looking for ways to combat the ever-rising financial burden. PONV adds millions of dollars in costs to healthcare insurers, providers, and patients, due to increased PACU stays, admission to the hospital, and readmission to the hospital following discharge. The length of PACU stays may increase by an average of 48 minutes due to PONV. The cost of a PACU stay increases by eighty-five dollars ($85) for nausea and one hundred and thirty-five dollars ($135) for vomiting. The cost of ondansetron has significantly reduced with the release of a generic form of the medication, but other newer medications are being tested which may add substantial cost to providers upon their introduction into the surgical arena. Aromatherapy may provide a cost-effective solution to deliver antiemetic treatment. For example, seventy percent (70%) IPA pads are found throughout the hospital and cost pennies per pad. Essential oils can be obtained at a low cost, and since each patient only uses a few drops of oil per application, the original bottle can dispense multiple doses for many patients until expiration. Essential oils can also be administered in a disposable inhaler that patients may take with them and use after discharge. Patients may also purchase and use IPA pads and essential oils to treat PONV without a prescription.

Patient Satisfaction

With the implementation of Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) and Press-Ganey patient satisfaction scores, providers are under more pressure than ever to deliver high quality care and positive patient experiences in order to obtain
A prospective study of three hundred and thirty-nine (339) patients, performed in a military hospital in the pacific northwest, examined the effectiveness of aromatherapy for PONV and patient satisfaction with such use. The study found that surgical patients were in favor of using aromatherapy as a first-line treatment for PONV. This study found that patients in the placebo control group asked for the same aromatherapy inhaler, QueaseEASE™, used in the study group patients upon discharge from the hospital, for at home use. Sites et al. also found that patients were very satisfied with peppermint aromatherapy, and that patients commented that having the oil throughout the recovery period would have been beneficial. High patient satisfaction reports with aromatherapy and its effectiveness has led to the introduction of aromatherapy at many facilities including a large multi-state hospital system based in Minneapolis, MN.

Current Use of Aromatherapy among Anesthesia Providers

No studies were found assessing the use or knowledge of anesthesia providers concerning aromatherapy and postoperative nausea and vomiting.

Future Studies

A Cochrane review by Hines at al. found that most of the research studies that have been performed involving aromatherapy and PONV have been of low quality. This has been the result of small, single center studies. Also, many of the studies have utilized different preparations of aromatherapy, making it difficult to compare results across studies. Therefore, large, multicenter
studies, with specific aromatherapy formulations, need to be performed to provide definitive evidence for the effectiveness of aromatherapy for PONV.

Summary

There are many studies that have shown the success and effectiveness of aromatherapy in reducing postoperative nausea and vomiting. Aromatherapy is cost-effective and safe for patients use, with minimal side effects. Additionally, aromatherapy may help to empower patients to take an active role in PONV control. Since twenty to thirty percent (20%-30%) of all patients undergoing anesthesia suffer from PONV and aromatherapy has been proven safe and effective in reducing PONV, aromatherapy should therefore become a part of the first-line antiemetic regimen.
CHAPTER III

Methodology

Research Design

We utilized a descriptive study design to measure the self-reported knowledge and use of aromatherapy for post-operative nausea and vomiting among Certified Registered Nurse Anesthetists.

Population Sample

The study population comprised of Certified Registered Nurse Anesthetists (CRNAs) who are members of the American Association of Nurse Anesthetists (AANA). The AANA is a professional organization representing CRNAs. The organization is made up of CRNAs and Student Registered Nurse Anesthetists (SRNAs). As of August, 2018, there are a total of fifty-two thousand six hundred and twenty-eight (52,628) members of the AANA, and of those members forty-four thousand six hundred and eleven (44,611) are CRNAs. The American Association of Nurse Anesthetist’s Research Services and Assistance department was utilized to obtain the sample population for this study.

G*Power software was utilized to determine sample size. With a power of 0.8 and an alpha of 0.05, the sample size was calculated to be three hundred and eighty-one (381). The AANA Research Services and Assistance department has estimated a seven percent (7%)
response rate based on previous survey studies.\textsuperscript{48} Using this information, a total of five thousand four hundred and forty-three (5,443) surveys would need to be distributed. The AANA Research Services and Assistance department allows surveys to be sent to no more than three thousand (3,000) recipients.\textsuperscript{48}

The AANA Research Services and Assistance department sent surveys to three thousand (3,000) recipients based on a random number generator pulled from its email database. Inclusion criteria included currently licensed CRNAs who have not elected to opt out of AANA surveys. Exclusion criteria included SRNAs, and CRNAs who have elected to opt out of AANA surveys.

\textit{Instrumentation}

Data was collected using a survey collection tool that was developed by the researcher. The Post-Operative Nausea and Aromatherapy Assessment Survey (PONAAS)(Appendix B). This tool was developed to identify the self-reported knowledge and use of aromatherapy for post-operative nausea and vomiting among Certified Registered Nurse Anesthetists (CRNAs). The tool consists of twenty-eight (28) questions in five sections. Participants spent approximately five to ten (5-10) minutes completing this tool.

The first section of the tool was designed to gather demographic data about the study population. Participants answered questions on gender, age, education, years of experience as a CRNA, type of institution, and regions in which they practice.

In the second section the participant answered questions about the patient population with which they work. Questions in this section were developed to ascertain information regarding the number of patients under the CRNAs’ care that may have been at high risk for and/or
experienced post-operative nausea and vomiting. These questions also focused on how often anti-emetic medications are administered to patients in the operating room and in the post anesthesia care unit. All questions in this section were multiple choice questions, which asked the participant to answer with the number of patients that had specific occurrences. One question in this section was asked using a five-point Likert scale format with options of never, rarely, sometimes, often, and always. (See Appendix B for Survey)

The third section of this tool was used to answer the first research question, “are Certified Registered Nurse Anesthetists knowledgeable about the use of aromatherapy for treatment of post-operative nausea and vomiting?” Questions in this section asked about training and education that CRNAs might have received pertaining to aromatherapy and alternative methods of relieving PONV. Questions in this section were in a yes/no format. One of these questions was open-ended to allow the participants to answer freely about alternative methods of relieving PONV.

The fourth section of this tool was used to answer the second research question, “do Certified Registered Nurse Anesthetists utilize aromatherapy for post-operative nausea and vomiting?” Participants were asked questions regarding the frequency of using aromatherapy and isopropyl alcohol for PONV in their practices, and the efficacy of relief experienced by those patients who received aromatherapy or isopropyl alcohol. This section also asked the participant about potential barriers to using aromatherapy for PONV such as institutional policies that may prevent its use. Questions in this section varied in format. Three questions were yes/no questions, while three questions were in a Likert scale format, and two questions were multiple choice. (See Appendix B for the survey)
The final section of the tool, was designed to test the participant’s knowledge pertaining to aromatherapy and PONV. The four questions included uses of aromatherapy, commonly routes of administration of aromatherapy, side effects of aromatherapy and mechanisms of action of aromatherapy.

This data collection tool was reviewed for validity by five experts to create an inclusive and coherent tool. This tool had not been used before: the collective critiques of the experts were compiled to revise the tool to ensure its validity insofar as possible. The first expert is a D.O. who has completed an integrative health fellowship, and has practiced pain management. The second expert is a CRNA who has a Ph.D. and was the former director of a Nurse Anesthesia Program. The third expert is a military trained CRNA who is very active in the state association of nurse anesthetists, and has practiced as a preceptor for a nurse anesthesia program. The fourth expert is a scientist who has earned a Ph.D. and has trained in epidemiology, biostatistics, and bioinformatics with extensive experience in clinical data analysis. The fifth is a practicing CRNA at a highly rated mid-Atlantic institution.

Procedures

After obtaining Georgetown University Internal Review Board (IRB) approval, the first step was to submit an application to the American Association of Nurse Anesthetists (AANA) Research Services and Assistance department. This application included the AANA IRB approval form, an endorsement letter from the research advisor, Post-Operative Nausea and Aromatherapy Assessment Survey (PONAAS), the letter of informed consent that was sent to
participants with the survey, the research methodology for the study, and the AANA membership
information of the principle investigator.

AANA Research Services and Assistance formatted the questions in the PONAAS survey
as a Survey Monkey document. The principle investigator reviewed the Survey Monkey survey
and gave final approval, prior to the creation of the survey link on Survey Monkey.48

Participants were chosen at random from the AANA database and each member who had
not opted out of receiving research emails had an equal opportunity of being chosen for
participation. Participants received an email from the AANA Research Services and Assistance
department containing an invitation to participate in the study, the Informed Consent Script
(ICS), and a link to the survey. The Cover letter/ICS (Appendix A) included the title and brief
description of the study, a description of processes to ensure privacy and confidentiality, and the
statement that participation in voluntary, as well as other required information (see protection of
human subjects, below). The participant was informed that submission of the survey implies
consent to participate in the study.

The survey was open for a period of four weeks. One follow-up reminder email was sent
directly from the AANA to participants one week prior to the closure of the survey.48 All
participants received this reminder as there was no identifying data received from the survey
responses and no way of identifying who had already completed the survey. The survey took
approximately five to ten minutes to complete.

After the survey had closed, the AANA compiled all responses into a document and only
this document was returned to the principle investigator for analysis.48 This data had no
identifying information. The document was stored on the principle investigators personal
computer that is password protected and only accessible by the principle investigator. Data was
then analyzed with the assistance of a statistician. Data will be stored for a period of three years per the IRB guidelines.

**Data Analysis**

The data collected from the survey tool were collected via the SurveyMonkey™ anonymous platform. This data was compiled into an excel spreadsheet which was obtained by the researcher. The excel spreadsheet was uploaded to R studio for statistical analysis. Descriptive statistics were used to analyze the demographic information of the study participants.

Chi squared analysis was used to determine associations between demographics and the research questions. The first research question examined CRNAs’ level of knowledge about aromatherapy for treatment of PONV. Simple T-tests were run to determine the statistical significance of each answer choice of the survey related to knowledge. Overall knowledge about aromatherapy was judged based on the percentage of respondents that answered each question correctly.

The second research question pertained to the use of aromatherapy by CRNAs for the treatment of PONV. Chi squared analysis were used to determine the statistical significance of use of both essential oils, isopropyl alcohol and each demographic. Likert scales were utilized to determine how often patients experienced PONV, and how often patients received one or two antiemetics. Likert scales were also utilized to determine the perceived effectiveness of both essential oils and isopropyl alcohol on PONV. Z-test analysis was used to determine if there was a statistical difference in the number of CRNAs that had used essential oils and the number of CRNAs that had used isopropyl alcohol.
Protection of Human Subjects

Permission to conduct this study was obtained from the Georgetown University Internal Review Board (IRB). Per the Georgetown University IRB requirements, the principle investigator and the research director had both completed the Collaborative Institutional Training Initiative (CITI) Human Resources curriculum (APPENDIX C).

American Association of Nurse Anesthetists (AANA) Research Services and Assistance department sent an email to members of the AANA to participate in the survey. This email contained a cover letter describing the survey. The cover letter detailed the confidentiality of the survey responses as well as the respondent’s personal information. The cover letter had a link to the research survey on SurveyMonkey™. Respondents were allowed to skip any question and stop the survey at any time. Responses were gathered by the research website SurveyMonkey™ and stored in their database under transport layer security (TSL) encryption.

The principle investigator did not have access to the email addresses or IP addresses of the participants at any point. The email addresses of the participants are stored in a secure database managed by authorized AANA employees. After a period of twelve months the email addresses as well as the responses will be deleted from the database. The database handling the survey is password and firewall protected in order to safeguard the personal information of the participants. Survey Monkey also utilizes secure transport layer security (TLS) cryptography on the servers which hold the participant information, to further protect the participants data.

After the survey had ended, the AANA obtained the data from SurveyMonkey and compiled it into a single document. This document had no identifying information. This document was then sent to the principle investigator and stored on their personal password.
protected computer. Only the principle investigator had access to this computer and data. All data collected by the researcher will be deleted after three years per the IRB guidelines, although no personal identifiers are present.
CHAPTER IV

Findings

This chapter presents the data collected at the end of the survey deployment period. The results will be presented by following the research questions of this study. Tables and figures will be presented and will summarize the findings and statistical analysis performed by the researcher.

Sample

Invitations to participate in the survey were sent to three thousand (3,000) CRNAs via the AANA Research Services and Assistance department. Of the three thousand (3,000) randomly selected CRNAs, one hundred and thirty-nine (139) met the exclusion criteria leaving two thousand-eight hundred and sixty-one (2861) invitations sent to members of the AANA. Survey responses were received from two hundred and forty-three (243) participants, twelve (12) of these were partially completed, leaving two hundred and thirty-one (231) completed surveys returned and used for data analysis. The response rate was eight percent (8%).

Survey respondents’ demographic data is listed in Table 1 and Figures 1-5. The majority of respondents were female (61%). Most of the participants worked primarily in a teaching facility (41%) or a community hospital (44%). Participants responded with the highest anesthesia degree with the majority holding a Master’s degree (78%), followed by Doctorate, and
Baccalaureate/Certificate degrees, (16%, 6%, respectively). The regional distribution of the participants was comparable to the regional distribution of AANA members.

Table 1. Survey Participant Demographics

<table>
<thead>
<tr>
<th>Gender</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>39%</td>
</tr>
<tr>
<td>Female</td>
<td>61%</td>
</tr>
</tbody>
</table>

Age (Avg. age in yrs) 43.44 ± 11.3

Figure 2. Average Number of Cases per Week
Figure 3. Years Practicing as a Certified Registered Nurse Anesthetist

Figure 4. Highest Degree Earned by Certified Registered Nurse Anesthetist Respondents
Figure 5. Region in which the Certified Registered Nurse Anesthetist Practices

Figure 6. Type of Facility in which the Certified Registered Nurse Anesthetist Practices
Research Question 1

The first research question explored CRNA knowledge regarding the use of aromatherapy for treatment of post-operative nausea and vomiting. Survey participants were asked if they had received formal training on alternative methods of alleviating PONV to which ninety percent (90%) of respondents said that they had not.

Of the respondents that had received formal training, thirty-three percent (33%) received training on aromatherapy, and nineteen percent (19%) had received training on acupressure devices. Other responses included controlled breathing, guided imagery, hypnotherapy, and auricular acupuncture. Despite the lack of formal education regarding alternative methods of alleviating PONV, seventy-one percent (71%) were aware that aromatherapy was an option for treating PONV.

Chi squared analysis found a statistically significant difference between awareness of aromatherapy as an option for PONV and previous formal training on alternative methods of relieving PONV. Ninety-five percent (95%) of CRNAs with formal training on alternative methods for relieving PONV were aware that aromatherapy was an option for treating PONV and only sixty-nine percent (69%) of CRNAs without aromatherapy training were aware that it was an option to treat PONV ($X^2=(1)=6.13$, $p<0.05$).

There were no significant differences were found between gender, region, education, work environment, or experience and the awareness of aromatherapy as an option for treating PONV ($p>0.05$). Additionally, chi squared analysis found no association between formal education on alternative methods of relieving PONV and the use of aromatherapy for relieving PONV.
At the end of the survey, participants were asked a series of questions to judge the base knowledge that CRNAs possess regarding aromatherapy. Exam results are listed in Figure 6. One sample t-tests were performed to calculate the significance of the results in this section against the chance that the answers were guessed randomly (50%). Question 25 asked participants to select the potential uses of aromatherapy, eighty-one percent answered the question correctly vs the mean of fifty percent (50%) \( (p<0.01) \). Question 26 pertained to commonly used routes for aromatherapy and ninety-nine percent answered correctly against the mean of fifty percent (50%) \( (p<0.01) \). Questions 27 asked about the most common side effects of aromatherapy and seventy-two percent of responses were correct against the mean of fifty percent (50%) \( (p<0.01) \). Finally question 28 asked participants to identify the mechanism of action of aromatherapy, with only about half (55%) of respondents answering correctly and against the mean of fifty percent (50%) this was not found to be significant. Despite the lack of formal education on aromatherapy, CRNAs appear to be knowledgeable about the use of aromatherapy, but may lack knowledge of the mechanisms by which they work.
Figure 7. Knowledge Exam Results

This figure depicts the results of the knowledge exam section of the PONAAS survey questions which ask the following:

1) Aromatherapy may be used for which of the following?
2) Which of the following is the most common route to administer aromatherapy in the United States?
3) Which side effect is most commonly associated with aromatherapy inhalation?
4) Aromatherapy is hypothesized to have its effects in what manner?

*** Denotes statistically significant result when compared against random chance (50%)

See Appendix B PONAAS for each question and answer in its entirety.

Research Question 2

Respondents were asked if they had ever utilized alternative methods for alleviating PONV such as aromatherapy, acupressure, acupuncture, or hypnosis. Results are listed in Figure 7. Thirty-seven percent (37%) of respondents stated that they had used an alternative method of alleviating PONV. Only nineteen percent (19%) of respondents stated that they had used essential oils for PONV. Chi squared analysis found no significant differences were found when accounting for gender, region, or type of facility in which the practitioner practiced primarily.

34
Interestingly ninety-two percent (92%) of respondents stated that they had used isopropyl alcohol to help alleviate PONV. Chi squared analysis showed no significant differences were found when accounting for gender, region, education, experience, or type of practice facility. When comparing use of aromatherapy and isopropyl alcohol, z-test analysis found that a statically larger portion of CRNAs have used isopropyl alcohol when compared to aromatherapy \( (p<0.01) \).

**Figure 8.** Use of Essential Oils and Isopropyl Alcohol for Post-Operative Nausea and Vomiting Treatment

To gauge the need for aromatherapy and other antiemetic medications, survey takers were asked the number of patients under their care that were at high risk of PONV. Results are listed in Figure 8. Fifty-four percent (54%) of respondents stated that they were involved in an average of sixteen to twenty-five cases per week. Forty-two percent (42%) of respondents stated that one to five patients per week were at high risk for PONV, while thirty-five percent (35%)
stated that six to ten patients per week were at high risk, and another fifteen percent (15%) stated that eleven to fifteen were at high risk.

![Bar chart showing percentage of respondents at risk for PONV and those who experienced PONV.]

**Figure 9.** Patients at Risk for Post-Operative Nausea and Vomiting vs. Patients that Experienced Post-Operative Nausea and Vomiting

CRNAs were then asked how many patients under their care experienced PONV per week. Seventy-three percent (73%) stated that one to five patients experience PONV, twenty three percent (23%) stated that no patients experience PONV, and three percent (3%) stated that six to eleven patients experience PONV. Participants were then asked how many patients under their care per week received additional antiemetics in the post-anesthesia recovery room (PACU). Seventy-four percent (74%) stated that one to five patients received additional antiemetics, twenty percent (20%) stated that no patients they took care of received antiemetics in the PACU, and four percent (4%) stated that six to ten patients per week received additional
antiemetics in the PACU. This suggests that while we are effective at preventing PONV, there is still room for improvement for better patient experiences and outcomes.

CRNAs were asked how often they administered antiemetics prophylactically for prevention of PONV. The results are listed in Figure 9. The majority of CRNAs responded that they provide one form of antiemetic prophylactically to their patients. Seventy-seven percent (77%) stated that they always do so, while seventeen percent (17%) stated that they often administer prophylactic antiemetics. A small minority stated that they rarely or never administer prophylactic antiemetics (3% and 2%, respectively) The routine use of two or more antiemetics received much more varied responses. Forty-seven percent (47%) stated they always administer two antiemetics, while 18% stated that they often administer two antiemetics. Administration of two or more antiemetics, sometimes and rarely, garnered fourteen percent (14%) and eighteen percent (18%) of responses respectively. A small minority stated that they never administer two antiemetics prophylactically (2%).

Figure 10. Prophylactic Antiemetics Administered
The perceived effectiveness of aromatherapy could have an impact on the willingness of providers in utilizing it for relieving PONV. Providers were asked to rate the amount of relief from PONV that patients experienced with both essential oils and isopropyl alcohol. Results are listed in Figure 10.

The majority of respondents (83%) stated that patients received mild to moderate relief, followed by ten percent (10%) of respondents that stated that patients received almost complete relief of PONV with the use of essential oils. And a minority of respondents (6%) stated that patients received no relief from PONV.

When asked about isopropyl alcohol, a majority of participants (85%) stated that patients received mild to moderate relief, followed by twelve percent (12%) who stated that patients experienced almost complete or complete relief from PONV; while a small number of respondents (3%) stated that their patients received no relief from PONV with isopropyl alcohol use.
Figure 11. Respondents Perceived Effectiveness of Aromatherapy for Post-Operative Nausea and Vomiting

The data collection tool included questions regarding barriers to the use of aromatherapy for PONV. Only forty-two percent (42%) of CRNAs responded that the institution that they work for has a policy for PONV treatment, while thirty-two percent (32%) of these facilities have no policy for PONV treatment. Interestingly, forty-eight percent (48%) of respondents stated that they would absolutely utilize aromatherapy in their own practice if it were proven effective and there were no institutional barriers to its use. Twenty-eight percent (28%) stated that they would probably use aromatherapy, fifteen percent (15%) stated that they would possibly use aromatherapy, nine percent (9%) stated that like were not likely to use aromatherapy, and three
percent (3%) stated that they would never use aromatherapy if it were proven effective and there were no institutional barriers to its use.

Figure 12. Respondents Likelihood of Using Aromatherapy

Summary

The present study finds that CRNAs are in fact knowledgeable about aromatherapy despite ninety percent of respondents stating that they had not received any formal training on aromatherapy and PONV. Indeed, seventy-one percent of respondents stated that they were aware that aromatherapy was an option for treating PONV.

A majority of CRNA respondents (92%) stated that they have used isopropyl alcohol for relief from PONV, compared to a small minority (8%) that have used essential oils for PONV. Most of the CRNA participants (77%) stated that they routinely use prophylactic antiemetics and
yet a majority of respondents (74%) stated that one to five patients per week that they cared for, experience PONV in the PACU requiring use of another rescue antiemetic. CRNAs reported a similar relief of PONV from both isopropyl alcohol and essential oils, with eighty-five percent (85%) and eighty-three percent (83%) of respondents stating that patients experienced mild to moderate relieve from PONV. The largest barriers to the routine use of aromatherapy for PONV was found to be a lack of formal education about the effects of aromatherapy on PONV, and institutional policy precluding its use for treatment of PONV.
Discussion

Post-operative nausea and vomiting (PONV) has been shown to be a significant side effect of general anesthesia. A previous study has shown that twenty to thirty percent (20-30%) of all patients undergoing general anesthesia will experience PONV, with as many as eighty percent (80%) in those deemed to be high risk for PONV. This study was undertaken to determine if certified registered nurse anesthetists (CRNAs) are knowledgeable and if they are utilizing alternative methods of relieving PONV.

Previous literature shows that most practitioners provide some form of prophylactic antiemetic relief to patients undergoing general anesthesia. Our research corroborates this finding. Ninety-five percent (95%) of providers surveyed provide some form of prophylactic treatment. The current treatment regimen for treating PONV includes an array of medications including Ondansetron, Dexamethasone, Metoclopramide, Scopolamine, Droperidol, and Aprepitant among others. These medications can be expensive and the side effects of these medications can be significant, including headache, diarrhea, sedation, hypotension, and cardiac conduction abnormalities. We found that despite the current availability of treatment regimens, 33% of patients deemed high risk for PONV still experienced PONV.

We found that CRNAs are knowledgeable about aromatherapy. Study participants successfully answered questions about the uses, side effects, and routes of administration of aromatherapy. We found that seventy-one percent (71%) of CRNAs surveyed were aware that aromatherapy was an option for treating PONV. This is despite the fact that only a small
percentage of CRNAs surveyed had any formal education regarding alternative forms of relieving PONV. Of those who had received education on alternative methods of relieving PONV, an even smaller number of respondents had any education on aromatherapy. There were no other studies found that assessed the awareness and education of aromatherapy among CRNAs. This shows a clear lack of education in an area that could have a large impact on patient outcomes and experiences. Further education should be taught at both anesthesia schools and national conferences for the greatest impact.

Our work included novel findings on the use of aromatherapy among CRNAs. We found that only eighteen percent of study participants had used essential oils to relieve PONV for their patients. However, ninety-two percent (92%) of study participants had used isopropyl alcohol (IPA) to relieve PONV in their patients. This suggests that CRNAs are both open, and willing to implement alternative methods of relieving PONV. This was further corroborated in our work, with ninety percent (90%) of participants stating that they would be open to using aromatherapy for relief of PONV in practice if there were no institutional barriers to its use.

Previous studies have shown the effectiveness of essential oils. Karaman et al. showed a reduction of nausea scores for ginger and lavender oils in eighty-three percent (83%) and sixty-five (65%) of participants, respectively. In another study it was found that an essential oil blend reduced PONV in eighty percent (80%) of patients, compared with placebo forty percent (40%). A Cochrane review of fourteen (14) studies on aromatherapy for PONV found that more patients who received aromatherapy were free from PONV by the end of treatment compared to those who had received placebo. We found that CRNAs in this study reported a similar rate of relief from PONV for their patients. CRNAs reported that ninety-three percent (93%) of patients who received essential oils for PONV experienced at least a mild
reduction in nausea, with only six percent (6%) experiencing no relief from nausea. This is despite no standardized formulations or technique for administration between CRNAs.

The effectiveness of IPA has also been demonstrated in previous studies.\textsuperscript{34,43} Merritt et al. found that there was no statistical difference between the effectiveness of IPA and conventional antiemetic treatment with fifty-two percent (52%) of the patients in their IPA group having relief from nausea.\textsuperscript{43} In our study, CRNAs stated that ninety-seven percent (97%) of patients who received IPA for treatment of PONV experienced at least a mild relief from nausea. A small fraction, only three percent (3%) of patients, had no relief from PONV. This corroborates the findings of Merritt et al. by showing that IPA can be effective in decreasing PONV.

Barriers to the use of aromatherapy were not found in the literature. We found that institutional policy and lack of knowledge/experience were the top barriers to the use of aromatherapy for the treatment of PONV for CRNAs. Education on alternative methods of treating PONV may have an impact on both of these barriers as CRNAs can be effective advocates for patients and change in institutional policies.

\textit{Limitations}

The data collection tool was 29 questions long. Survey participants were allowed to proceed even if a question remained unanswered. This led to several questions that were left blank by a few participants, and ultimately incomplete data points.
Future Recommendations

This study included many novel findings and opens the door for more research into alternative treatments for PONV and their use within the anesthesia community. New research opportunities may pertain to timing of aromatherapy after general anesthesia, which specific essential oils have the greatest impact on PONV, comparing aromatherapy to other alternative treatment modalities, and whether use of aromatherapy upon emergence from general anesthesia and throughout the recovery period may relieve PONV completely.

Education on aromatherapy needs to be expanded to bring this potential treatment to a larger portion of practitioners. Only ten percent (10%) of CRNAs surveyed stated that they had received any formal education on alternative methods for relieving PONV, and only three percent (3%) had received education on aromatherapy specifically. Only one formal educational opportunity about aromatherapy for PONV was found in the literature for healthcare providers, this was in the form of a continuing education unit for registered nurses. CRNAs should be educated on the potential benefit of this low-cost treatment that could have a positive impact on many patients.

Post-operative nausea and vomiting has been well documented as a significant side effect of general anesthesia. This may impact quality of care and patient satisfaction, which are both important parameters in how perioperative settings are evaluated and reimbursed. Despite current PONV prevention techniques, a portion of the population still suffers from PONV. This prolongs PACU stays, increases costs, and decreases patient satisfaction. New techniques of relieving PONV are needed. Aromatherapy is a promising alternative to medications, with a low cost, minimal side effects, and high efficacy.
APPENDIX A. Letter to Survey Participants

October 4, 2018

Dear Certified Registered Nurse Anesthetist:

In behalf of Georgetown University’s School of Nursing and Heath Science, you are invited to participate in a research study titled “An Exploration of Certified Registered Nurse Anesthetists Knowledge and Use of Aromatherapy for Treatment of Post-Operative Nausea and Vomiting”. This study is being conducted by Christopher Parrish, SRNA, BSN. The purpose of this survey is to explore the knowledge that CRNAs possess in regards to aromatherapy and explore its utilization for the treatment of post-operative nausea and vomiting (PONV). You are being asked to take part in this study because you are a CRNA. Participation in this study is entirely voluntary at all times. You can choose not to participate at all, decline to answer any of the questions, or discontinue participation and not submit the online survey. Regardless of your decision, there will be no effect on your relationship with Georgetown University.

If you agree to participate, you are asked to fill out a survey that you will access online through SurveyMonkey – the link is provided below. The survey includes five sections: demographics (gender, years of experience, type of facility in which you practice), information on your patient population, education for aromatherapy, use of aromatherapy in practice, and a short aromatherapy assessment. This survey is 28 questions and should take approximately 5-10 minutes to complete. Once you complete the questions and submit the survey through SurveyMonkey, your response will be sent directly to the Georgetown Principal Investigator.

All of your responses to this survey will remain anonymous and cannot be linked to you in any way. No identifying information about you will be collected at any point during the study. The SurveyMonkey system has been determined to be sufficiently protected/secure to allow for its use by Georgetown University researchers. Once you submit your completed survey, there will be no way to withdraw your responses from the study because there is no mechanism to identify you. Study data are returned to the researcher in a digital format that does not identify individual responses. The digital, non-identifiable, data will be kept by the researcher on a password-protected computer. Aggregate, non-identifiable data will be shared with TMS members, who also will be informed of any published articles based on this study.

There are no risks associated with this study. While you will not experience any direct benefits from participation, information collected in this study may benefit others in the future by contributing to our knowledge and understanding education and utilization of aromatherapy for PONV.

If you have any questions regarding the survey or this research project in general, please contact the principal investigator, Christopher Parrish at (816) 838-7899 or via email at ccp64@georgetown.edu, or Dr. Catherine Horvath at (202) 687-8122 or chh24@georgetown.edu. If you have any questions about your rights as a research participant, please contact the Georgetown University IRB at (202) 687-1506 or irboard@georgetown.edu.

By submitting this survey, you are indicating your consent to participate in this study. There is no need for a signed consent to participate.
To start the survey, please follow this link:

We request that you submit the survey by

Sincerely,

Christopher Parrish, BSN
Student Registered Nurse Anesthetist
Georgetown University

Catherine Horvath, DNP, CRNA
Assistant Professor, Nurse Anesthesia Program
Georgetown University
APPENDIX B. Post-Operative Nausea and Aromatherapy Assessment Survey

Post-Operative Nausea and Aromatherapy Assessment Survey

This survey is intended to assess the knowledge and use of aromatherapy and isopropyl alcohol to treat post-operative nausea and vomiting among certified registered nurse anesthetists. Please answer all questions to the best of your ability. Select one answer for each question. The survey should take about five to ten minutes to complete. All answers will be kept anonymous.

Demographics

1. Age (Years)
   - 20-30
   - 31-40
   - 41-50
   - 51-60
   - 61+

2. Gender?
   - Male
   - Female
   - Prefer not to answer

3. What is the average number of cases per week in which you provided anesthesia?
   - < 5
   - 6-10
   - 11-15
   - 16-20
   - 21-25
   - 26+

4. Years spent practicing as a CRNA?
   - 0-5
5. Highest degree earned?

- PhD
- DNP
- DNAP
- Masters
- Baccalaureate
- Certificate

6. AANA region in which you currently practice?

- Region 1 (CT, ME, MA, NH, NJ, NY, Puerto Rico, RI, VT)
- Region 2 (GA, KY, NC, SC, TN, VA, WV)
- Region 3 (IL, IN, MI, WI)
- Region 4 (AR, IA, KS, MN, MO, ND, NE, OK, SD)
- Region 5 (AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA, WY)
- Region 6 (DE, DC, MD, OH, PA)
- Region 7 (AL, FL, LA, MS, TX)

7. Type of facility in which you currently practice?

- Teaching Hospital
- Community Hospital
- Surgery Center
- Physician’s Office
- Other

**Patient Population**

8. What is the average number of patients per week under your care that are at high risk for PONV (post-operative nausea and vomiting)?

- None
- 1-5
- 6-10
- 11-15
- 16-20
- 21+

9. What is the average number of patients per week under your care that experienced PONV?
10. On a scale of 1-5 with 1 Never, 2, Rarely, 3 Sometimes, 4 Often, and 5 Always, In the last year, how often do you routinely administer prophylactic antiemetics (ondansetron, metoclopramide, scopolamine, dexamethasone, etc.) to patients undergoing general anesthesia?

1 Never
2 Rarely
3 Sometimes
4 Often
5 Always

11. On a scale of 1-5 with 1 Never, 2, Rarely, 3 Sometimes, 4 Often, and 5 Always, In the last year, how often do you routinely administer two or more prophylactic antiemetics (ondansetron, metoclopramide, scopolamine, dexamethasone, etc.) to patients undergoing general anesthesia?

1 Never
2 Rarely
3 Sometimes
4 Often
5 Always

12. What is the average number of patients per week under your care that have required antiemetics (ondansetron, metoclopramide, scopolamine, dexamethasone, etc.) in the post anesthesia recovery unit?

None
1-5
6-10
11-15
16-20
21+

Aromatherapy Education
13. Have you utilized alternative methods, such as acupressure, aromatherapy, controlled breathing, or hypnosis, for controlling PONV?

   Yes
   No

14. Have you received formal training on alternative methods to alleviating PONV?

   Yes
   No

15. If yes, what methods have you been educated about?

   _______________________
   
   I have not received formal training on alternative methods of alleviating PONV.

16. Are you aware that aromatherapy is an option for treatment of PONV?

   Yes
   No

**Use of Aromatherapy in Practice**

17. Have you used aromatherapy (essential oils) to help alleviate PONV in your patients?

   Yes
   No

18. On a scale of 1-5 with 1-no relief, 2-mild relief, 3-moderate relief, 4-almost complete relief, 5-complete relief from post-operative nausea and vomiting, what was the patient response when aromatherapy (essential oils) was used?

   1 No relief
   2 Mild relief
   3 Moderate relief
   4 Almost complete relief
   5 Complete relief
   6 I have never used essential oils for treatment of nausea and vomiting.
   7 Do not know; I do not see my patients postoperatively

19. Have you had patients inhale isopropyl alcohol pads to alleviate post-operative nausea and vomiting?
20. On a scale of 1-5 with 1-no relief, 2-mild relief, 3-moderate relief, 4-almost complete relief, 5-complete relief from post-operative nausea and vomiting, what was the patient response when isopropyl alcohol pads were used?

1 No relief
2 Mild relief
3 Moderate relief
4 Almost complete relief
5 Complete relief
6 I have never used isopropyl alcohol pads for treatment of nausea and vomiting.
7 Do not know, I do not see my patients postoperatively

21. If you have used aromatherapy or isopropyl alcohol pads for treatment of post-operative nausea and vomiting, did these patients also receive an antiemetic medication (ondansetron, metoclopramide, scopolamine, dexamethasone, etc.)?

Yes
No
I have never used isopropyl alcohol pads for treatment of nausea and vomiting.
Do not know, I do not see my patients postoperatively

22. If you have not used aromatherapy or inhaled isopropyl alcohol pads for control of post-operative nausea and vomiting, why?

My patients’ post-operative nausea and vomiting is well controlled with antiemetics.
I have limited or no knowledge of aromatherapy for PONV and therefore I do not use it.
My institution does not have a policy that allows for the use of aromatherapy.
Other
I have used aromatherapy for control of post-operative nausea and vomiting.

23. Does your institution have a policy pertaining to treatment of post-operative nausea and vomiting and what medications/ treatments are approved for use?

Yes, my institution does have a policy for post-operative nausea and vomiting treatment.
No, my institution does not have a policy for post-operative nausea and vomiting treatment.
I do not know if my institution has a policy for post-operative nausea and vomiting treatment.

24. On a scale of 1-5 with 1-never, 2-not likely, 3-possibly, 4-probably, and 5 being absolutely, would you utilize aromatherapy in practice if aromatherapy was proven to be effective in treating PONV and there were no institutional barriers to using aromatherapy.
Aromatherapy Assessment

25. Aromatherapy may be used for which of the following?

   Anxiety
   Nausea and Vomiting
   Pain
   Fatigue
   All of the above are uses of aromatherapy

26. Which of the following is the most common route to administer aromatherapy in the United States?

   Orally
   Intramuscular
   Intravenous
   Direct Inhalation

27. Which side effect is most commonly associated with aromatherapy inhalation?

   Hypotension
   Dizziness
   Tachycardia
   Blurred Vision
   There are no known side effects of aromatherapy inhalation

28. Aromatherapy is hypothesized to have its effects in what manner?

   Recognition of the aromatherapy molecules by the olfactory nerve which in turn sends signals to the brain.
   Absorption into the bloodstream through the alveoli which in turn carries these molecules to the brain.
   Molecules of aromatherapy cross the blood brain barrier due to their lipophilic nature.
   All of these are hypotheses on the manner in which aromatherapy exerts its effects.
APPENDIX C. Citi Program Completion Certificate

This is to certify that:

Christopher Parrish

Has completed the following Citi Program course:

Human Research
Group 2. Social and behavioral research investigators and key personnel,
1 - Basic Course

Under requirements set by:

Georgetown University

Completion Date 08-Sep-2018
Expiration Date 07-Sep-2021
Record ID 28573220

Verify at www.citiprogram.org/verify?w28a11aa8-4ec8-4656-9c72-985f9c374098-28573220
APPENDIX D. Application for Survey Distribution

American Association of Nurse Anesthetists
222 North Prospect Avenue, Park Ridge, Illinois 60068
Tel: 847-692-7050 Fax: 847-692-6968

AANA Electronic Survey Policy and Order Form

Version 3.27.18

Name: Christopher Parish
Page 1/5  AANA # 128372

Title, affiliated institute/company: Georgetown University

Address: 1600 N. Oak St Apt. 309

City: Arlington  State: VA  Zip Code: 22209

E-mail address: cgp84@georgetown.edu

Telephone: (202) 336-7000 (Office  Home  Cell)

Survey Title: Post-Operative Nausea and Aromatherapy Assessment Survey

Maximum character (not word) count is 80 characters, including spaces. This will be used as the subject line and incur a charge fee if not compliant.

SELECT THE SERVICE: See the Fee Schedule Section describing the two services.

* Full-Service* (see page two for submission instructions)

Instrument Deployment Only* (see page two for submission instructions)

*Cover letter should include a direct link to the survey tool, and survey tool should display all questions and answers.

YOUR CURRENT MEMBERSHIP STATUS:

Certified (Passed exam within past 2 years – practicing)
Recertified (Passed exam over 2 years ago – practicing)
Life (Life Members typically are not practicing)
Student (Currently enrolled in a nurse anesthesia program)
Not a member

CUSTOMER TYPE:

Please indicate which type applies to you as a customer (check only one).

AANA Member
External Entity (an additional charge of 25% of the total fees)
Corporation
Researcher

SURVEY FORMAT: (Check only one. If blank, all questions will be marked optional.)

Respondents are required to answer all survey questions.

Respondents are not required to answer any survey question (all are optional).

Survey questions are a mix of required and optional. Data tool specifies this information.

In addition, each question on the survey tool must indicate if answers should be formatted as “select all” or “select only one.” This is unrelated to optional vs. required above.
SELECTION CRITERIA OF THE SURVEY SAMPLE

SAMPLE SIZE REQUESTED: 3000 (Number Not Range Required).

SELECTING THE MEMBER TYPES OF YOUR SAMPLE: (Select all that apply)
- Certified (Passed exam within past 2 years – practicing)
- Recertified (Passed exam over 2 years ago – practicing)
- Student (Currently enrolled in a nurse anesthesia program)

SELECTING THE PRACTICE SETTINGS AND LOCATIONS OF YOUR SAMPLE: (Select all that apply)

a. All states or Specific state(s):
   ________________________________
   ________________________________
   ________________________________
   ________________________________
   ________________________________

b. Selecting the above state(s) based on (choose one, not both):
   _______ State of Residence (Live) or _______ State of Membership (Work)

NOTE: Choosing any of the following items may dramatically decrease the email addresses that we can provide. Because these items are not required to be answered on the membership profile, we can only provide those names who have given this information to us. We recommend that you refrain from narrowing down your list whenever possible.

c. Primary Employment Arrangement/Source of Income (the employment arrangement that provides the greatest portion of income): (Select all that apply)
   - Employee of hospital
   - Employee of office/clinic
   - Employee of freestanding surgical center
   - Employee of surgicenter in other institution
   - Employee of college/university
   - Employee of joint CRNA/physician group
   - Employee of CRNA-only group
   - Employee of physician-only group
   - Army
   - Navy
   - Air Force
   - Veterans Administration
   - U.S. Public Health Service
   - Owner/partner of CRNA-only group
AANA Electronic Survey Policy and Order Form

ELECTRONIC SURVEY ORDER FORM, Page 3/5

Name: Christopher Parrish

__ Owner/partner of joint CRNA/physician group  
__ Owner/partner of locum tenens agency  
__ Independent contractor for locum tenens agency  
__ Independent contractor for joint CRNA/physician group  
__ Independent contractor for physician-only group  
__ Independent contractor for CRNA-only group  
__ Independent contractor for hospital  
__ Independent contractor for surgery center  
__ Independent contractor for various arrangements  
__ Independent contractor for office/clinic  
__ Other employment arrangement/source of income

d. _____ Primary Position Description (51% or greater time in these areas)
   _____ Practice _____ Education _____ Management _____ Research _____ Other

e. _____ Highest Level of Education
   _____ Diploma/Certificate _____ Baccalaureate _____ Master _____ Doctorate

f. _____ Other (Additional fee may apply)

Describe the selection variable(s):

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2 The sample will be randomly selected from the pool of your selection criteria. Members that opted out of mass e-mail communication will not be included.
3 Due to high demand, AANA cannot guarantee that we will be able to meet your list preferences. Whenever possible, please provide a broad list selection upon application.
4 Work addresses and emails are extremely limited. If you choose that option, AANA cannot guarantee a sufficient quantity, and will complete the order with home contact information.
A. SELECT THE SERVICE THAT YOU WOULD LIKE TO PURCHASE: (Required)
   ✔ Full-Service ($500)
   Instrument Deployment Only Service ($200)

B. INDICATE NUMBER OF QUESTIONS AND FEE (Required for full-service)
   (Waived for Instrument Deployment Only)
   Matrix question will be counted differently from the normal question. The number for a matrix question will be counted as 1/3 of the number on the questions that are nested in a matrix question.

   Number of Questions: 28  Fee: $500

C. INDICATE NUMBER OF ADDRESSES AND FEE (Required)
   This fee is required for either service (Full-service or Instrument Deployment Only).

   Number of Addresses: 3000  Fee: $1900

D. INDICATE NUMBER OF REMINDERS AND FEE (Required, if you have more than one reminder for full-service, Instrument Deployment Only Service is limited to one reminder)

   Number of Additional Reminders:  
   Fee:  

E. CHECK HERE IF YOUR SURVEY HAS MORE THAN TWO SKIP LOGICS OR THREE MATRIX QUESTIONS ($500): (Required for Full-service, if your instrument has several skip logics or matrix questions)

   TOTAL OF ALL CHARGES*
   (Adding items A through E):
   $2500

   (*AANA reserves the right to confirm the fee calculations.)

PAYMENT OPTION* (Please select one):
   _____ Check
   _____ Credit Card

   a. Name on Credit Card ___________________________

   b. Credit Card Number ___________________________

   c. Expiration Date ___________________________ CID

   d. Signature: ________________________________

*Approved requests will NOT be filled without RECEIPT OF FULL PAYMENT for the service and a signed survey agreement. Payment will not be processed until survey has been approved.
RESOURCES


