Assessing Aromatherapy Compliance in the Post-Anesthesia Care Unit

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Abstract

Problem & Purpose: Aromatherapy is effective in post-operative nausea and vomiting (PONV) management in post-anesthesia care units (PACU). Aromatic inhalers were previously implemented in the PACU at a tertiary care hospital in Maryland before the COVID-19 pandemic. This evidence-based practice was discontinued during the pandemic, and the supply of aromatic inhalers was not maintained. The purpose of this quality improvement (QI) project was to reinstate the hospital's practice of aromatherapy utilizing bulk peppermint essential oil for colorectal surgical patients in the PACU. **Methods:** Approval was obtained from the infection prevention, pharmacy, and PACU directors before implementation. An evidence-based aromatherapy administration protocol was introduced for colorectal patients in the PACU, and the nursing staff received an in-service on implementation procedures. After administering aromatherapy, nurses documented the intervention in patients' electronic health records. Chart reviews were conducted weekly to audit nursing compliance. This project was expected to impact approximately 50 colorectal patients over the 15-week implementation. **Results:** Aromatherapy supplies were available in the designated location throughout the implementation period. One hundred percent of PACU nurses received education about the new protocol. The rate of aromatherapy administration compliance was 38%. The rate of PONV during implementation was 17%. **Conclusions:** Findings suggest a low compliance rate with aromatherapy administration. Implementation of the protocol has not reduced the PONV rate among colorectal patients in the PACU. Low compliance may be related to documentation burden or increased level of sedation among this patient population. Aromatherapy compliance may improve if offered upon PACU discharge when patients are more alert and participatory in care.

Keywords: postoperative nausea and vomiting, aromatherapy, colorectal surgery

Assessing Aromatherapy Compliance in the Post-Anesthesia Care Unit

Postoperative nausea and vomiting (PONV) are common consequences of anesthesia and occur in approximately 30-80% of patients, depending on the surgical procedure and type of anesthetic provided (Elvir-Lazo et al., 2020). Although pharmacologic prophylaxis is available, it is not effective in 20% of patients who still experience PONV (Tran et al., 2015). Nausea and vomiting contribute significantly to patient dissatisfaction and surgical complications, such as aspiration, wound dehiscence, dehydration, and electrolyte disturbances (Nagelhout, 2018). These factors can prolong patients' lengths of stay and increase costs associated with additional requirements for medication and management (Hiraki et al., 2022). Proper screening, adequate prophylaxis, use of regional anesthesia, and administering total intravenous anesthesia (TIVA) are strategies known to reduce PONV symptoms.

Aromatherapy care using aromatic inhalers to manage PONV was implemented in the post-anesthesia care unit (PACU) at a tertiary care hospital in central Maryland before the COVID-19 pandemic. During the pandemic, this evidence-based practice was discontinued due to the unknown mode of transmission of COVID-19, and the supply of aromatic inhalers was not maintained due to cost considerations. After the administration of prophylactic medication during the preoperative and intraoperative periods, current postoperative management in the PACU at this facility is limited to rescue pharmacologic therapy.

As seen in Figure 1, colorectal surgical patients have an increased risk of PONV. Colorectal surgical patients are at risk of PONV due to the nature of their surgeries. These procedures require bowel manipulation and laparoscopy to facilitate surgical exposure, both of which contribute to PONV. Colorectal surgical patients at this institution are at particular risk for PONV due to the limited use of regional anesthesia among this population and anesthesia

providers' hesitancy to use TIVA (Nagelhout, 2018). In addition, this hospital is a teaching institution that utilizes surgical residents, who can prolong surgery and increase the duration of anesthesia.

The purpose of this quality improvement (QI) project was to reinstate the hospital's practice of aromatherapy utilizing bulk peppermint essential oil for colorectal surgical patients in the PACU and to monitor nurses' adherence to the clinical practice. Peppermint oil was selected for this project due to its effectiveness in relieving symptoms of PONV and other gastrointestinal conditions, such as irritable bowel syndrome (Alammar et al., 2019).

Available Knowledge and Specific Aims

Research has revealed that aromatherapy using essential oil inhalation is a successful strategy to address PONV symptoms in the PACU (Tables 1-8). The Johns Hopkins Evidenced-Based Practice Model for Nursing (Dang et al., 2022) was used to appraise seven research articles that discuss the benefits of aromatherapy for the relief of PONV. Four studies included Level I evidence from randomized control trials (Amirhosseini et al., 2020; Karaman et al., 2019; Khatiban et al., 2022; Maghami et al., 2020). During these four studies, patients were exposed to different aromas (ginger, lavender, cardamom, clary sage, and peppermint). Ginger, lavender, and peppermint oil inhalation significantly reduced the incidence and severity of PONV symptoms in the PACU (Amirhosseini et al., 2020; Karaman et al., 2019; Maghami et al., 2020). Females exposed to cardamom aromatherapy after Cesarean section experienced less nausea and reduced retching (Khatiban et al., 2022). Clary sage aroma reduced nausea in patients undergoing percutaneous nephrolithotomy (Amirhosseini et al., 2020).

The remaining three articles are quasi-experimental studies (Briggs et al., 2016; Brown et al., 2018; Fearrington et al., 2019), exhibiting Level II evidence. Peppermint oil was utilized in

each of these studies, and it significantly reduced nausea in cardiac (Briggs et al., 2016) and ambulatory surgical patients who underwent general anesthesia (Brown et al., 2018). A combination of ginger and peppermint oils decreased the number of rescue antiemetics administered to ambulatory surgical patients (Fearrington et al., 2019). Overall, the strength and quality of available evidence supported the implementation of aromatherapy in the PACU.

Rationale

The Promoting Action on Research Implementation in Health Services (PARiHS) quality improvement framework was used to guide the implementation of an aromatherapy QI project at the tertiary care facility. This framework postulates that interactions among context, facilitation, and evidence are necessary to implement evidence into practice successfully (Kitson et al., 1998; Slaughter et al., 2013). As shown in Figure 2, thoroughly investigating these constructs as they related to the clinical site facilitated the future sustainability of the intervention.

Evidence describes the research and information supporting the proposed intervention. A comprehensive appraisal of the evidence demonstrated a robust body of research supporting aromatherapy. Interviews with directors of PACU, infection prevention, and pharmacy revealed support for implementing nurse-led aromatherapy in the PACU. The context describes the environment of the project site, including site culture and availability of resources. Analysis of the site's context created an understanding of the facilitators and barriers to the new initiative. Facilitation describes the structures and processes supporting staff during the proposed practice changes. The PARiHS framework was selected to guide this QI project because it emphasizes the importance of appraising evidence and assessing a facility's context and facilitation strategies before implementation. Successful practice changes result from thorough assessments of evidence, context, and facilitation.

Methods

Context

The site's context was thoroughly evaluated to understand the current structures and processes relevant to the clinical problem. The facility conducts approximately 1300 colorectal surgeries each year, and unless intensive care is required, patients recover in the PACU after surgery. A nurse manager and an assistant nurse manager comprise PACU leadership. Shortly before the coronavirus pandemic, nursing leadership introduced aromatic inhalers to patients who developed PONV in the PACU. After the pandemic began, aromatherapy was discontinued due to the virus's unknown transmission mode. It was not reintroduced because hospital leadership deemed the aromatic inhalers too expensive. The Enhanced Recovery After Surgery (ERAS) committee and PACU leadership were eager to introduce a cost-effective aromatherapy intervention to reinstate the previous clinical practice. The PACU staff included 43 registered nurses, the front-line staff implementing aromatherapy. These nurses received education on the benefits of aromatherapy and the proposed administration protocol. The unit provided gauze and disposable medicine cups for the intervention and the space required to store these materials. The ERAS purchased the peppermint oil needed for the intervention.

When patients arrive at the PACU, nurses assess for symptoms of PONV as one of the post-anesthesia recovery score (PARS) criteria. In the PARS assessment flowsheet in the electronic health record (EHR), PACU nurses document "controlled" in the "nausea and vomiting" section if patients do not develop PONV. However, if patients experience symptoms of PONV, nurses select "further intervention required" and administer a rescue antiemetic (Figure 3). At this site, anesthesia providers almost exclusively include ondansetron (Zofran) as a rescue antiemetic in PACU orders, even if it was administered preoperatively or intraoperatively.

Current PONV management guidelines recommend that a rescue antiemetic be from a different pharmacologic class than prophylactic antiemetics because repeating an antiemetic from the same class within six hours of administration is ineffective. (Gan et al., 2020). As a result of this current practice, patients may experience unrelieved or prolonged PONV symptoms.

Intervention

The proposed interventions were to reinstate aromatherapy for colorectal surgical patients and monitor clinical practice adherence. A multidisciplinary team, consisting of a doctoral nursing student, PACU leadership and staff, anesthesia personnel, and a data analyst, was recruited, and responsibilities were assigned to each member (Table 9). A project timeline was created and shared with team members (Tables 10-13). During PACU staff huddles, nursing staff received education on the benefits of aromatherapy and the administration protocol.

Implementation of the project took place over 15 weeks. As part of the approved protocol (Figure 4), when a colorectal surgical patient arrived to the PACU, the nurse prepared the aromatherapy materials in the designated supply area. He or she dispensed peppermint essential oil into a disposable medicine cup, saturated a piece of gauze with the oil, and placed the saturated gauze in a small resealable bag. The nurse instructed the patient to inhale the peppermint aroma. The PACU nurse documented the aromatherapy administration in the EHR and continued routine PACU assessments.

Several strategies were used to guide implementation. A formal written commitment was obtained to establish expectations with all team members to promote accountability. Identifying champions, such as PACU leadership, the ERAS committee, and the anesthesia department, promoted the multidisciplinary collaboration needed for successful implementation. Email reminders and conversations with PACU staff reinforced the project’s goals and objectives.

Weekly data analysis revealed when interventions were needed to improve compliance with aromatherapy administration.

Measures

Structure, process, and outcome goals were created with input from the project's multidisciplinary team (Table 14). The continued presence of aromatherapy supplies in the designated location and staff education indicated the achievement of the project's structure goals. A staff roster obtained from PACU management was used to monitor education progress. The project's process goal pertained to adherence to aromatherapy administration. To measure the process goal, the number of colorectal surgical patients offered aromatherapy was divided by the total number of colorectal surgical patients admitted to the PACU. The project's outcome goal stated that the rate of PONV among colorectal surgical patients in the PACU would decrease by 25%; this was defined as the number of colorectal patients experiencing PONV symptoms divided by the total number of colorectal surgical patients admitted to the PACU. Outcome goals demonstrate the results of process changes, so the project's outcome measure was chosen because research has shown that aromatherapy reduces PONV.

There is no validated tool in the literature measuring compliance with aromatherapy administration, a fundamental limitation of this project. For this reason, an EHR audit tool designed to monitor compliance (Appendix) was created on REDCap, a secure, Health Insurance Portability and Accountability Act (HIPAA)-compliant data collection system. This database was used to store data throughout the project, ensuring its completeness and accuracy. The project leader (QI-PL) was responsible for data collection and management. The QI-PL reviewed the facility's daily surgical postings as part of data collection procedures. To ensure all eligible participants were included in data collection, the QI-PL conducted weekly EHR audits for every

colorectal surgery patient. At the end of each week, this information was used to calculate the weekly rates of administration compliance and PONV.

Ethical Considerations

This QI project intended to improve PONV by adapting clinical practice in the PACU to provide nurse-led aromatherapy, a low-risk intervention, to colorectal surgical patients. Patients were at liberty to decline the aromatherapy intervention if they did not wish to participate. Before implementation, the project received a non-human subject's research determination from the Human Research Protections Office (HRPO) of the University of Maryland School of Medicine Institutional Review Board (IRB). The site's IRB reviewed the project and approved its design as a QI project.

One individual conducted chart audits in a private location at the clinical site to promote data protection. Data was stored in RED-Cap, a HIPAA-compliant, password-protected data management program available only by a virtual private network. The software is only accessible to the QI-PL and project faculty members. Data reports were deidentified and reported in aggregate. After the data analysis was completed, results were shared internally with the site for ongoing QI-PL evaluation and presented externally with site permission.

Results

Structure goals were achieved throughout the project's implementation. Each week during the implementation period, the QI-PL assessed the designated aromatherapy supply location to ensure project materials were available and restocked materials when supply levels were low. Lack of supplies never served as a barrier to implementation. One hundred percent (n=43) of PACU nurses received education about the QI project's goals. In addition, all PACU nurses received an electronic copy of the aromatherapy administration protocol to reference

throughout the implementation period.

Throughout the 15-week implementation period, 47 patients met inclusion criteria and were included in this QI project. Frequencies and percentages of the three nominal variables (administration of aromatherapy, development of PONV, and administration of rescue antiemetics) are displayed in Table 15. Eighteen colorectal surgical patients (38%) received aromatherapy. The project's process goal of achieving 100% compliance with aromatherapy administration was unmet. While 39 patients remained free of PONV symptoms, eight colorectal surgical patients (17%) experienced PONV. The project's outcome goal was not attained because the rate of PONV among colorectal patients did not decrease by 25%. Instead, compared to the PONV data from September 2022 to December 2022, the rate of PONV in this patient population experienced a significant increase.

Run charts were created to track process and outcome measures and to understand the variability trends over the 15-week implementation period. Figure 5 shows the weekly aromatherapy administration compliance rate. The PACU nurses' compliance rate in administering aromatherapy ranged from 0% in weeks one and five to 100% in weeks seven and eight. From weeks one through eleven, the median aromatherapy administration compliance was 33%, but during week 12 through the completion of the project, the median compliance increased to 38%. The run chart displayed in Figure 5 does not present any observable shifts, trends, or astronomical points (Institute for Healthcare Improvement, 2019). Five runs are noted; however, of the 15 data points on the run chart, only 11 points are meaningful because four points are on the median line (Institute for Healthcare Improvement, 2019). Five runs fall within the expected number of runs, indicating a significant change did not occur. Although the median compliance rate increased throughout the project, the interventions did not produce meaningful

changes in administration compliance.

The run chart in Figure 6 shows the weekly PONV rate over the implementation period. The PONV rate ranged from 0% to 50%. During weeks one through eleven, the median PONV rate was 0%, but from weeks 12 through 15, the median rate increased to 37%. No shifts, trends, or astronomical points are observed in this run chart. Four runs are noted, but there are only nine meaningful data points, which is insufficient to determine significance. Based on these results, aromatherapy administration did not have a meaningful impact on the rate of PONV. Instead, the increased PONV rate was likely the result of inadequate prophylaxis or other surgical- or anesthesia-related factors.

Several unintended consequences of the QI project became apparent during implementation and afterward during project evaluation. Although run chart analyses did not reveal significant changes during this project's implementation, interventions, such as email reminders to PACU and anesthesia staff and educational rounding, increased compliance (Figures 5 & 6). Unexpected benefits of this project were high levels of patient and PACU nurse satisfaction with the aromatherapy intervention. Facilitators to the project's implementation include continual support from PACU nurse leadership and the site's ERAS committee and the QI-PL's constant presence at the clinical site, which allowed for continual supervision, evaluation, and intervention. Patient admissions and increased workload on the unit limited the number of PACU nurses who could attend the educational sessions during PACU huddles and, so, served as a barrier to the initial education. As a result, some PACU nurses only received education via electronic communication. Other unforeseen limitations or barriers to the QI project included patients' levels of sedation and documentation challenges.

Discussion

Although the project's process and outcome measures were not met, an aromatherapy administration protocol and supplies were successfully implemented for colorectal surgical patients recovering in the PACU. Frequent rounds conducted by the QI-PL ensured sufficient aromatherapy supplies were available in the designated location each day. The administration compliance rate increased throughout implementation. Frequent evaluation and interventions, as documented in Figures 5 and 6, proved beneficial in improving the compliance rate. Despite the increase in compliance, the rate of PONV among colorectal surgical patients increased during the implementation period. This is likely related to the short implementation period and the increase in eligible participants during the last five weeks of the implementation period.

Despite the project's results, the aromatherapy intervention had a positive impact. During educational rounds, several nurses commented that patients frequently reported relief of nausea symptoms after exposure to the scent and were satisfied with the light, pleasant peppermint aroma. Nurses also enjoyed the scent throughout the unit, felt therapy was effective, and enjoyed the ease of administration. Aromatherapy facilitated a calming environment conducive to recovering from surgery and anesthesia.

Financial analysis reveals that the aromatherapy intervention is cost-effective. The hospital's previous aromatherapy intervention utilized aromatic inhalers, which ranged in price from $6-$10 per inhaler. Pharmacologic rescue antiemetics are less than $2 per dose. After cost analysis, hospital leadership abandoned these inhalers despite favorable reviews from staff and patients. This QI project was designed to implement a cost-conscious approach to aromatherapy. Evidence shows that aromatherapy, utilizing bulk oil, is effective in managing PONV symptoms (Amirhosseini et al., 2020; Karaman et al., 2019). Two 16-ounce bottles of peppermint oil were purchased for $45. The oil is highly concentrated, so only a few drops are needed to produce a

sufficient aroma. This essential oil supply will suffice for hundreds of patients who wish to participate in aromatherapy.

Prior approval from the infection prevention and pharmacy departments and PACU leadership ensures future project sustainability. During the project's planning phase, the leader infection prevention specialist approved the use of bulk oil and the proposed protocol. Because the oil is not a medication, pharmacy leaders do not require the pharmacy to dispense it, so it can remain in an easily accessible area for PACU staff to utilize when needed. Nursing leadership in the PACU continues to support and advocate for this nurse-led intervention in the unit, routinely reminding staff of its availability for patients who develop PONV.

Literature supports the use of aromatherapy using various inhalation techniques (inhalers, gauze, clips, etc.) to relieve PONV symptoms in various patient populations. Some studies demonstrate a reduction in rescue antiemetics administration (Karaman et al., 2019; Fearrington et al., 2019). This QI project did not assess the effectiveness of aromatherapy utilizing patients' reported pre-intervention and post-intervention nausea scales because the clinical site's IRB committee did not approve that proposed design. Since evidence has demonstrated aromatherapy's effectiveness in reducing PONV symptoms, administration compliance was measured instead.

Factors that may have limited the validity of the result include inconsistency in documentation and instances of simultaneous administration of aromatherapy and rescue antiemetics. Data collection relied on PACU nurses to document the intervention. Bedside nurses are overburdened with documentation as requirements continue to increase (Gesner et al., 2022). Patients may have received aromatherapy, but because there was no documentation in the EHR, administration went unrecognized and was not accounted for in data analysis. There were also

instances when aromatherapy administration care deviated from the written protocol, and patients received aromatherapy as a rescue therapy rather than as a prophylactic measure. Another limitation encountered during the project's implementation was patients' levels of sedation during their PACU stays. Intraoperative anesthetic management for colorectal surgery patients at the site includes long-acting intravenous infusions. Patients often arrive to PACU sedated, which limits participation in aromatherapy.

Conclusion

Complementary therapies, including aromatherapy, have become attractive options for treating various medical conditions. Current research and this QI project's results have shown that aromatherapy, utilizing bulk essential oil, is a simple, cost-effective, and evidence-based method to manage PONV symptoms in patients recovering in the PACU. It can improve comfort and satisfaction and improve rates of PONV, potentially leading to a shorter recovery period. It is relatively benign and non-invasive and can spare patients some side effects of routine rescue antiemetics, such as headaches, drowsiness, and QT prolongation. While it is a safe practice, PACU nurses must educate patients about proper administration to avoid ingestion and allergic reactions.

Since this project has gained the support of various hospital leaders, it is highly likely to be a sustainable intervention. While this project focused on colorectal surgical patients, aromatherapy should be offered to patients who develop PONV in PACU. Although research supports aromatherapy, this project demonstrated that outcomes may vary. For this reason, aromatherapy should be offered as an adjunct therapy to pharmacologic therapy as part of a comprehensive PONV symptom management strategy.

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Table 1

Evidence Review Table for Study 1

Citation: Briggs, P., Hawrylack, H., & Mooney, R. (2016). Inhaled peppermint oil for postop nausea in patients undergoing cardiac surgery. *Nursing*, *46*(7), 61–67. https://doi.org/10.1097/01.NURSE.0000482882.38607.5c	
Purpose or Hypothesis	The purpose of this study was to investigate the use of inhaled peppermint oil in treating postoperative nausea in patients undergoing cardiac surgery.
Type of Evidence & Design	Research: quasi-experimental design
Sample	**Sampling Technique:** convenience **Eligible Participants:** adult postoperative cardiac surgery patients; age > 18 years; understand and speak English; consents to aromatherapy **Setting:** cardiac care step-down unit at a large academic tertiary care facility in Delaware, USA **Exclusion Criteria:** allergy to peppermint or alcohol-based products **Accepted:** 123 participants **Control:** 89 patients (those who did not develop nausea after cardiac surgery) **Intervention:** 34 patients (those who developed nausea after cardiac surgery); 1 patient lost to follow up **Power Analysis/Achieved:** 30 patients required in the sample to achieve alpha 0.05, no mention of beta in study – power analysis met **Group Homogeneity:** Participants in each group had similar average ages, but other demographic characteristics (smoking status, history of PONV, history of gastrointestinal disorders) varied between the groups.
Intervention Procedures	**Control Protocol:** Nausea evaluated after surgery. Patients in this group denied nausea, so no further intervention provided. **Intervention Protocol:** Nausea evaluated after surgery. Patients who had nausea received a peppermint oil nasal inhaler. Three drops of peppermint essential oil were applied to cotton wick in the inhaler. Patients instructed to inhale deeply through one open nostril for three seconds, hold their breath for three seconds, and exhale through pursued lips for three seconds. Patients completed this exercise three times. After two minutes, patients rated their nausea again. **Treatment Fidelity:** Within the intervention group, treatment fidelity was intact. The same nurse prepared all the plastic inhaler tubes the same way with the same amount of peppermint essential oil. Patients were all taught how to use the nausea scale. Patients received the same instructions on how to breathe through the inhaler. Patients rated their nausea after the same amount of time.
Primary Outcome & Measure	**Dependent Variable:** Nausea severity **DV Measure:** Nausea scale from 0 to 5 developed from a prior study (Halpin et al., 2010): 0 = no nausea; 1 = nausea anticipated and prophylaxis medications may be given; 2 = mild nausea, persistent, able to tolerate food or medication by mouth; 3 = moderate nausea, persistent, lacks appetite, does not feel like eating, but can eat small meals; 4 = great nausea, ongoing, no appetite, unable to tolerate food or medications by mouth; 5 = severe nausea, nausea with dry heaves reported
Results & Conclusion	**Statistical Results:** Paired *t*-test showed nausea severity scores significantly declined after exposure to peppermint aromatherapy inhaler. **Conclusions:** Peppermint oil inhalation can be considered as a first-line treatment for postoperative nausea in cardiac surgery patients.
Level & Quality	Level II and Quality B (good) based on the Johns Hopkins Evidenced-Based Practice Model for Nursing and Healthcare Professionals (JHEBPM)

Table 2

Evidence Review Table for Study 2

Citation: Maghami, M., Afazel, M. R., Azizi-Fini, I., & Maghami, M. (2020). The effect of aromatherapy with peppermint essential oil on nausea and vomiting after cardiac surgery: A randomized clinical trial. *Complementary Therapies in Clinical Practice, 40*, 1-7. https://doi.org/10.1016/j.ctcp.2020.101199	
Purpose or Hypothesis	The purpose of this study is to investigate the effect of peppermint oil inhalation on the severity of nausea and vomiting in patients recovering from open-heart surgery.
Type of Evidence & Design	Research: single-blind, randomized clinical trial
Sample	**Sampling Technique:** convenience **Eligible Participants:** cardiac patients undergoing elective open-heart patients wanting to participate in the trial; age > 18 years; fully conscious postoperatively; no respiratory comorbidity; ability to answer study questions **Setting:** cardiac surgery ward in a teaching hospital in Kashan, Iran **Exclusion criteria:** patients who withdrew from the trial; history of allergic reaction to peppermint; endotracheal intubation > 24 hours; reintubation during the first hours after extubation; patients who needed to return to the operating room for surgery; patient death before the end of the trial **Accepted:** 60 open-heart surgical patients. Coin-tossing was used to assign patients to either control or intervention group. **Control:** 30 patients; 4/30 patients were lost in the follow up period **Intervention:** 30 patients **Power Analysis/Achieved:** 30 patients per group required to meet 80% beta, 0.05 alpha – power analysis not met **Group Homogeneity:** Groups homogenous at baseline in terms of age, gender, type of surgery, history of gastric ulcers, pre- and post-surgical vital signs, duration of anesthesia, intubation, and time on bypass pump, fasting times, and amounts of anesthetics administered.
Intervention Procedures	**Control Protocol:** Routine care, consisting of pain management and post-extubation oxygen therapy (4-8 L/min) via simple mask or nasal cannula **Intervention Protocol:** Patients received three phases of peppermint oil aromatherapy: 30 minutes before tracheal extubation (aromatherapy delivered via nebulizer of the ventilator), four hours after extubation (aromatherapy delivered via nebulizer mask), and eight hours after extubation. **Treatment Fidelity:** All members of the intervention group received 0.1 mL of 10% peppermint oil from the same manufacturer mixed with 10 mL distilled water delivered via nebulization during each phase. Nausea and vomiting severity and frequency were assessed at the same times for both groups. If nausea or vomiting occurred, patients in both groups were given antiemetics. The study does not describe what antiemetic or dosage was administered as a rescue therapy, or if every patient with nausea and vomiting received the same medication, creating potential for treatment infidelity. Patients did not receive the same oxygen flow rate but, instead, received a range of oxygen flow rates (4-8 L/min). Data statisticians remained blind to the group assignments.
Primary Outcome & Measure	**Dependent Variable:** Frequency, duration, and severity of nausea and frequency of vomiting **DV Measure:** Nausea and vomiting were assessed using a numerical scale consisting of four questions about the severity, frequency, and duration of nausea and the frequency of emesis during the first twelve hours after surgery at three interval periods (first four hours, second four hours, and third four hours). Severity scores ranged from zero (no nausea) to 100 (most nausea). No documentation of validity or reliability of nausea severity tool.
Results & Conclusion	**Statistical Results:** *T*-tests were used to compare the mean severity, duration, and frequencies of nausea and vomiting. Patients in the intervention group experienced significantly fewer instances of nausea in the first four hours after surgery ($p < 0.05$). Patients in the intervention group experienced a significantly shorter duration of nausea in the first four hours after surgery ($p < 0.05$). Patients in the intervention group experienced significantly fewer instances of emesis after surgery ($p = 0.000$). **Conclusions**: Aromatherapy with peppermint oil decreases the frequency and duration of nausea and the frequency of emesis episodes in the first four hours after tracheal extubation in cardiac surgery patients.
Level & Quality	Level I & Quality B (good) based on the JHEBPM

Table 3

Evidence Review Table for Study 3

Citation: Karaman, S., Karaman, T., Tapar, H., Dogru, S., & Suren, M. (2019). A randomized placebo-controlled study of aromatherapy for the treatment of postoperative nausea and vomiting. *Complementary Therapies in Medicine, 42*, 417–421. https://doi.org/10.1016/j.ctim.2018.12.019	
Purpose or Hypothesis	The purpose of this study was to compare the treatment effect of aromatherapy on PONV in surgical patients using oils of various scents.
Type of Evidence & Design	Research: randomized controlled trial
Sample	**Sampling Technique:** convenience **Eligible Participants:** patients who experienced PONV after undergoing elective surgery with general anesthesia from April 2016-November 2018 **Setting:** postoperative recovery room at various hospitals in Tokat, Turkey **Exclusion Criteria:** age < 17 years or age > 65 years; pregnant or breastfeeding; history of psychological, cardiovascular, or pulmonary disease; allergies to lavender, rose, or ginger; poor sense of smell; received antiemetic drug **Accepted:** 184 participants who met eligibility criteria and gave informed consent. A computer-generated random number table was used to assign patients to four different groups. **Control:** 46 patients in control group (Group P) **Intervention:** 46 patients in ginger oil group (Group G); 46 patients in lavender oil group (Group L); 46 patients in rose oil group (Group R) **Power Analysis/Achieved:** 42 patients per group required to meet 80% beta, 0.05 alpha – power analysis met **Group Homogeneity:** Patients in all four groups were homogenous at baseline in terms of demographic characteristics, predictive factors for PONV at baseline, type of surgery, reversal drug received, analgesics received, and initial nausea scores.
Intervention Procedures	**Control Protocol:** Two drops of pure water were dropped onto a 5x5 cm impermeable gauze pad, which was given to the patient. The patient inhaled the scent for five minutes. At 15 and 40 minutes after the beginning of the aromatherapy, the patient's nausea and vomiting scores were reevaluated. If the nausea score > 1 or vomiting persisted, 8 mg of ondansetron was administered. **Intervention Protocol:** Based on the group assignment (G, L, or R), two drops of oil were dropped onto a 5x5 cm gauze pad. The patient inhaled the scent for five minutes. At 15 and 40 minutes after the beginning of the aromatherapy, the patient's nausea and vomiting scores were reevaluated. If the nausea score > 1 or vomiting persisted, 8 mg of ondansetron was administered. **Treatment Fidelity:** Treatment fidelity intact. The certified registered nurse anesthetist (CRNA) assessed patients' baseline nausea and vomiting scores for both groups using the same scales. The same amount of liquid was administered on the same size gauze pad. Patients were exposed to the gauze pad for the same amount of time. Patients' nausea and vomiting scores were evaluated at the same time periods. The same rescue antiemetic at the same dose was given to patients with persistent PONV.
Primary Outcome & Measure	**Dependent Variable:** PONV scores **DV Measure:** Patients reported their nausea severity scores utilizing a Likert scale ranging from 0 to 3 (0 = no nausea, 1 = some nausea, 2 = a lot of nausea, 3 = severe nausea) before the aromatherapy, 15 minutes after treatment, and 40 minutes after treatment. The investigator provided the patients' vomiting scores using a Likert scale ranging from 0 to 3 (0 = no vomiting, 1 = vomited once, 2 = vomited 2 or 3 times, 3 = vomited more than 3 times) at each of the three time intervals. No documentation of validity or reliability of PONV scoring tool.
Results & Conclusion	**Statistical Results:** Kruskal-Wallis tests revealed nausea scores were significantly different among the four groups after 15 minutes. Post hoc Dunn's analysis showed patients in the lavender and ginger groups had significantly less nausea. Results from the placebo group and the rose oil group were not significant. Logistic regression demonstrated lavender and ginger aromatherapy were significantly related to nausea improvement. Chi-squared test showed vomiting and antiemetic drug requirements were significantly different among the groups. **Conclusions:** Aromatherapy using lavender and ginger oil helps reduce postoperative nausea severity and vomiting after surgical procedures.
Level & Quality	Level I and Quality A (high) based on JHEBPM

Table 4

Evidence Review Table for Study 4

Citation: Khatiban, M., Mirzaie, M., Fazeli, A., Tapak, L., & Khalili, Z. (2022). Effect of cardamom inhalation therapy on intra-and postoperative nausea and vomiting of mothers undergoing spinal anesthesia for elective Cesarean section. *Journal of Perianesthesia Nursing*, *37*(4), 452–457. https://doi.org/10.1016/j.jopan.2021.09.008	
Purpose or Hypothesis	The purpose of this study is to investigate the effect of cardamom inhalation on intraoperative and postoperative nausea and vomiting in females undergoing spinal anesthesia for elective Cesarean section.
Type of Evidence & Design	Research: single-blind, randomized controlled trial
Sample	**Sampling Technique:** convenience **Eligible Participants:** women presenting to the OR for elective Cesarean section; age > 16 years; normal singleton pregnancy; no reported history of nausea during the third trimester of pregnancy, chronic diseases, respiratory illnesses; no allergy to essential oils or herbs; no history of drug or alcohol abuse; no history of motion sickness; no use of antiemetics in 24 hours prior to surgery **Setting:** surgical department at Mehr Hospital in west Iran **Exclusion Criteria:** complicated Cesarean section; repeated (> 2) attempts for spinal needle insertion; contraindication for spinal anesthesia; initiation of general anesthesia; severe hypotension (>20% of baseline blood pressure) with bradycardia (pulse < 50 bpm); received opioids before study intervention **Accepted:** 70 participants. Permutation was used to randomly assign participants into the intervention and control groups. **Control:** 35 parturients; no participants lost to follow up **Intervention:** 35 parturients; no participants lost to follow up **Power Analysis/Achieved:** 35 patients per group required to meet 80% beta, 0.05 alpha – power analysis met **Group Homogeneity:** Participants in both groups were similar at baseline in terms of operating times, urbanization, education status, employment status, having nausea and vomiting during pregnancy, and receiving opioids during surgery.
Intervention Procedures	**Control Protocol:** When complaining of nausea, patients were instructed to inhale from a plastic bag containing two sterile, 2-in by 2-in gauze pads soaked in 2 mL normal saline. **Intervention Protocol:** When complaining of nausea, patients were instructed to inhale from a plastic bag containing two sterile, 2-in by 2-in gauze pads soaked in 2 mL normal saline and two drops of cardamom essential oil. **Treatment Fidelity:** Treatment fidelity intact. Participants were all trained on how to perform controlled breathing exercises using the plastic bag filled with soaked gauze pads. Participants were trained how to rate their nausea via a standard scale and were given an opportunity to practice grading their nausea. The cardamom essential oil came from the same approved manufacturer. Spinal anesthesia technique was the same for each participant. Patients received the same dosage of local anesthesia and flow rate of oxygen.
Primary Outcome & Measure	**Dependent Variable:** Nausea and its severity; frequency of emesis **DV Measure:** The visual analog scale was used to measure the severity of nausea with scores ranging from 0 (no nausea) to 100 (“worst imaginable nausea”). Frequency of emesis was defined as the number of instances of retching or vomiting.
Results & Conclusion	**Statistical Results:** Chi-square test showed five minutes after treatment the incidence of nausea was significantly lower in the intervention group. *T*-test demonstrated five minutes after treatment both intervention and placebo groups had decreased severity of nausea. However, linear regression analysis revealed the decline in nausea severity was more pronounced in the intervention group than the placebo group. Chi-square test showed the number of participants who experienced retching was significantly lower in the intervention group. Although fewer participants experienced vomiting in the intervention group, this was not statistically significant. **Conclusions:** Cardamom aromatherapy helps reduce the incidence and severity of nausea and the incidence of retching in parturients undergoing spinal anesthesia for elective Cesarean section. It may also help reduce the incidence of vomiting in this population.
Level & Quality	Level I and Quality A (high) based on JHEBPM

Table 5

Evidence Review Table for Study 5

Citation: Amirhosseini, M., Dehghan, M., Mangolian, S. P., & Pakmanesh, H. (2020). Effectiveness of aromatherapy for relief of pain, nausea, and vomiting after percutaneous nephrolithotomy: A randomized controlled trial. *Complementary Medicine Research, 27*(6), 440–448. https://doi.org/10.1159/000508333	
Purpose or Hypothesis	The purpose of this study was to investigate the effectiveness of lavender and clary sage aromatherapy on pain, nausea, and vomiting in patients after percutaneous nephrolithotomy.
Type of Evidence & Design	Research: single-blind, randomized controlled trial
Sample	**Sampling Technique:** convenience **Eligible Participants:** patients undergoing percutaneous nephrolithotomy; age between 18-65; absence of coagulation disorders; no migraine/chronic headache; no allergy to medicinal plants and aromatic substances; no use of sedatives or aromatherapy in the last week; no history of asthma or respiratory disease; no mental or psychological disease **Setting:** anesthesia recovery area at Shahid Bahonar Hospital in southeast Iran **Exclusion Criteria:** cardiopulmonary disorders, admission to CCU and ICU; discharge before the end of the intervention period; skin or respiratory allergy to lavender or clary sage **Accepted:** 79 participants. Participants were randomized into three groups but does not describe randomization process. **Control:** 26 patients; no patients lost to follow up **Intervention:** 26 patients assigned to lavender group, no patients lost to follow up; 26 patients assigned to clary sage group, no patients lost to follow up **Power Analysis/Achieved:** 26 patients per group were required to meet 80% beta, alpha 0.05 – power analysis met **Group Homogeneity:** Patients in each of the three groups were similar in terms of age, gender, and marital status, and income. Duration of surgery and use of analgesics and antiemetics were similar among each group.
Intervention Procedures	**Control Protocol:** Routine post-anesthesia care: oxygen mask, treatment with medication for pain, nausea, and vomiting according to physician order **Intervention Protocol:** Sterilized gauze with three drops of oil (lavender or clary sage based on group assignment) placed within 10 cm of patient's nose. Patient asked to inhale it for five minutes. **Treatment Fidelity:** Patients in all groups were evaluated for pain, nausea, and vomiting at the same intervals: arrival to the recovery area, three hours after surgery, and six hours after surgery. Essential oil was obtained from the same company. The purity, concentration, and components of the oil were analyzed at the company's laboratory and then purchased for the study.
Primary Outcome & Measure	**Dependent Variable:** Pain, nausea, and episodes of emesis **DV Measure:** The severity of pain and nausea was assessed using the visual analog scale, where 0 indicated the lowest severity of pain or nausea and 10 indicated the highest intensity of pain or nausea. The episodes of emesis were defined as the frequency of vomiting episodes a patient experienced.
Results & Conclusion	**Statistical Results:** Friedman and Kruskal-Wallis tests revealed no significant difference in pain immediately after surgery, 30 minutes after surgery, and six hours after surgery. Although mean nausea scores were lower in the intervention groups, these tests did not detect statistical significance. Fischer test determined the rate of vomiting was significantly lower in the lavender group. **Conclusions:** Lavender aromatherapy reduces the number of emetic episodes in patients who undergo percutaneous nephrolithotomy. Lavender and clary sage oil may help reduce the incidence of nausea in patients who undergo percutaneous nephrolithotomy.
Level & Quality	Level I and Quality B (Good) based on JHEBPM

Table 6

Evidence Review Table for Study 6

Citation: Brown, L., Danda, L., & Fahey, I. T. J. (2018). A quality improvement project to determine the effect of aromatherapy on postoperative nausea and vomiting in a short-stay surgical population. *AORN Journal, 108*(4), 361–369. https://doi.org/10.1002/aorn.12366	
Purpose or Hypothesis	The purpose of this study was to investigate the effectiveness of aromatherapy on preventing or treating postoperative nausea and vomiting (PONV) in a short-stay surgical population.
Type of Evidence & Design	Research: quasi-experimental design
Sample	**Sampling Technique:** convenience **Eligible Participants:** male and female patients aged 18-80 years undergoing a short-stay (<72 hours) surgical procedure under general anesthesia **Setting:** short-stay surgical unit at Weill Cornell New York Presbyterian Hospital in New York, USA **Exclusion Criteria:** persistent nausea before the administration of general anesthesia; opted for antiemetic to treat nausea; unable to speak or comprehend English; cognitive impairments; limited nasal breathing due to obstruction **Accepted:** 50 participants **Control:** no control group based on nature of design **Intervention:** 50 patients **Power Analysis/Achieved:** sample size of 35 patients to achieve 80% beta, 0.05 alpha – power analysis met **Group Homogeneity:** Not applicable as the study did not include a control group.
Intervention Procedures	**Control Protocol:** Not applicable. **Intervention Protocol:** Nausea assessed upon entry to short-stay surgical unit. All patients were offered an aromatherapy patch consisting of orange and peppermint essential oils or standard intravenous ondansetron antiemetic treatment. Patients who chose aromatherapy received a patch that was secured to the upper chest of the hospital gown. Nausea was assessed again 30 minutes later. If nausea persisted, patients were given the option of ondansetron or another patch application. **Treatment Fidelity:** Patients were assessed for nausea at the same time using the same scale. Post-anesthesia nurses received education regarding placement and application of the aromatherapy patches to ensure proper usage. Frequent in-services were held on the unit to promote continuous education to ensure compliance and reinforce the correct process.
Primary Outcome & Measure	**Dependent Variable:** PONV symptoms **DV Measure:** PONV assessment tool called Ambulatory Surgery Index of Nausea, Vomiting, and Retching (AS-INVR), a validated 5-point Likert scale assessment tool: 1 = no nausea; 2 = mild, nausea reported, able to tolerate food and medication; 3 = moderate, nausea persisting, lacking appetite, able to eat small meals occasionally; 4 = great, nausea ongoing, no appetite; 5 = severe, nausea with dry heaves reported.
Results & Conclusion	**Statistical Results:** The Wilcoxon signed rank test determined administration of aromatherapy resulted in a significant decline in nausea score. Thirty-five (70%) patients reported lower nausea scores after aromatherapy implementation. **Conclusions:** Aromatherapy using orange and peppermint essential oil helps reduce nausea symptoms in patients undergoing short-stay surgical procedures with general anesthesia.
Level & Quality	Level II and Quality B (good) based on JHEBPM

Table 7

Evidence Review Table for Study 7

Citation: Fearrington, M. A., Qualls, B. W., & Carey, M. G. (2019). Essential oils to reduce postoperative nausea and vomiting. *Journal of Perianesthesia Nursing, 34*(5), 1047–1053. https://doi.org/10.1016/j.jopan.2019.01.010	
Purpose or Hypothesis	The purpose of this study is to determine if essential oils would reduce the need for antiemetics to treat postoperative nausea and vomiting (PONV) in ambulatory surgical patients.
Type of Evidence & Design	Research: quasi-experimental design
Sample	**Sampling Technique:** convenience **Eligible Participants:** adult patients scheduled for ambulatory surgery or 23-hour stays following surgery; age > 18 years; able to understand and follow directions; able to provide informed consent; understand, read, and write English **Setting:** surgical center of a large urban teaching hospital **Exclusion Criteria:** history of chronic obstructive pulmonary disease, asthma, or other respiratory condition that could be worsened by strong aromas; inability to smell fragrances; allergy to peppermint or ginger; sensitivity to strong odors **Accepted:** 322 participants **Control:** 179 patients; retrospective chart review of the prior year's surgeries that met the same inclusion criteria **Intervention:** 143 patients **Power Analysis/Achieved:** 190 patients needed in sample to meet 80% beta, alpha 0.05 – power analysis met **Group Homogeneity:** Group homogeneity established in terms of age and sex. Groups were statistically different in terms of race, episodes of PONV, and total hours in the operating room.
Intervention Procedures	**Control Protocol:** Limited description of control protocol based on retrospective status. Received the standard IV antiemetic medication for any complaints of PONV. **Intervention Protocol:** Inhalers contained four drops of essential oils of peppermint or ginger or two drops of each of the two oils. Inhalers were sealed in a plastic bag and marked with a four-digit number. Patients in the preoperative area randomly selected an inhaler from a basket. Patients were taught how to use the inhaler before any sedating medications were given. In the recovery area, nurses assessed nausea with every set of vital signs. If nausea was present, the nurse offered the patient the inhaler selected in the preoperative area. Nausea was assessed again five minutes later. If persistent, patients would be offered a second dose from the inhaler. Patients who were actively vomiting received an antiemetic medication without using the inhaler. **Treatment Fidelity:** Inhalers were arranged by designated personnel who were not associated with the surgical center. Inhalers contained the same volume of essential oil. Essential oil was randomly selected by the patient, but two different types and a combination of these oils were utilized, creating concern of treatment infidelity.
Primary Outcome & Measure	**Dependent Variable:** Nausea, nausea severity, and antiemetics administered **DV Measure:** Nausea scale based on a 0 to 3 verbal descriptive scale: 0 = no nausea and 3 = worst nausea. The amount of antiemetics administered was defined as the number of doses of antiemetics administered per patient.
Results & Conclusion	**Statistical Results:** *T*-test showed patients in the intervention group had greater histories of PONV, but patients received significantly fewer doses of antiemetics. There was no significant difference in nausea score or in doses of antiemetics administered among the various essential oils. **Conclusions:** Aromatherapy with ginger and peppermint essential oil helps reduce the need for pharmacologic antiemetic therapy needed to treat PONV in ambulatory surgical patients.
Level & Quality	Level II and Quality B (good) based on JHEBPM

Table 8

Evidence Synthesis Table

<table>
<tr><td colspan="4">Project Title: Aromatherapy for Postoperative Nausea and Vomiting Management in the Recovery Area</td></tr>
<tr><th>JHNEBP Model Level</th><th>Total Number of Sources</th><th>Author & Quality of Each Study</th><th>Synthesis of Findings</th></tr>
<tr><td>Level I
Experimental Study – randomized controlled trial (RCT) – Systematic review of RCTs with or without meta-analysis</td><td>4 single-blind RCT</td><td>(Amirhosseini et al., 2020): B
(Karaman et al., 2019): A
(Khatiban et al., 2022): A
(Maghami et al., 2020): B</td><td>Amirhosseini et al. (2020) found lavender and clary sage essential oils reduced the incidence of nausea, and lavender oil reduced the number of emesis episodes in patients undergoing percutaneous nephrolithotomy. Karaman et al. (2019) discovered ginger and lavender essential oils reduced PONV severity in surgical patients in the recovery area. Khatiban et al. (2022) showed cardamom aromatherapy reduced the incidence and severity of nausea and the incidence of retching in women undergoing Cesarean section with spinal anesthesia. Maghami et al. (2020) found aromatherapy with peppermint oil decreases the incidence and duration of nausea and the incidence of emesis in the first four hours after tracheal extubation in cardiac surgery patients.</td></tr>
<tr><td>Level II
Quasi-experimental studies – Systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis</td><td>3 quasi-experimental research studies</td><td>(Briggs et al., 2016): B
(Brown et al., 2018): B
(Fearrington et al., 2019): B</td><td>Briggs et al. (2016) found peppermint oil inhalation was an effective first-line therapy for postoperative nausea in cardiac surgery patients. Brown et al. (2018) showed aromatherapy using a combination of orange and peppermint essential oils reduced nausea symptoms in ambulatory surgical patients who underwent general anesthesia. Fearrington et al. (2019) found ginger and peppermint essential oils reduced the amount of rescue antiemetic medications administered to ambulatory surgical patients.</td></tr>
<tr><td colspan="3">Level III
Non-experimental study – Systematic review of a combination of RCTs, quasi-experimental, and non-experimental studies, or non-experimental studies only, with or without meta-analysis – Qualitative study or systematic review of qualitative studies with or without meta-synthesis</td><td></td></tr>
<tr><td colspan="3">Level IV
Opinion of respected authorities and/or reports of nationally recognized expert committees/consensus panels based on scientific evidence</td><td></td></tr>
<tr><td colspan="3">Level V
Evidence obtained from literature reviews, quality improvement, program evaluation, financial evaluation, or case reports – Opinion of nationally recognized expert(s) based on experiential evidence</td><td></td></tr>
<tr><td colspan="4">Overall Quality Rating w/ Rationale and Recommendation: B, good and consistent evidence to support practice change</td></tr>
<tr><td colspan="4">Recommendations Based on Evidence Synthesis
• Strong, compelling evidence, consistent results: solid indication for a practice change.
• Good and consistent evidence: practice change
• Good but conflicting evidence: questionable indication for practice change; consider risk/benefit analysis
• Little or no evidence: no indication for practice change</td></tr>
</table>

Table 9

Site Team Table

Team Member Name & Credentials	Role in Project Implementation	Responsibilities
1. Danielle Miller, BSN, RN	Doctor of Nursing Practice Candidate; Project Team Leader	Initiated and led project. Gathered preliminary and post-implementation data. Communicated and collaborated with all members of the project team. Garnered PACU nurse support. Designed intervention and guided implementation. Designed measurement and audit tools.
2. S. H., MSN, CRNA	Director of Clinical Training; Project Site Sponsor	Provided guidance and advocacy to the project leader. Senior staff CRNA who served as a link to other departments and disciplines. Assisted in problem-solving. Provided administrative support.
3. A. H., DNP, CRNA, CRNP, FNP-BC	Anesthesia Representative on ERAS Committee; Clinical Site Representative	Regularly collaborated with the project leader. Supported and advocated for project implementation. Served as a liaison for other disciplines. Assisted in problem-solving. Approved practicum hours. Helped garner PACU nurse support.
4. S. W., MSN, NP	Nurse Practitioner for Department of General Surgery; Leader of ERAS Committee	Served as a liaison for hospital administration and the ERAS committee. Provided financial support and purchased project material (peppermint essential oil).
5. S. I., BSN, RN	Perioperative Services Manager; Champion of Aromatherapy	Oversaw perioperative nurses. Promoted the project among department staff.
6. A. E., BSN, RN	PACU Assistant Manager; Champion of Aromatherapy	Oversaw PACU nurses. Promoted the project among department staff.
7. PACU Nurses	First-Line Implementers of Aromatherapy	Assessed patients for PONV. Educated colorectal surgical patients about the benefits of aromatherapy. Implemented aromatherapy intervention per protocol. Documented intervention in EHR.
8. Anesthesia Providers	Physicians, CRNAs, SRNAs, anesthesia residents	Notified PACU nurses of patients' risks of PONV. Reminded PACU nurses to utilize aromatherapy during handoff.
9. L. L.	Senior Data Analyst; IT Specialist	Served as project IT expert. Assisted project leader in gathering data prior to and after project implementation.

Table 10

Project Identification Gantt Chart

DNP Project Title: Assessing Aromatherapy Compliance in the Post-Anesthesia Care Unit

Student: Danielle Miller

Project Start: Mon, 1/23/2023

Display Week: 1

Project Identification (NDNP810)	Responsible	START	END
Start of Spring Term		1/23/23	
CITI (enter renewal date as end)	Dani Miller	1/26/22	1/25/25
HIPAA (enter renewal date as end)	Dani Miller	1/26/22	1/25/25
Identify stakeholders/team	Dani Miller	1/23/23	1/30/23
Identify roles/responsibilities	Dani Miller	1/23/23	1/30/23
Identify practice problem/root cause	Dani Miller	1/23/23	1/30/23
Context Assessment	Dani Miller	1/23/23	2/13/23
Identify scope/goals	Dani Miller	1/23/23	2/13/23
Synthesize Evidence	Dani Miller	1/23/23	2/13/23
Development project plans	Dani Miller	1/23/23	3/13/23
MILESTONE: Submit initial project proposal	Dani Miller	1/23/23	4/3/23
MILESTONE: Submit revised project proposal	Dani Miller	1/23/23	4/24/23
MILESTONE: Submit final project proposal	Dani Miller	1/23/23	5/10/23
Contact IT specialist	Dani Miller	1/23/23	2/7/23
Identify aromatherapy product	Dani Miller	1/23/23	3/2/23
Purchase aromatherapy product	Dani Miller	1/23/23	5/10/23
Site IRB Inquiry	Dani Miller	4/3/23	4/23/23
REDcap	Dani Miller	1/23/23	5/15/23
End of Spring Term			5/15/23

Table 11

Project Development Gantt Chart

DNP Project Title: Assessing Aromatherapy Compliance in the Post-Anesthesia Care Unit

Student: Danielle Miller

Project Start: Mon, 6/5/2023

Display Week: 1

Project Development (NDNP811)			
Start of Summer Term		6/5/23	
Develop implemenation plans	Dani Miller	6/5/23	7/14/23
Develop teaching plan	Dani Miller	6/5/23	7/14/23
MILESTONE: Site Presentation and Approval	Dani Miller	6/5/23	7/21/23
MILESTONE: IRB Determination	Dani Miller	6/5/23	7/26/23
End of Summer Term			7/28/23

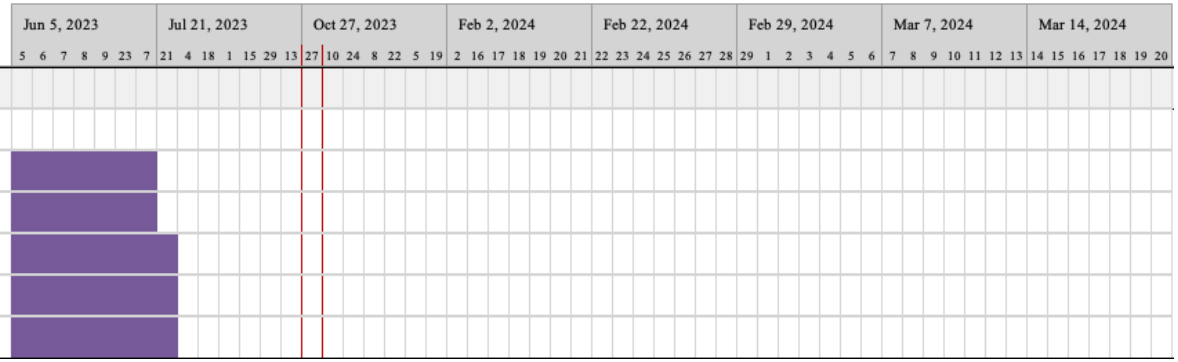


Table 12

Project Implementation Gantt Chart

DNP Project Title: Assessing Aromatherapy Compliance in the Post-Anesthesia Care Unit

Student: Danielle Miller

Project Start: Mon, 8/28/2023

Display Week: 1

Project Implementation (NDNP812)			
Start of Fall Term		8/28/23	
MILESTONE: Project go-live (implement)	Dani Miller	9/4/23	12/15/23
Educaton/Training	Dani Miller	8/28/23	12/15/23
Monitor tactics and progress	Dani Miller	9/4/23	12/15/23
Communicate with stakeholders	Dani Miller	8/28/23	12/15/23
Data Collection	Dani Miller	9/4/23	12/15/23
Dissemination Plan	Dani Miller	10/23/23	12/15/23
MILESTONE: Manuscript	Dani Miller	11/10/23	12/15/23
End of Fall Term			12/15/23

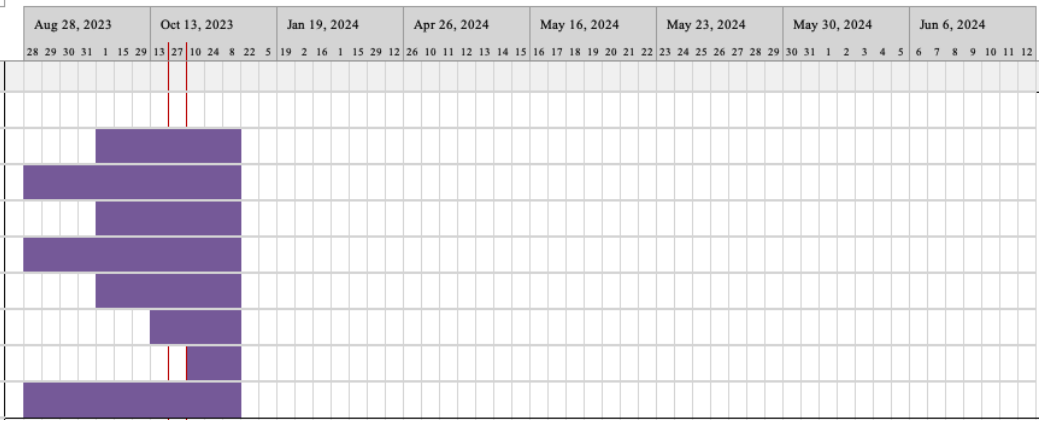


Table 13

Project Evaluation Gantt Chart

DNP Project Title: Assessing Aromatherapy Compliance in the Post-Anesthesia Care Unit

Student: Danielle Miller

Project Start: Mon, 1/22/2024

Display Week: 1

Project Evaluation and Dissemination (NDNP813)			
Start of Spring Term		1/22/24	
Analyze, synthesize & evaluate results	Dani Miller	1/22/24	2/29/24
Sustainability Plan	Dani Miller	3/1/24	3/31/24
MILESTONE: Develop Poster	Dani Miller	1/22/24	3/29/24
MILESTONE: Site Presentation	Dani Miller	1/22/24	4/1/24
MILESTONE: Extrernal Dissemination	Dani Miller	1/22/24	4/8/24
MILESTONE: Final Manuscript	Dani Miller	1/22/24	4/30/24
MILESTONE: UMSON Poster Day	Dani Miller	1/22/24	5/10/24
Project Closure w/site	Dani Miller	1/22/24	4/30/24
End of Spring Term			5/10/24

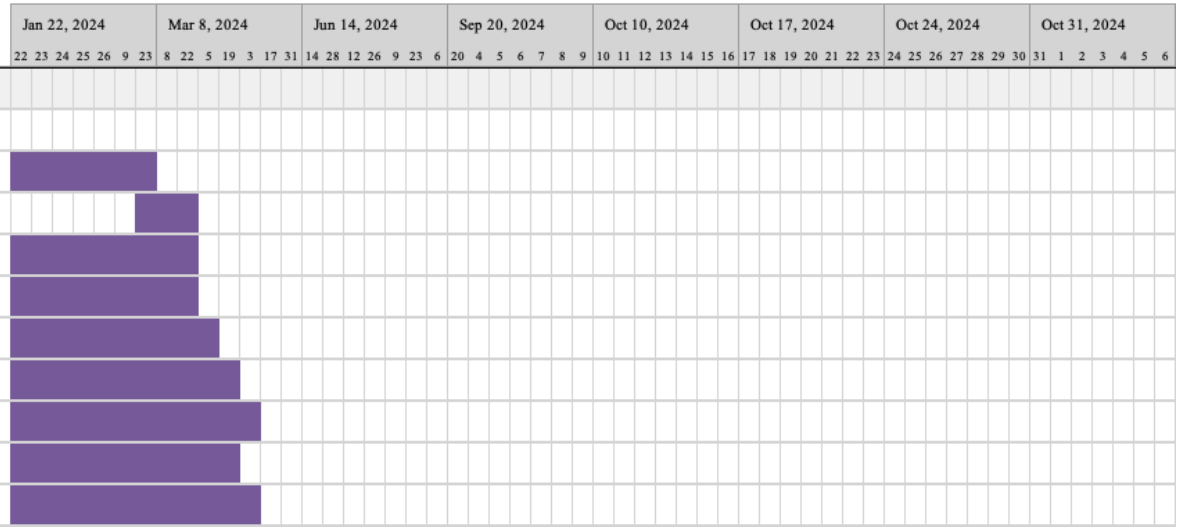


Table 14

Outcome Measurement Plan

Project Goals	**Measure Pre-Implementation**	**Measure During Implementation**
Structure		
1. By September 4, 2023, peppermint essential oil will be available on the unit in a designated location, and 100% of PACU nurses will know the location of the aromatherapy supplies.	Presence/absence of essential oil on the unit in a designated location. Use of email directory and PACU nurse roster.	Presence/absence of essential oil on the unit in a designated location. Use of email directory and PACU nurse roster
2. By September 4, 2023, 100% of PACU nurses will receive education on the benefits of aromatherapy and approved aromatherapy administration protocol.	Use of email directory and PACU nurse roster.	Use of email directory and PACU nurse roster.
Process		
1. By December 15, 2023, 100% of colorectal surgical patients will be offered aromatherapy in the PACU.	**Numerator:** total number of colorectal surgical patients offered aromatherapy **Denominator:** total number of colorectal surgical patients admitted to the PACU	**Numerator:** total number of colorectal surgical patients offered aromatherapy **Denominator:** total number of colorectal surgical patients admitted to the PACU
Outcome		
1. By December 15, 2023, the rate of PONV among colorectal surgical patients in the PACU will decrease by 25%.	**Numerator:** number of colorectal surgical patients experiencing PONV in the PACU **Denominator:** number of colorectal surgical patients admitted to the PACU	**Numerator:** number of colorectal surgical patients experiencing PONV in the PACU **Denominator:** number of colorectal surgical patients admitted to the PACU

Project Goals	**Data Collection Procedures**	**Name of Data Collection Tool**
By September 4, 2023, peppermint essential oil will be available on the unit in a designated location, and 100% of PACU nurses will know the location of the aromatherapy supplies.	**Who:** Project lead **How:** Routine assessment and education sessions **When:** By September 4, 2023	Not applicable.
By September 4, 2023, 100% of PACU nurses will receive education on the benefits of aromatherapy and approved aromatherapy administration protocol.	**Who:** Project lead **How:** Education during staff meeting/huddle **When:** By September 4, 2023	Not applicable.
By December 15, 2023, 100% of colorectal surgical patients will be offered aromatherapy in the PACU.	**Who:** Project lead **How:** Chart audits **When:** By December 15, 2023	REDCap Chart Audit Tool
By December 15, 2023, the rate of PONV among colorectal surgical patients in the PACU will decrease by 25%.	**Who:** Project lead **How:** Chart audits **When:** By December 15, 2023	REDCap Chart Audit Tool

Table 15

Frequency Table for Eligible Colorectal Surgical Patients Admitted to the PACU During Each Week of Implementation (n=25)

Variable	n	Percentage
Week 1 Sample Size	2	
Week 2 Sample Size	3	
Week 3 Sample Size	3	
Week 4 Sample Size	3	
Week 5 Sample Size	2	
Week 6 Sample Size	4	
Week 7 Sample Size	1	
Week 8 Sample Size	3	
Week 9 Sample Size	3	
Week 10 Sample Size	3	
Week 11 Sample Size	6	
Week 12 Sample Size	5	
Week 13 Sample Size	3	
Week 14 Sample Size	2	
Week 15 Sample Size	4	
Total Number of Patients	47	
Was aromatherapy administered?		
Yes	18	38.3%
No	29	61.7%
Did the patient develop PONV?		
Yes	8	17.0%
No	39	83.0%
Did the patient require a rescue antiemetic?		
Yes	8	17.0%
No	39	83.0%

Note. Due to rounding errors, percentages may not equal 100%.

Figure 1

Fishbone Diagram Exploring PONV at a Tertiary Care Academic Hospital

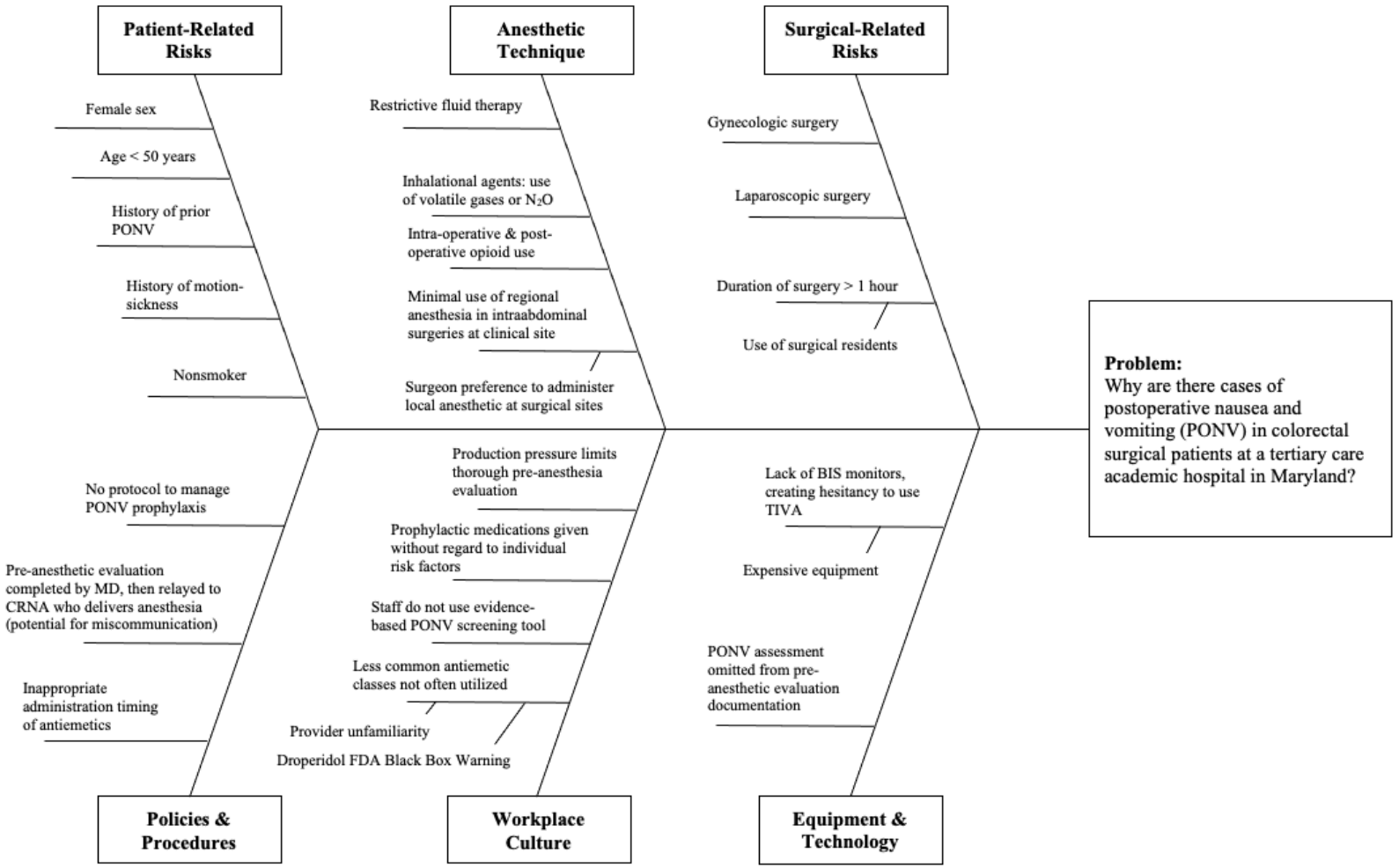
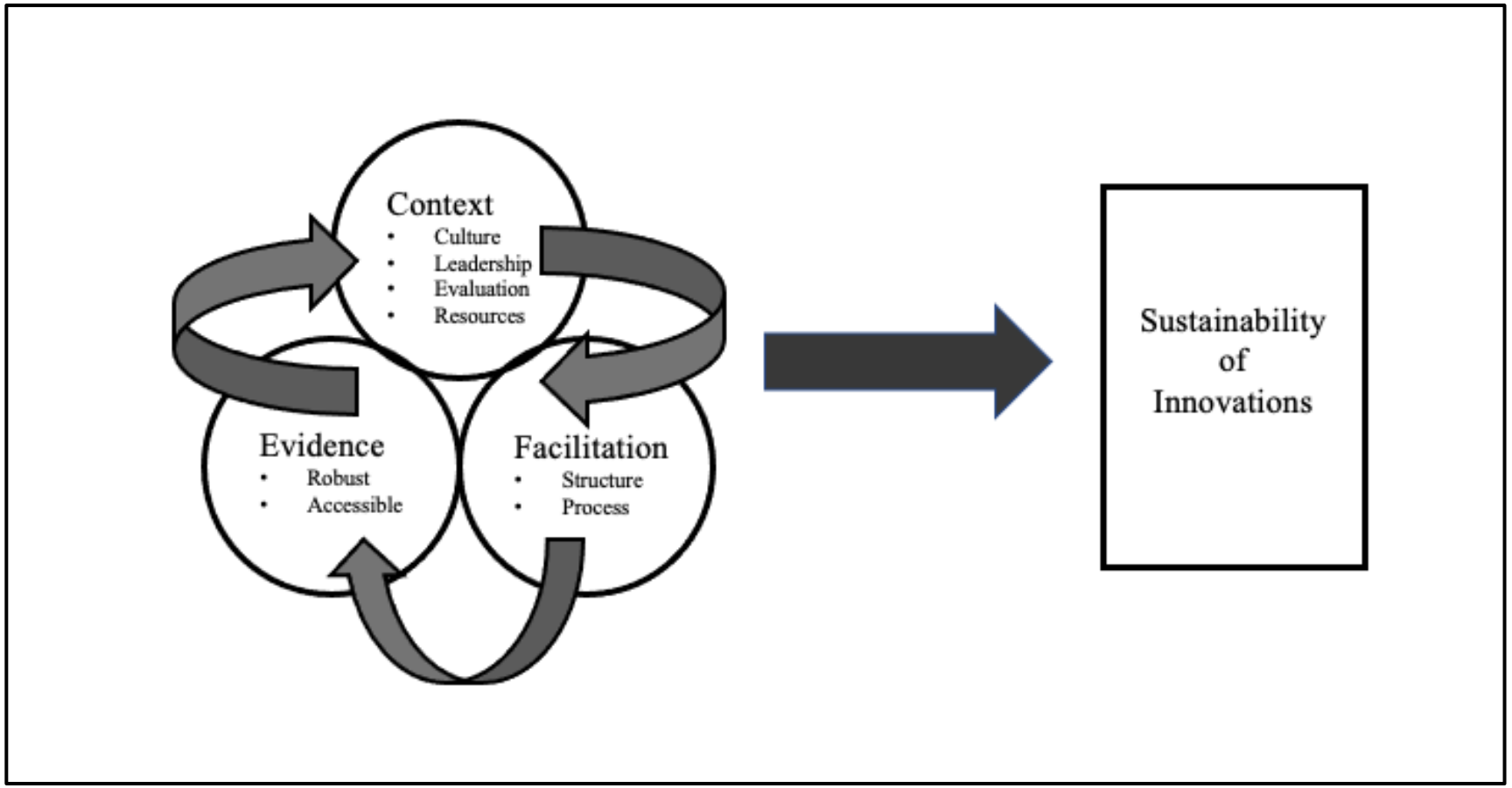


Figure 2

Promoting Action on Research Implementation in Health Services (PARiHS) Framework



Note. Diagram adapted from Slaughter et al. (2013).

Figure 3

Current Site Process Map

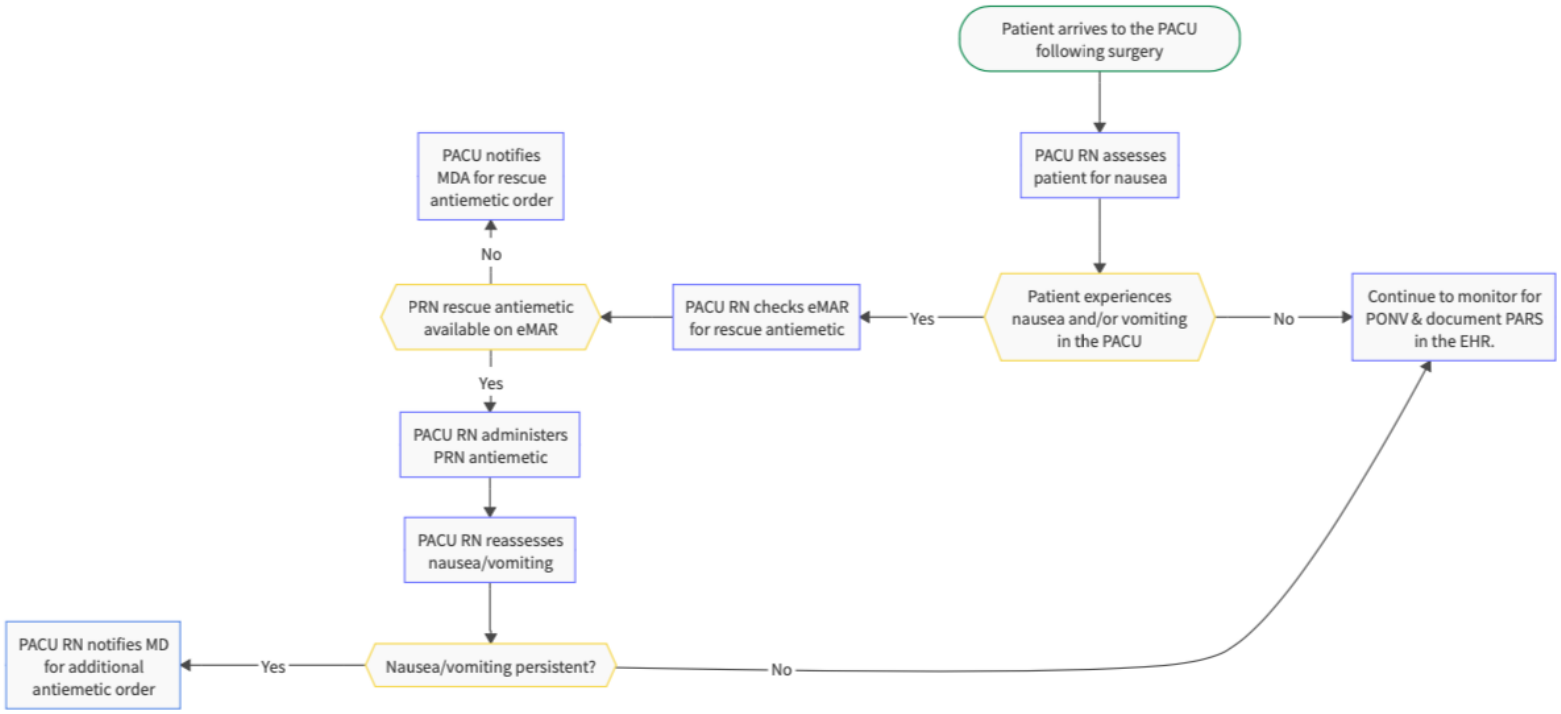


Figure 4

Proposed Site Process Map

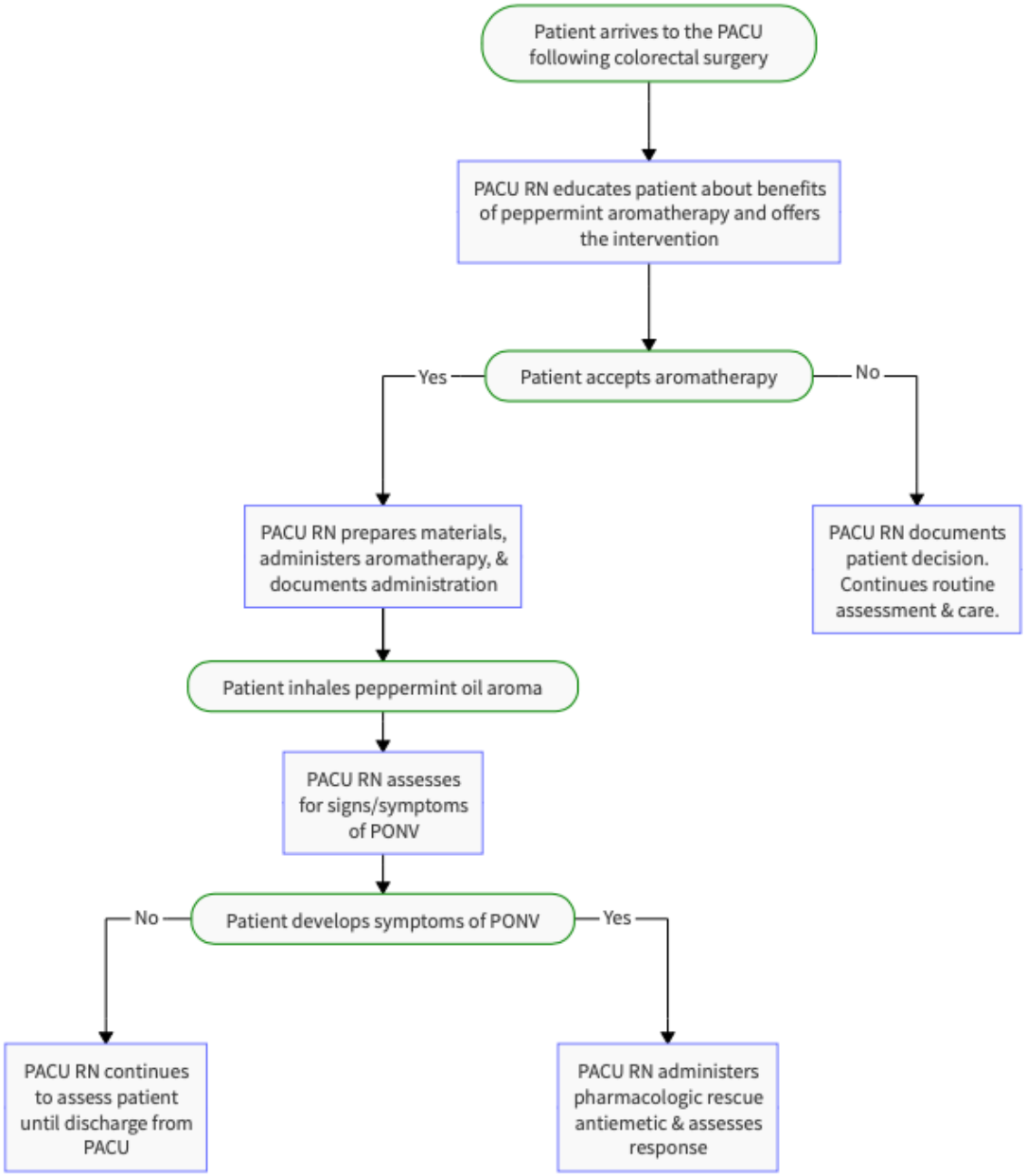


Figure 5

Run Chart Displaying Process Measure (Aromatherapy Administration Compliance)

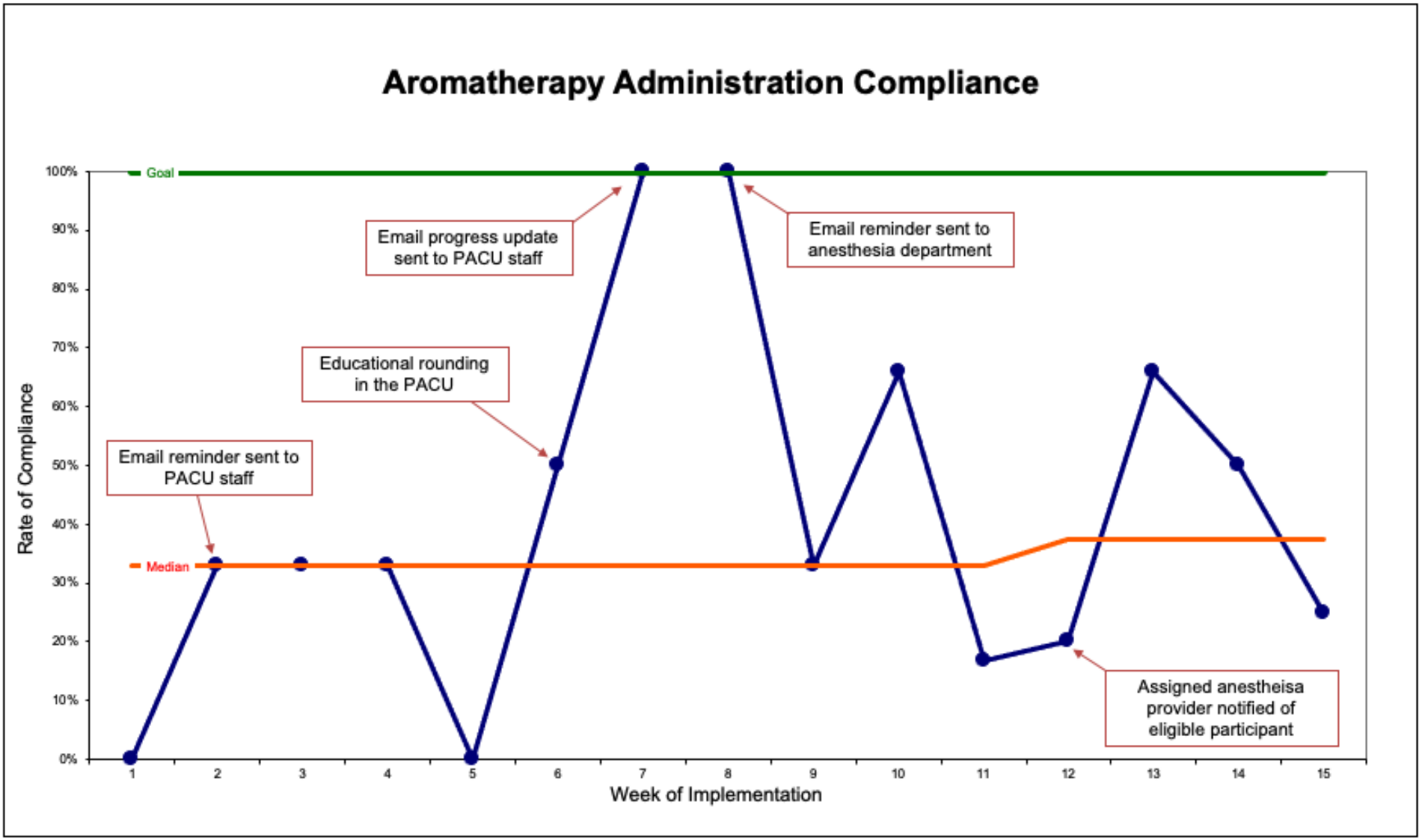
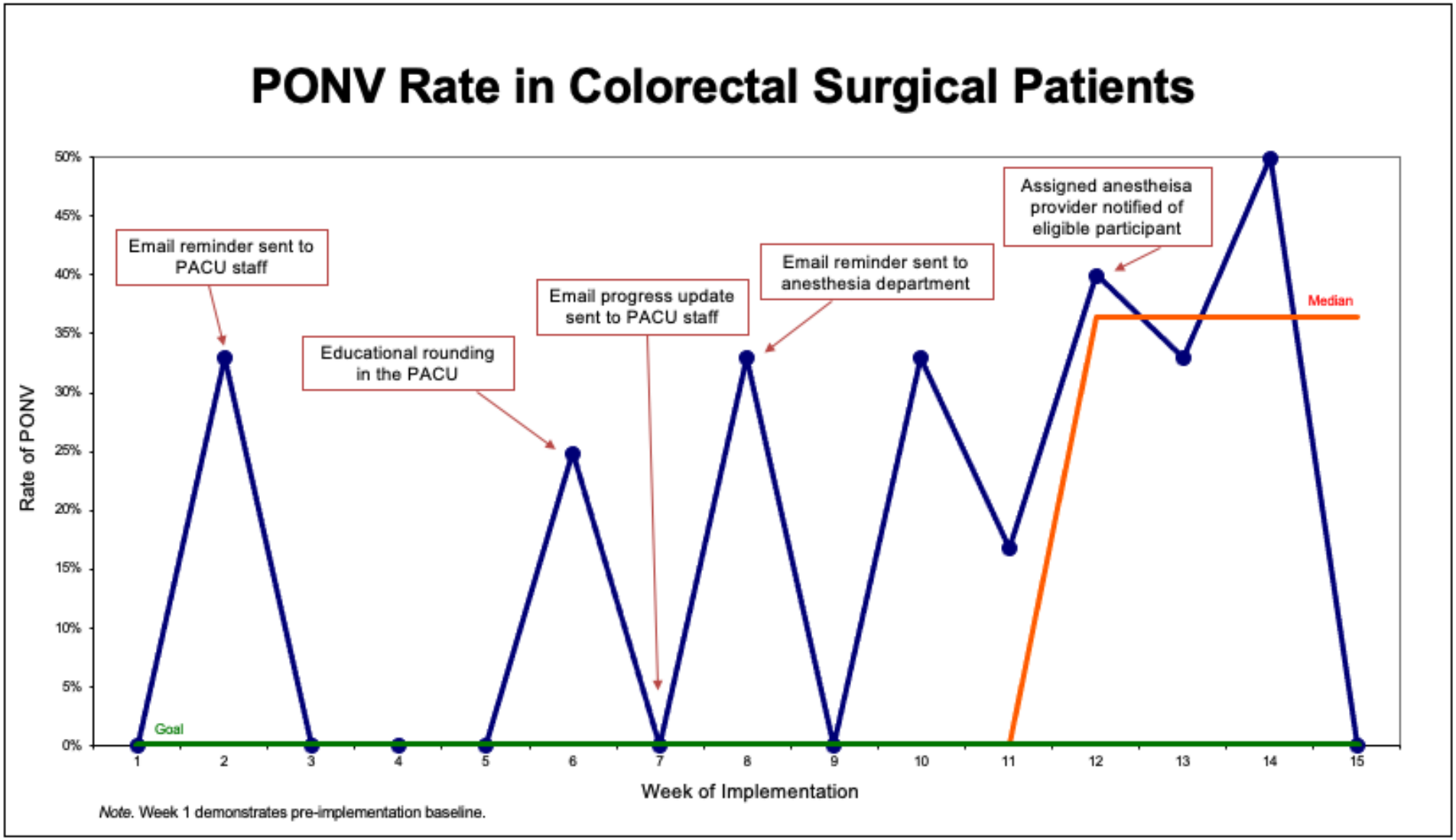


Figure 6

Run Chart Displaying Outcome Measure (PONV Rate in Colorectal Surgical Patients)



Appendix

REDCap Chart Audit Tool

Chart Audit Tool

MRN	_____
Date of Procedure	_____
Primary Procedure	◯ Colostomy creation, ◯ Colostomy reversal/takedown ◯ Diagnostic laparotomy ◯ Exploratory laparoscopy ◯ Hemicolectomy ◯ Hemorrhoidectomy ◯ Ileocolic resection ◯ Ileostomy reversal ◯ Sigmoid colectomy ◯ Small bowel resection ◯ Total abdominal colectomy ◯ Other
What was the primary procedure?	_____
Did the PACU nurse comment about the administration of the aromatherapy intervention in his/her nausea assessment in the patient's EHR?	◯ Yes ◯ No
Did the patient decline aromatherapy?	◯ Yes ◯ No
What was the PACU nurse's nausea & vomiting assessment documented in the EHR as part of the Post-Anesthesia Recovery Score?	◯ Controlled ◯ Further treatment needed
Was a pharmacologic rescue antiemetic administered to the patient?	◯ Yes ◯ No
What pharmacologic rescue antiemetic was administered?	◯ Ondansetron (Zofran) ◯ Droperidol ◯ Prochlorperazine (Compazine) ◯ Promethazine (Phenergan) ◯ Diphenhydramine (Benadryl) ◯ Other
What rescue antiemetic was administered?	_____
Additional Comments:	