Increasing Perioperative Nurse Knowledge of Preoperative Urine Pregnancy Testing: A Quality Improvement Project

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Increasing Perioperative Nurse Knowledge of Preoperative Urine Pregnancy Testing:

A Quality Improvement Project

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July 29, 2022

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Thank you to the hospital organization for allowing me to develop my professional and leadership skills through implementation of this quality improvement project.

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Dedication

This project is dedicated to my mother and father, Sherrie and Glenn Hall, for supporting my academic and personal goals, my significant other, Jarred Kwiatkowski, for being part of my journey towards achieving my nursing license and master’s degree, and my cousin, Nicole Quadros, who inspired me to become a nurse.
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Abstract

Background: Nurses in the perioperative environment are responsible for assessing patients prior to undergoing surgery. Preoperative urine pregnancy testing is utilized to determine the pregnancy status of patients. Various risks of anesthesia and surgery exist for pregnant patients and the fetus. The perioperative nurse must be knowledgeable about these risks and ensure preoperative urine pregnancy tests are obtained when appropriate.

Local Problem: Within this microsystem, a gap in knowledge of perioperative nurses related to the nature and significance and institutional policy for preoperative urine pregnancy testing was identified.

Aim: The aim of this project was to increase knowledge of preoperative urine pregnancy testing among perioperative nurses through education, to promote patient safety and quality of care.

Methods: Guided by the Nursing Professional Development Practice Model, a virtual presentation was created to support continuing education of the perioperative nurse to increase knowledge related to preoperative urine pregnancy testing. Pre- and post-intervention surveys were utilized to analyze knowledge before and after continuing education. Perioperative nurse knowledge of the current risks and recommendations, the institutional policy, and documentation in the electronic health record as they pertain to preoperative urine pregnancy testing were assessed.

Results: Pre-intervention survey data indicated a gap in knowledge of perioperative nurses pertaining to preoperative urine pregnancy testing. An increase in knowledge across all questions in each competency assessed was evident following education. Additionally, statistically significant data across each competency was found.

Conclusions: Continuing education improved perioperative nurse knowledge of preoperative urine pregnancy testing including the risks and recommendations, institutional policy, and documentation. Continued education on this topic may be useful in other perioperative environments and may be adapted to meet the learning needs of other facilities.

Keywords: nurse, preoperative, perioperative, urine, pregnancy test, pregnant, fetus, surgery, anesthesia, policy, documentation, knowledge, electronic health record
Introduction

The Main Operating Room (MOR) in the macrosystem manages twenty-six operating rooms, twenty-four hours a day, seven days per week. During the fiscal year 2021 (FY-21), the MOR averaged 67.8 cases per day with a grand total of 8,472 surgical procedures performed, across fifteen surgical services (DHMC Perioperative Services, 2020). The MOR sees patients across the lifespan, from infancy to elderly, of all sexes and gender identities.

A revised procedure as of August 5th, 2021, details the guidelines for pregnancy screening of patients receiving care in Perioperative Services (Appendix A). This guideline applies to all female patients eleven years of age or older on the day of surgery (DOS), excluding those undergoing emergency surgery, scheduled for a surgery related to pregnancy, or patients with impairments affecting their ability to participate in the assessment (DHMC Perioperative Services, 2021). The registered nurse (RN) is required to assess individuals of the defined population, for pregnancy, prior to undergoing procedures using anesthesia. On the DOS, three questions are asked to the defined population by the pre-operative RN and documented in the electronic health record (EHR) including, Are you menstruating?, When was the date of your last menstrual period?, and Is there any chance you could be pregnant?. Patients, including minors, are asked these questions in private, separate from family, friends, or other visitors. Based on the responses to these questions, the RN determines if a Point of Care urine pregnancy test (UPT) is indicated and obtains verbal consent from the patient to obtain the specimen for testing. Results of the UPT are documented by the RN in the EHR (DHMC Perioperative Services, 2021).
**Problem Description**

On the DOS, a document within the patient's paper chart is used to identify additional DOS needs which are indicated using a check mark. Included within this section is a space labeled *UPT* with the option to be checked off. Once completed by the pre-operative RN, this document travels with the patient’s chart to the operating room where it is reviewed by the perioperative RN. The perioperative nurse can review this document to assess if a pregnancy test was indicated for the patient. However, when left unchecked, it is unknown to the perioperative nurse why a pregnancy test was not indicated or performed for a patient of the defined population, without consulting the EHR.

Observations in the MOR between February and March of 2022 found that *UPT* was left unchecked in the additional DOS needs document for three patients of the defined population. The perioperative RN responsible for these patients acknowledged that the individuals may not have received a UPT but admitted to being unaware of the reason for exclusion from testing. Additionally, the RN did not demonstrate the knowledge of how to locate pregnancy testing results or answers to preoperative urine pregnancy testing assessment questions for these individuals in the EHR. These events prompted examination of perioperative nurse knowledge as it relates to preoperative urine pregnancy testing.

A pre-implementation survey sent to the perioperative nursing staff on April 18, 2022, gathered responses from 23 RNs (Appendix B). In response to the question, *How well do you understand the policy on and indications for preoperative urine pregnancy testing?*, eight participants responded, *Not well at all*, four *Slightly well*, seven *Moderately well*, three *Very well*, and one *Extremely well*. Additionally, 78% of these respondents indicated that they would benefit from continued education on preoperative urine pregnancy testing. Open responses to a
question indicating areas where participants would like further education on the topic included the following, *More education surrounding UPT labs [and] certain cases that are prioritized over others, Is there a way to prominently display results in [the EHR]?*, My understanding is that [the microsystem] does not test for pregnancy, why?, Who needs to be tested? If [a] patient is on [birth control], do they need to be tested?, What is the best practice for testing [and] why don't all orthopedic procedures requiring imaging test female patients?, When do we do them [and] why?, and *Is there a clear process or policy for [perioperative] HCG? What are clear guidelines?*. Based on the findings of this survey, a gap in knowledge of perioperative RNs was made apparent.

This issue may negatively impact patient safety and autonomy in Perioperative Services as it is unknown whether anesthesia may cause harmful effects during pregnancy (Committee on Quality Management and Departmental Administration, 2021). Additionally, surgery has been found to have negative effects both on pregnant patients and fetuses (McKenzie & Pulley, 2016). “The ASA [American Society of Anesthesiologists] Practice Advisory for Preanesthesia Evaluation recommended that pregnancy testing may be offered to female sex patients of childbearing age for whom the result would alter the patient’s medical management (Committee on Quality Management and Departmental Administration, 2021, p.1).” According to the institutional policy, patients are to be counseled about the risks of proceeding with a surgical procedure if a UPT is positive, or if a patient who may be pregnant declines a UPT (DHMC Perioperative Services, 2021). It is important that perioperative RNs understand the indications and policy for preoperative urine pregnancy testing of the defined population. This understanding ensures patient safety during surgery and respects the autonomy of the patient to choose whether to undergo surgery given the risk of pregnancy.
Available Knowledge

Background

It is estimated that forty million people undergo procedures requiring anesthesia every year in the United States (Lamb et al., 2019). Of these forty million people, approximately seventy-five thousand are pregnant women undergoing surgery for non-obstetric purposes. This means that two percent of pregnant women will undergo anesthesia at some point during their pregnancy. Pregnant women and fetuses are particularly vulnerable to the effects of anesthesia and surgery and additional surgical and anesthetic considerations are necessary for this population (Maher & Mahabir, 2012). Preoperative urine pregnancy testing is a tool used to identify pregnancy prior to surgery to make decisions about the care plan. However, it remains a controversial topic as to whether pregnancy testing should be universal or based on specific guidelines. The purpose of this literature search is to identify recommendations for preoperative urine pregnancy testing, including other perioperative considerations related to pregnancy to gather a comprehensive image of perioperative management of the pregnant patient.

Critical Appraisal

Cohort Studies. The retrospective review conducted by Lamb et al. (2019), explores the compliance rate of preoperative urine pregnancy testing at an ambulatory surgery center as well as barriers and a cost analysis. Lamb et al. (2019) explored the electronic medical records of 150 female patients between the ages of 12 and 55 scheduled for elective surgeries. Compliance to preoperative urine pregnancy testing included six steps: asking about last menstrual period and possibility of pregnancy during a preanesthesia phone interview and on the day of surgery, proper pregnancy testing inclusion and exclusion, and pregnancy kit lot number and expiration
documentation completed. The authors found that compliance to all steps was only 0.7%. Compliance to preanesthesia interview questions were 21% and 37% respectively, and day of surgery compliance was 30% and 57%, respectively. 80% of the female patients in this study were eligible for preoperative pregnancy testing, however, 36% of eligible patients did not receive them. Exclusion of the appropriate patients from pregnancy testing occurred 93% of the time. Finally, 52% of pregnancy testing lot numbers and expiration dates were documented. All pregnancy tests completed were found to be negative.

The most common barriers to preoperative urine pregnancy testing compliance included patient factors such as gathering the sample from the patient, patient consent for the test, and late arrivals, as well as nursing factors such as delays in ordering tests and documentation, and staffing. Additionally, their cost analysis of equipment and labor costs totaled $19,033 to $30,202 per year. A weakness of this study is that it was conducted on a relatively small sample size at one surgical facility. As well, the mean age of patients for this population was 41.5, which may have influenced the nurses’ decisions to order pregnancy tests based on age. It should be noted that when using data from day of surgery protocols, the overall compliance rate increases to 12.7%. The authors recommend increased education for patients and providers, as well as clarification and simplification of protocols to increase compliance.

Gong & Poterack (2018) conducted a retrospective review of a universal pregnancy testing protocol at a single hospital between September 2010 and May 2015. This protocol requires preoperative urine pregnancy testing for all female patients from menarche to menopause before elective surgeries. Exceptions to this protocol include surgical sterilization, a pregnancy test within the past seven days, or patient refusal. The authors of this study explored the electronic medical records of female patients > 18 years of age and found that 8,245 patients
were tested. Of those tested, 11 patients had positive urine pregnancy tests, however, 6 tests were determined to be false positives following serum testing. Of the 5 remaining patients, all decided to alter their care plan in some way; 3 patients canceled their surgeries, 1 underwent surgery for malignancy and terminated her pregnancy, while the other agreed to undergo surgery using local anesthesia. The positive pregnancy rate at this facility was 0.13%, or 0.06% when accounting for false positives. Additionally, Gong & Poterack (2018) conducted a cost analysis which indicated that the overall cost of diagnosing each positive test was $49,000, at a cost of $30 per point-of-care urine pregnancy test provided. Recommendations from the authors include reconsidering universal pregnancy testing due to the low yield of positive pregnancy tests and high yields of false positives. Limitations of this study include the fact that adolescent patients were not accounted for and that 75% of the population was aged >35.

Hutzler et al. (2014) conducted a cost-benefit analysis of preoperative urine pregnancy testing for women undergoing elective orthopedic surgery at an acute care hospital and ambulatory surgery center under the same institution. Per institutional policy, all females of menstruating age are given a pregnancy test on the day of surgery. The authors retrospectively reviewed the charts of patients from November 2009 to September 2011 to identify patients who received preoperative urine pregnancy tests, totaling 4,723. Of these tests, 7, or 0.15% were found to be positive. Additionally, it was later found that one test was a false negative, however there were no complications to the pregnancy and the patient carried to term. Hutzler et al. (2014) reported that the cost of a single urine pregnancy test was $1.49, totaling $7,037.27 for all patients included in this article. As well, the total cost of diagnosing each of the pregnancies reported was $1,005.32. The authors also concluded that the average cost of each orthopedic surgery was $4,900, amounting to a loss for the hospital due to each case cancellation. However,
Hutzler et al. (2014) argues that avoiding performing surgery on pregnant patients far outweighs the cost of performing preoperative urine pregnancy testing.

**Systematic Reviews.** Maher & Mahabir (2012) conducted a comprehensive literature review regarding the fetal risk of anesthesia and surgery, and preoperative pregnancy testing. Various studies have been conducted to assess the risks that anesthesia and surgery pose for pregnant women and fetuses. The first report in 1963 found that the fetal mortality rate of 67 women who underwent surgery during pregnancy was 15%. A study in 1965 reported that in pregnant women who underwent surgery, perinatal mortality and low birth weights were increased compared to the control. However, when procedures involving cerclage (suturing of the cervix) were removed from the study, the findings were non-significant. In 1980, a study found that women undergoing surgery during the first and second trimesters were at a significantly increased risk for spontaneous abortion; a subsequent study in 1986 reported the same finding. In 1989, the largest study to date reported that mothers who underwent surgery during pregnancy had an increased incidence of low and very low birth weights, a 46% increase in premature births, and a higher risk of mortality within seven days of birth. In 1990, the previous study was reanalyzed, and the authors found that a significant number of these infants had neural tube defects, especially those who were exposed to surgery and anesthesia during four to five weeks of gestation, when neural tubes begin to form. In 1994, a study showed that women who underwent surgery and anesthesia during the first trimester had increased associations with hydrocephalus and eye defects in infants. Additionally, multiple studies have reported detrimental effects to the fetus from perioperative drugs like antibiotics, analgesics, non-steroidal anti-inflammatory drugs (NSAIDs), topical nasal administration of cocaine, and antiarrhythmics, as well as radiation and fluoroscopy.
Multiple studies have been conducted assessing various aspects of preoperative pregnancy testing. In 1995, a 0.34% incidence rate of unrecognized pregnancies in 2,056 women was reported before surgery resulting in cancellation of all procedures. A study focusing on the rate of positive preoperative pregnancy tests in adolescents in 1996 reported an overall incidence rate of 1.2% among female adolescents aged 15 and older. Another 1996 study found an incidence rate of 2.2% among all female patients receiving preoperative pregnancy testing. A few of these studies focused on the cost-benefit of preoperative pregnancy testing. A 1995 study reported a cost of $2,879 per pregnancy identified, and a 2014 study included in the review was discussed previously in this paper.

The authors of this literature review concluded that there is still controversy over universal pregnancy testing, however, they agree that there should be implicit guidelines and policies regarding who should receive a preoperative pregnancy test. They state the evidence shows that consistency in policies is key to ensure appropriate care standards are upheld, especially while there is still much debate on the topic. Additionally, Maher & Mahabir (2012) implemented a preoperative pregnancy testing policy at their facility based on their findings. The policy states that female patients of childbearing age will undergo preoperative urine pregnancy testing on the day of surgery, unless they meet the exclusion criteria which includes history of hysterectomy or bilateral salpingo-oophorectomy, or patient refusal. Patients with results which are uncertain or positive will require discussion with a physician and a serum pregnancy test. Those found to be positive following serum testing will be referred to their obstetrician-gynecologist (OB-GYN). A major limitation of the review by Maher and Mahabir (2012) is that much of the included research is outdated as most studies were conducted between the 1960s and 1990s, however, there are not many recent studies available.
Clinical Practice Guidelines. Volz & Muldowney (2017) discuss guidelines for managing perioperative care of the adolescent, to include preoperative pregnancy testing. The authors recognize that this is a sensitive and controversial topic. Findings from various studies are reported regarding pregnancy testing in female adolescents. A study from 1996 found that adolescent patients were able to adequately respond to interview questions for evaluating the necessity of pregnancy testing. Another study from 1996, discussed previously, reported an incidence rate of positive preoperative pregnancy tests in adolescents to be 1.2%. The authors also report that, as of 2015, the teen birth rate in the United States was 22.3 per 1,000 females aged 15 to 19, and 0.2 per 1,000 females aged 10 to 14.

An important aspect for consideration includes consent and assent of the adolescent patient (Volz & Muldowney, 2017). In many states, there are laws which grant minors decision-making capabilities over matters which involve pregnancy. Additionally, many states grant reproductive privacy to females of any age, and patients may become emancipated minors if they are confirmed to be pregnant. Based on recommendations from the American Society of Anesthesiologists (ASA), female patients of childbearing age should be offered preoperative pregnancy tests, which indicates that consent or assent should be given prior to. The ethical implications of preoperative pregnancy testing of adolescents are challenging; however, the privacy of the patient must be prioritized, and providers must be knowledgeable of the rules and regulations in their state regarding consent and privacy of the minor (Volz & Muldowney, 2017).

August & Everett (2014) also provide guidelines for adolescent considerations related perioperative management, including a brief note on pregnancy testing. The authors state that adolescents may not give an accurate history of sexual activity or matters relating to pregnancy, especially in the presence of parents. It is recommended that questions related to pregnancy be
asked in the absence of parents, however, in many states parents must consent to pregnancy testing of minors. It is mentioned that mature minor status may apply if the adolescent patient believes she is pregnant. Additionally, the authors also recommend providers be knowledgeable of the laws and regulations pertaining to who may be informed of a positive pregnancy test in an adolescent and recommend that social support should be available to the patient if needed.

Bock et al., (2016) provides a comprehensive guideline for preoperative laboratory testing, which includes preoperative pregnancy testing. The authors state that it is likely management of care will be altered if a patient is discovered to be pregnant on the day of surgery, and therefore pregnancy testing should be offered to females of childbearing age before surgery, per the ASA. Variations in institutional policies are discussed. The importance of gathering an accurate history, including the last menstrual period is emphasized, and it is stated that when a patient’s history is unreliable, pregnancy testing be offered. Additionally, Bock et al. (2016) discusses specificity and sensitivity of pregnancy tests, stating that when the threshold for human chorionic gonadotropin (hCG) is exceeded, a positive pregnancy test will result, which is usually within the range of 20 to 50 mIU/mL for urine pregnancy tests. Unless an ultrasensitive urine pregnancy test is utilized, which is usually not the standard in clinical practice, results may not be reliable until one or two weeks following a missed period.

McKenzie & Pulley (2016) provide clinical guidelines for managing pregnant patients in the perioperative setting. Important topics covered include the physiologic changes that occur during pregnancy, the fetal and maternal effects of anesthesia and surgery, the risks associated with commonly used medications in the perioperative setting, recommendations, and preoperative pregnancy testing. Physiologic changes which occur during pregnancy include cardiac, respiratory, hematologic, renal, and gastrointestinal changes. These must be considered
for the pregnant patient undergoing anesthesia or surgery. There are various maternal risks to undergoing anesthesia and surgery during pregnancy including an elevated risk of desaturating during and difficulty with intubation, an increased risk of aspiration during the second and third trimesters, a decrease in minimum alveolar concentration of inhaled anesthetics, an increased risk of awareness, as well elevated risk for hypotension while in the supine position as a result of aortic or vena cava compression. Studies included by the authors report a very low 30-day mortality rate (0.25%) and low incidence of complications (5.8%) following surgery. Conversely, one study reported a higher rate of complications and greater cost to care for pregnant women following surgery. However, a more recent study showed no difference related to complications in pregnant women versus the control.

When caring for a pregnant patient in the perioperative setting, there is a second patient to be considered; the unborn fetus. Teratogenicity is one of the most concerning factors related to anesthesia and surgery (McKenzie & Pulley, 2016). There is currently limited data regarding the fetal effects of anesthesia, and none are currently listed as teratogenic, however, it is best to minimize drug exposure. Teratogenicity may occur during surgery due to maternal conditions like hypoglycemia, hypoxemia, hypercarbia, and hypothermia. A systematic review from 1996-2000 included in the article found that the rate of induction of labor due to surgery was 3.5% and fetal death was 2.5%. Additionally, the report found that those undergoing appendectomy surgery were at an increased risk for these complications. Multiple studies have reported an increased risk for preterm delivery. Another study found that surgery was safest during the second trimester.

McKenzie and Pulley (2016) discuss the dangers of commonly prescribed medications in the perioperative setting including sedatives and hypnotics, inhaled anesthetics, opioids,
NSAIDs, and local anesthetics. There is potential for neurodevelopmental effects on the fetus from the use of propofol and ketamine, as demonstrated in animals. Effects on neurodevelopment may also occur from the use of nitrous oxide, as well as an association with spontaneous abortions. In early pregnancy, opioid use has been correlated to birth defects including congenital heart disease. Additional precautions should be taken with opioids to avoid maternal substance misuse and neonatal abstinence syndrome. In all trimesters, NSAIDS have been found to have effects on the fetus including risk for spontaneous abortion, association with congenital cryptorchidism, renal injury, and ductus arteriosus constriction. Topical anesthetics are generally safe, aside from cocaine which may cause placental abruption. The authors also discuss ionizing radiation. High doses of radiation, especially between 8-15 weeks of gestation may cause mental retardation. There is also a risk for childhood leukemia in children exposed to radiation. The use of radioactive isotopes is contraindicated during pregnancy.

The American College of Obstetricians and Gynecologists (ACOG) recommends that pregnant women should not be denied surgery, however, non-urgent cases should be deferred to the second trimester, and elective surgeries should be performed after pregnancy (McKenzie & Pulley, 2016). Other recommendations from the authors include coordination of care with the pregnant patient’s OB-GYN, including fetal monitoring during and after surgery. Plans should also be in place should fetal heart tracing or emergency cesarean delivery be necessary. The authors also point to recommendations for preoperative pregnancy testing, including ASA recommendations.

The gold standard for recommendations regarding preoperative urine pregnancy testing, referred to multiple times in the previous articles discussed, comes from the American Society of Anesthesiologists. The Committee on Quality Management and Departmental Administration
(2021) provides information regarding indications for preoperative pregnancy screening, accuracy of testing, medico-legal concerns, ethical considerations, concluded by recommendations. According to the Committee, preoperative urine pregnancy testing is indicated for female patients of childbearing age if there is potential for alteration of the care plan due to the results of the test. It is stated that risk for fetal harm from surgeries involving the uterus, disruption of fetal blood flow, x-rays, and teratogenic medications should warrant additional considerations for pregnancy testing. The ASA does however point out that no currently used anesthetics are labeled as teratogenic in humans.

The ASA does not recommend at-home urine pregnancy tests for diagnosing pregnancy prior to surgery. However, point-of-care urine pregnancy testing performed by nurses is simple and has been found to be accurate. Fourteen days following ovulation and fertilization, hCG may be detected in urine, with a sensitivity >99% and specificity of 99.2%. Detection of hCG in urine occurs when hCG is >25 IU/L; specificity decreases 10% when hCG is < 25 IU/L. Additionally, pregnancy testing preoperatively involves legal consideration. The Anesthesia Closed Claims Database recorded 7 incidents in which undiagnosed pregnancy preoperatively led to complications including 3 miscarriages and 4 accounts of fetal loss.

There are many ethical considerations for this topic. Informed consent should be obtained from patients prior to administering a pregnancy test to protect patient autonomy. The patient should be informed of risks, benefits, and options related to preoperative urine pregnancy testing to promote health and avoid harm to the patient. It is also recommended that patients should be given educational resources regarding this prior to scheduling surgery. As mentioned previously, pregnancy screening of minors is a sensitive topic which requires additional considerations.
Confidentiality and trust between patient and provider are of utmost importance and it is critical that providers understand the legal rights of minors pertaining to pregnancy in their state.

The overall recommendations from the Committee on Quality Management and Departmental Administration (2021) for preoperative pregnancy testing include the following:

1. Pregnancy testing may be offered to female sex patients of childbearing age and for whom the result would alter the patient’s management, but testing should not be mandatory. Informed consent or assent of the risks, benefits, and alternatives related to preoperative pregnancy testing should ideally be obtained. Best practice may employ shared decision-making between patients and providers.

2. In facilities where an informed consent process is adopted as policy, local policy development should also consider any associated documentation requirements.

3. Preanesthetic educational materials should ideally be developed and given to patients to allow them to make an informed decision. This material should include information about false positives and negatives of pregnancy testing and that the scientific literature is inadequate to inform patients or physicians on whether exposure to anesthesia causes unknown harmful effects during early pregnancy. (p.3)

**Evidence Synthesis**

Preoperative urine pregnancy testing is important to protect the health and wellbeing of pregnant patients and fetuses. It has been estimated that the incidence of positive preoperative pregnancy tests ranges from 0.34% to 2.4% (Maher and Mahabir, 2012). The literature is inadequate to inform whether anesthetics used during surgery are teratogenic, while many commonly used drugs in the perioperative settings are. Additionally, many studies have identified a myriad of fetal and maternal risks related to undergoing surgery, including death. For
these reasons, identifying pregnancy preoperatively is critical and the benefit of preventing surgery from being performed unknowingly on a pregnant patient far outweighs the cost of urine pregnancy testing. There is still controversy over whether preoperative pregnancy testing should be universal, however, it is clear the need for specific institutional policies outlining the indications for and process of preoperative pregnancy testing in female patients of childbearing age, including minors. Additionally, policies should be clear and easy to follow as compliance to preoperative pregnancy testing by staff is low (Lamb et al., 2019).

**Implications**

The evidence on preoperative urine pregnancy screening highlights the necessity of ensuring tests are performed to prevent undue harm to pregnant patients and fetuses. As has been reported in the literature, compliance to testing by preoperative nursing staff may be low, therefore it is ever more important that perioperative nurses understand their institutional policies on preoperative pregnancy testing. Perioperative nurses are the final safeguard between the patient and surgery, it is their duty to ensure preoperative tasks have been completed and to verify completion with the patient and surgical team. Perioperative nurses must understand the indications for pregnancy testing, along with being able to identify patients who are potential candidates for pregnancy screening to ensure testing was provided, and results recorded and discussed, as necessary. The purpose of this quality improvement project was to increase knowledge of preoperative urine pregnancy testing among perioperative RNs through education, to promote patient safety and quality of care.
Rationale

Theoretical Framework

This quality improvement project was guided by the Nursing Professional Development (NPD) Practice Model. Continuing education is a necessity for nurses in maintaining competence in their role, and this may be achieved through various methods of delivery and is a shared responsibility of nurses, educators, leadership, and other stakeholders (Bindon, 2017). When there are gaps in the knowledge of nurses, there is an opportunity for improvement. As seen in Figure 1, the NPD Practice Model is characterized by the environment, input, outputs, and throughputs (Rheingans, 2016). The environment is where the inputs of this system occur, which involves both the leaders of professional development and learners, and the place where gaps in practice and continuing education takes place. The throughputs in the system include the ways in which the NPD practitioner can implement standards of practice, including education. Finally, the outputs include learning and change, which results in professional growth and competence contributing to protection of those who receive health care (Rheingans, 2016).

Nurses in the perioperative environment must assess their knowledge, skills, and attitudes related to competencies and identify areas where improvement is needed as the perioperative microsystem is a fast-changing environment with frequent updates to best practice (Bindon, 2017). Within the perioperative environment, nine domains have been identified in which competence is expected. These domains include patient assessment and diagnosis, communication, expected outcome identification and care planning, discharge planning, intraoperative activities, emergent situations, cleaning, disinfecting, sanitizing, and sterile packaging, personnel management, and accountability (Bindon, 2017). This quality improvement
project aimed to improve the domain of patient assessment as it relates to pregnancy screening through continuing education as described by the NPD Practice Model.

**Figure 1**

*Nursing Professional Development Practice Model (NPD)*

![Nursing Professional Development (NPD) Practice Model](image)

**Specific Aims**

Within this microsystem, a gap in knowledge related to preoperative urine pregnancy testing was identified. For this reason, the global aim of this project was to increase knowledge of preoperative urine pregnancy testing among perioperative nurses through education, to promote patient safety and quality of care. The specific aim of this project was to increase perioperative nurse knowledge related to preoperative urine pregnancy testing from baseline pre-intervention knowledge to a 50% overall increase in knowledge post-intervention in each competency by June 26, 2022. This specific aim was accomplished by using the NPD Practice Model to develop continuing education.
Methods

Context

This project was conducted in June of 2022 in the MOR at a large Level I Trauma Center located in New Hampshire. The microsystem sees a large number and vast array of patients with many interdisciplinary team members responsible for their care.

The mission of Perioperative Services is:

“...to develop and advance the art and science of peri-operative medicine so as to best meet the needs of our patients and their families, and to practice careful stewardship in the delivery of evidence-based, innovative, high-quality care in a multidisciplinary and collaborative environment (McHugh, 2018, Mission & Vision section).”

Additionally, the vision of the microsystem

“...promotes a patient and family-centered, team-based model of peri-operative care delivery and seeks to advance the national standard for quality, research, and education with a sincere commitment to creative and continuous improvement, professional development, evidence-based practice, and the most efficient use of resources (McHugh, 2018, Mission & Vision section).”
There are many processes which occur perioperatively, flowing consecutively to ensure surgery can be performed safely and efficiently in the MOR. An important process which occurs in the preoperative setting is urine pregnancy testing prior to surgery as indicated by the institutions’ policy (Appendix A). This policy and process was not understood well by the perioperative nursing staff, as gathered from in-person discussions and responses to a pre-implementation survey regarding preoperative urine pregnancy testing (Appendix B).

Various cost-benefit analyses have been performed regarding preoperative urine pregnancy testing. One study found that the per patient cost of preoperative urine pregnancy testing was $30, and the cost for diagnosing each positive pregnancy test totaled $49,000 (Gong & Poterack, 2018). Another study calculated the total cost for equipment and labor required for urine pregnancy testing to be between $19,033 and $30,202 (Lamb et al., 2019). An additional study found the cost for a single urine pregnancy test to be $1.49, with a total cost of $1,500.32 for diagnosing each positive test (Hutzler et al., 2014). However, avoiding performing surgery on pregnant patients far outweighs the cost of performing preoperative urine pregnancy testing (Hutzler et al., 2014).

Intervention

Continuing Education

As guided by the NPD Practice Model, a virtual presentation was created to support continuing education of the perioperative RN to increase knowledge related to preoperative urine pregnancy testing. The presentation was reviewed by the perioperative Nurse Educator before distribution to verify the information and to make suggestions. Content encompassed within the presentation included a review of current literature as it pertains to the risks and
recommendations for preoperative urine pregnancy testing and care of the pregnant patient in the operating room, a review of the institution’s policy and indications for testing, as well as a review on locating documentation in the EHR related to preoperative urine pregnancy testing. The presentation was distributed to the nursing staff in the MOR by the Nurse Educator on behalf of the project lead, via work email on June 10th, 2022.

**Study of the Intervention**

Two anonymous electronic surveys were created by the project lead to evaluate the perioperative RNs’ knowledge of risks and recommendations, the institution’s policy, and documentation related to preoperative urine pregnancy testing, pre- and post-intervention. Both surveys included Likert-style questions, however the post-intervention survey also included a few open-ended questions. The surveys opened for responses on June 10th, 2022 and closed on June 26th, 2022. The pre-intervention survey to gather data about the current state of knowledge was embedded on the first slide of the educational presentation. Instructions were provided which directed participants to click on the link to take the survey before proceeding. Once participants completed the initial survey, they were directed back to the presentation to complete the education portion. The post-intervention survey to gather data about the nurses’ new state of knowledge was embedded on the last slide of the presentation with directions to click on the link to complete the survey. Following completion of the post-intervention survey, participants were automatically redirected to a separate survey where they were given the option to enter a gift card raffle.
Measures

Outcomes of the intervention were measured by comparing pre- and post-intervention survey responses to Likert-style questions using Qualtrics®. Psychometric testing was not completed on the surveys created by the project lead. To maintain confidentiality, all responses were anonymous. Following the intervention, an increase in knowledge in the following competencies was expected: an understanding of the risks and recommendations, increased knowledge of the institution’s policy, and location of documentation in the EHR, all pertaining to preoperative urine pregnancy testing, as evidenced by performance on the post-intervention survey. A gift card incentive to complete the surveys in their entirety was offered to participants to reduce the occurrence of incomplete responses.

Analysis

Quantitative data from the pre- and post-intervention surveys were analyzed by using Microsoft Excel to run an unpaired t-test. The t-test identified if there was a statistically significant difference between responses to questions from the pre- and post-intervention surveys (p value < 0.05), or whether the difference was related to chance. Descriptive statistical analysis of the continuous data gathered from the Likert style questions included mean, standard deviation, and range. Descriptive statistical analysis of categorical data included frequency and percentage. Qualitative data from the open-ended questions collected in the post-intervention survey were reviewed for identification of recurring themes.

Ethical Considerations

Survey participants were be provided with information regarding the name of the project lead, goals of the surveys and intervention, confidentiality, and voluntarily participation as part
of the process for informed consent prior to beginning the surveys. Confidentiality of participants was maintained by ensuring responses remained anonymous. There was a chance for response bias from participants based on the nature of Likert-style questions which may have resulted in the actual knowledge of perioperative nurses being misrepresented. Additionally, the results of this project may not characterize the knowledge of all perioperative nurses, as there is inherent sample bias from conducting this survey in a single perioperative setting. Gift cards were utilized as an incentive for participants to complete the surveys which may have produced response bias as an undue influence. No protected patient information was collected for the purposes of this project. Conflicts of interest to be disclosed include the author being hired as a clinical nurse at the institution’s ambulatory surgery center during the time this project was conducted. However, all quality improvement activities were conducted during non-scheduled employee hours. The proposal for this quality improvement project was reviewed by the University of New Hampshire Department of Nursing Quality Committee, which confirmed that the project met the requirements for a quality improvement project exempt from the Institutional Review Board for the Protection of Human Subjects in Research (IRB). Permission to complete this quality improvement project at the institution was granted by the Director of Nursing and the Nurse Educator of Perioperative Services.

**Results**

**Implementation**

The pre- and post-intervention surveys were embedded in the educational presentation sent via work email by the Nurse Educator on behalf of the project lead to all RNs in the MOR
on June 10, 2022. The surveys were open for responses until June 26, 2022. Upon closing the surveys for responses, 11 respondents completed the pre-intervention survey, and 10 respondents completed the post-intervention survey. It was found shortly after dispersing the presentation and opening the surveys for responses that the directions included in the presentation to complete the post-intervention survey may have been ambiguous and led participants to conclude that this survey was for the gift card raffle. A follow-up email was sent to clarify and asked respondents to complete both surveys, however, one respondent did not complete the post-intervention survey.

**Demographics**

11 participants responded to the survey questions pertaining to their demographics (Table 1). The majority (72%) of RNs were 21 to 40 years of age. 36% of participants were RNs for 1-5 years, with the remaining 54% split evenly among the ranges of 6-10, 11-20, and >20 years. One response was not recorded. Most RNs, 73%, received a Bachelor of Science in Nursing degree, 18% received a Master of Science in Nursing degree, and 9% received an Associate Degree in Nursing. 64% of RNs reported working in the circulating nurse role in the operating room for 1-5 years, 9% for 6-10 years, 9% for 11-21 years, and 18% for >20 year. Participants reported working on the following surgical services: cardiac (9%), ear, nose, and throat, and plastic surgery (27%), general (18%), gynecology and/or urology (9%), multiservice (9%), orthopedics (9%), and vascular (18%). 64% of RNs reported experience working in other nursing roles including medical/surgical, intensive care (ICU), neonatal intensive care (NICU), primary care, informatics, pediatrics, home care, and assisting the surgeon in the OR. 36% of RNs reported having no additional nursing experience outside of the OR.
**Table 1**

*Demographic Survey Responses*

<table>
<thead>
<tr>
<th>Demographic Data</th>
<th>Total Sample (N = 11) n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. What is your age?</strong></td>
<td></td>
</tr>
<tr>
<td>18-20 years</td>
<td>0 (0)</td>
</tr>
<tr>
<td>21-30 years</td>
<td>4 (36)</td>
</tr>
<tr>
<td>31-40 years</td>
<td>4 (36)</td>
</tr>
<tr>
<td>41-50 years</td>
<td>1 (9)</td>
</tr>
<tr>
<td>51-60 years</td>
<td>2 (18)</td>
</tr>
<tr>
<td>&gt;61 years</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>2. How long have you been a registered nurse (RN)?</strong></td>
<td></td>
</tr>
<tr>
<td>Less than 1 year</td>
<td>0 (0)</td>
</tr>
<tr>
<td>1-5 years</td>
<td>4 (36)</td>
</tr>
<tr>
<td>6-10 years</td>
<td>2 (18)</td>
</tr>
<tr>
<td>11-20 years</td>
<td>2 (18)</td>
</tr>
<tr>
<td>&gt;20 years</td>
<td>2 (18%)</td>
</tr>
<tr>
<td>No Response</td>
<td>1 (9)</td>
</tr>
<tr>
<td><strong>3. What is the highest level of education you have received?</strong></td>
<td></td>
</tr>
<tr>
<td>Diploma in Nursing</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Associate Degree in Nursing</td>
<td>1 (9)</td>
</tr>
<tr>
<td>Bachelor of Science in Nursing Degree</td>
<td>8 (73)</td>
</tr>
<tr>
<td>Master of Science in Nursing Degree</td>
<td>2 (18)</td>
</tr>
<tr>
<td>Doctor of Nursing Degree</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>4. How long have you been in the circulating nurse role in the operating room?</strong></td>
<td></td>
</tr>
<tr>
<td>Less than 1 year</td>
<td>0 (0)</td>
</tr>
<tr>
<td>1-5 years</td>
<td>7 (64)</td>
</tr>
<tr>
<td>6-10 years</td>
<td>1 (9)</td>
</tr>
<tr>
<td>11-20 years</td>
<td>1 (9)</td>
</tr>
<tr>
<td>&gt;20 years</td>
<td>2 (18)</td>
</tr>
<tr>
<td><strong>5. Which surgical service do you primarily work on in the circulating nurse role?</strong></td>
<td></td>
</tr>
<tr>
<td>Cardiac</td>
<td>1 (9)</td>
</tr>
<tr>
<td>ENT and/or Plastics</td>
<td>3 (27)</td>
</tr>
<tr>
<td>General</td>
<td>2 (18)</td>
</tr>
<tr>
<td>Gynecology and/or Urology</td>
<td>1 (9)</td>
</tr>
<tr>
<td>Multiservice</td>
<td>1 (9)</td>
</tr>
<tr>
<td>Orthopedics</td>
<td>1 (9)</td>
</tr>
<tr>
<td>Vascular</td>
<td>2 (18)</td>
</tr>
</tbody>
</table>
6. Do you have experience in other nursing roles? If you responded “Yes”, please describe your experience.

<table>
<thead>
<tr>
<th>Role</th>
<th>Yes (64)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical/Surgical</td>
<td>3 (27)</td>
</tr>
<tr>
<td>ICU</td>
<td>1 (9)</td>
</tr>
<tr>
<td>NICU</td>
<td>1 (9)</td>
</tr>
<tr>
<td>Primary Care</td>
<td>1 (9)</td>
</tr>
<tr>
<td>Informatics</td>
<td>1 (9)</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>1 (9)</td>
</tr>
<tr>
<td>Homecare</td>
<td>2 (18)</td>
</tr>
<tr>
<td>Scrub Nurse</td>
<td>2 (18)</td>
</tr>
</tbody>
</table>

No | 4 (36)

Pre- and Post-Intervention Survey Questions

Pre- and Post-Intervention survey questions were formatted using a 5-point Likert-type scale with the option of choosing the following responses: not well at all (NW), slightly well (SW), moderately well (MW), very well (VW), and extremely well (EW). Questions were grouped into the following themes: risks and recommendations, institutional policy, and documentation in the EHR. Mean and standard deviation (SD) were reported using Microsoft Excel for each question, pre- and post-intervention. Responses were analyzed using Microsoft Excel by comparing pre- and post-intervention survey responses using an unpaired, two-tailed, t-test to report a P-value for each question. Categorical and continuous data, including percentages, mean, standard deviation, and range for each question can be found in Table 2. Responses to questions regarding the effectiveness of the presentation were also recorded in the post-intervention survey.

Nurses’ Understanding of Risks and Recommendations. Respondents answered five questions pertaining to the risks and recommendations for preoperative urine pregnancy testing
(Table 2). An independent-samples t-test was run to determine if there were differences in understanding of the risks and recommendations for preoperative urine pregnancy testing pre- to post-intervention. The first question, *How well do you understand the current recommendations for preoperative urine pregnancy testing?* pre-intervention (M = 3.091, SD = 2.697) and post-intervention (M = 3.800, SD = 3.347), did not have a statistically significant difference, p = 0.0789. The second question, *How well do you understand the risks of anesthesia to pregnant patients?* pre-intervention (M = 2.818, SD = 2.486) and post-intervention (M = 3.700, SD = 3.256), had a statistically significant difference, p = 0.0504. The third question, *How well do you understand the risks of surgery to pregnant patients?* pre-intervention (M = 3.000, SD = 2.663) and post-intervention (M = 3.700, SD = 3.256), did not have a statistically significant difference, p = 0.1172. The fourth question, *How well do you understand the risks of anesthesia to the fetus?* pre-intervention (M = 2.545, SD = 2.216) and post-intervention (M = 3.700, SD = 3.256), had a statistically significant difference, p = 0.0112. The fifth question, *How well do you understand the risks of surgery to the fetus?* pre-intervention (M = 2.727, SD = 2.412) and post-intervention (M = 3.700, SD = 3.256), had a statistically significant difference, p = 0.0351.

**Nurses’ Understanding of the Institutional Policy.** Respondents answered three questions pertaining to the institutional policy on preoperative urine pregnancy testing (Table 2). An independent-samples t-test was run to determine if there were differences in understanding of the institutional policy pre- to post-intervention. The first question, *How well do you understand [the medical center's] policy on preoperative urine pregnancy testing?* pre-intervention (M = 2.818, SD = 2.558) and post-intervention (M = 3.400, SD = 3.033), did not have a statistically significant difference, p = 0.2695. The second question, *How well do you understand who should receive a preoperative urine pregnancy test at [the medical center]?* pre-intervention (M =
2.909, SD = 2.763) and post-intervention (M = 3.900, SD = 3.493), did not have a statistically significant difference, p = 0.0958. The third question, *How well do you understand the process for obtaining a preoperative urine pregnancy test at [the medical center]?* pre-intervention (M = 2.182, SD = 2.000) and post-intervention (M = 3.600, SD = 3.162), had a statistically significant difference, p = 0.0071.

**Nurses’ Understanding of EHR Documentation for UPT.** Respondents answered two questions about documentation related to preoperative urine pregnancy testing in the EHR (Table 2). An independent-samples t-test was run to determine if there were differences in understanding of documentation in the EHR pre- to post-intervention. The first question, *How well do you understand where to locate a preoperative urine pregnancy testing result in [the EHR]?* pre-intervention (M = 3.272, SD = 3.357) and post-intervention (M = 4.300, SD = 3.821), did not have a statistically significant difference, p = 0.1730. The second question, *How well do you understand where to locate preoperative urine pregnancy testing assessment questions in [the EHR]?* pre-intervention (M = 2.000, SD = 1.859) and post-intervention (M = 3.600, SD = 3.130), had a statistically significant difference, p = 0.0022.

**Table 2**

*Descriptive and Inferential Statistics for Key Study Variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-Intervention</th>
<th>Post-Intervention</th>
<th>Range</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>How well do you understand the current recommendations for preoperative urine pregnancy testing?</td>
<td>EW 0.0 VW 36.4 MW 45.5 SW 9.1 NW 9.1</td>
<td>3.091 2.697</td>
<td>EW 20.0 VW 40.0 MW 40.0 SW 0.0 NW 0.0</td>
<td>3.800 3.347</td>
</tr>
<tr>
<td></td>
<td>EW 0.0</td>
<td>VW 27.3</td>
<td>MW 45.5</td>
<td>SW 9.1</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------</td>
<td>--------</td>
<td>---------</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>How well do you understand the risks of anesthesia to pregnant patients?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How well do you understand the risks of surgery to pregnant patients?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How well do you understand the risks of anesthesia to the fetus?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How well do you understand the risks of surgery to the fetus?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurses’ Understanding of the Institutional Policy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How well do you understand [the medical center’s] policy on preoperative urine pregnancy testing?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How well do you understand who should receive a preoperative urine pregnancy test at [the medical center]?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How well do you understand the process for obtaining a preoperative urine pregnancy test at [the medical center]?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Nurses’ Understanding of EHR Documentation for UPT*
How well do you understand where to locate a preoperative urine pregnancy testing result in [the EHR]?  

<table>
<thead>
<tr>
<th></th>
<th>EW 27.3</th>
<th>VW 36.4</th>
<th>MW 18.2</th>
<th>SW 18.2</th>
<th>NW 0.0</th>
<th>3.272</th>
<th>3.357</th>
<th>EW 40.0</th>
<th>VW 50.0</th>
<th>MW 10.0</th>
<th>SW 0.0</th>
<th>NW 0.0</th>
<th>4.300</th>
<th>3.821</th>
<th>1-5</th>
<th>0.1730</th>
</tr>
</thead>
<tbody>
<tr>
<td>How well do you understand where to locate preoperative urine pregnancy testing assessment questions in [the EHR]?</td>
<td>EW 9.1</td>
<td>VW 0.0</td>
<td>MW 18.2</td>
<td>SW 27.3</td>
<td>NW 45.5</td>
<td>2.000</td>
<td>1.859</td>
<td>EW 10.0</td>
<td>VW 40.0</td>
<td>MW 50.0</td>
<td>SW 0.0</td>
<td>NW 0.0</td>
<td>3.600</td>
<td>3.130</td>
<td>1-5</td>
<td>0.0022*</td>
</tr>
</tbody>
</table>

*p ≤ .05

EW= extremely well, VW = very well, MW = moderately well , SW = slightly well, NW = not well at all

**Effectiveness of the Presentation.** Participants were asked to answer three questions about the effectiveness of the presentation. The first question asked, *Is there more information you would have liked to receive about any of the topics discussed in the presentation? If you responded Yes, please describe.*, to which 9 participants responded No. 1 participant responded Yes and commented, *Could the UPT be a standing order for patients 12-55 who are scheduled for surgery?*. The second question asked, *Were there any other topics related to preoperative urine pregnancy testing that you would have liked addressed in the presentation? If you responded Yes, please describe.*, to which 9 participants responded No, and 1 did not respond. The final question asked, *Will the education you have received from the presentation change your nursing practice? Please describe why or why not.* 3 participants responded No, but did not leave comments, and 1 did not respond. However, 6 participants responded Yes and 4 left comments. The comments include the following: *I would not have thought the age group went to...*
55. I am an OR nurse not a preop nurse but after this presentation I will look to see if patients have had preop pregnancy tests and if they have tested positive speak with the surgeon to make sure they have talked to the patient about the risks of undergoing surgery., Easier to find result., and This presentation did an excellent job at describing the context for why we do UPTs. This will change my practice being more consistent in checking UPT results on patients of childbearing age.

Discussion

Summary

The specific aim of this project was to increase perioperative nurse knowledge related to preoperative urine pregnancy testing. The goal was to improve baseline pre-intervention knowledge to a 50% overall increase in knowledge post-intervention in each competency. This would be accomplished by using the NPD Practice Model to develop continuing education for perioperative RNs. This goal was not met directly, however, there were two survey questions which had at least a 50% increase in understanding. The first question, How well do you understand the process for obtaining a preoperative urine pregnancy test at [the medical center]? increased from a mean of 2.182 to a mean of 3.6; an increase by 55%. The second question, How well do you understand where to locate a preoperative urine pregnancy testing result in [the EHR]? increased from a mean of 2.0 to a mean of 3.6; an increase by 60%. This was confirmed with an unpaired t-test which showed the highest statistical significance for those two questions. Key findings and statistically significant data indicated an increase in perioperative nurse knowledge regarding preoperative urine pregnancy testing following continuing education in the select areas of risks and recommendations, institutional policy, and documentation.
**Demographics**

Demographic data collected showed that most RNs were relatively young and received a Bachelor of Science in Nursing degree. Most RNs reported 1-5 years of experience in nursing and in the OR. These findings indicate a relatively young and new nursing workforce in the perioperative setting who may benefit from education on preoperative urine pregnancy testing in their new graduate orientation. However, more than half of the RNs had experience in areas of nursing aside from the OR. Additionally, a variety of surgical services were represented in this population, with most working on the ear, nose, throat, and plastic surgery surgical service.

**Nurses’ Understanding of Risks and Recommendations**

Pre-intervention survey data showed that RNs did not understand the risks and recommendations *Extremely well* (0%). However, post-intervention data showed that 20% of RNs understood them *Extremely well* following education. It was also recorded in the pre-intervention survey that RNs did not understand the risks and recommendations, with individuals responding *Not well at all* or *Somewhat well* to all questions asked. In the post-intervention survey, no participants responded, *Not well at all* or *Somewhat well* to any of the questions asked; all participants responded, *Moderately well*, *Very well*, or *Extremely well*. Additionally, there was a statistically significant difference in the understanding of risks of anesthesia to pregnant patients, risks of anesthesia to the fetus, and risks of surgery to the fetus between pre- and post-intervention survey responses. While this did not represent an increase in knowledge by 50%, it is an important increase in knowledge.
**Nurses’ Understanding of the Institutional Policy**

According to the survey data collected, there was an increase in RNs who understood the institutional policy on preoperative urine pregnancy testing with more RNs responding *Extremely well* to each question post-intervention compared to pre-intervention. As well, RNs responded *Not well at all* to understanding the institutional policy prior to receiving education, while none responded *Not well at all* after receiving the educational presentation. An increase in RNs who understood the questions related to policy *Extremely well* was noted. Additionally, it was found that there was a significant difference between the responses received pre- and post-intervention and a 55% increase in knowledge related to the process for obtaining a preoperative urine pregnancy test at the facility.

**Nurses’ Understanding of EHR Documentation for UPT**

Pre- and post-intervention survey data showed an increase in RNs understanding the questions related to documentation *Extremely well*. A statistically significant difference was found between the data related to locating preoperative urine pregnancy testing assessment questions, indicating a 60% increase in knowledge following the presentation. Almost 50% of RNs responded *Not well at all* to this question pre-intervention and 0% responded this way post-intervention. This question had the most significant difference pre- and post-intervention compared to all other questions asked throughout the survey. This increase in knowledge indicates that RNs will now be able to successfully locate questions related to preoperative urine pregnancy testing when they are unsure about the UPT status of their patients.
Effectiveness of the Presentation

Questions related to the effectiveness of the presentation brought about a few key points as noted in the free text areas. First, one participant questioned if a standing order for preoperative urine pregnancy tests could be implemented for patients between the ages of 12-55 scheduled for surgery. The controversial topic of universal pregnancy testing is discussed in the current literature presented in this paper; however, this was not included in the educational presentation the RNs received. RNs responded that there were no additional topics or more information on the topics presented that they would have liked to receive information on related to preoperative urine pregnancy testing, aside from this comment. Additionally, 6 nurses responded that the information they learned from the presentation would change their nursing practice, however, 3 responded that it would not, though they did not provide reasoning as for this response.

Strengths

RNs responded positively to the presentation they received, with more than half responding that the information would change their nursing practice as it relates to preoperative urine pregnancy testing. RNs noted that they would be more aware of the age group indicated for testing, would confirm testing results on their patients prior to surgery, and that it would be easier for them to locate the results in the EHR. The demographic data collected represented a diverse group of RNs of a variety of ages, educational backgrounds, and professional experience.
**Interpretation**

**Intervention and Outcomes**

Outcomes from this project were found to be statistically significant in various areas across the competencies of preoperative urine pregnancy testing education provided to RNs. Additionally, all competencies showed an increase in knowledge pre- and post-intervention in some respect. These competencies included knowledge of the current literature on risks and recommendations, institutional policy, and documentation in the EHR related to preoperative urine pregnancy testing. As well, most RNs indicated that the education they received would change their nursing practice and comments regarding an increased understanding were collected following education. The statistical significance between the pre- and post-intervention survey data from certain questions indicates that the increase in knowledge is likely a result of the education the RNs received from the presentation on preoperative urine pregnancy testing. Statistically significant data included an increase of knowledge in the following areas: risk of anesthesia to pregnant patients, risk of anesthesia to the fetus, risk of surgery to the fetus, the process for obtaining a preoperative urine pregnancy test at the medical center, and where to locate preoperative urine pregnancy testing assessment questions in the EHR. Although not all data was statistically significant, there was an increase in understanding of all questions asked following education as evidenced by an increase in the mean response for each question from pre- to post-intervention.

**Observed and Anticipated Outcomes**

Compared to the pre-implementation survey, the pre- and post-intervention surveys recruited far less participants, despite free text responses from the pre-implementation survey
indicating a concerning gap in knowledge. 23 participants partook in the pre-implementation survey, while only 11 RNs participated in the intervention, despite 78% of participants responding that they would benefit from education on preoperative urine pregnancy testing in the pre-implementation survey. The drop in participation is likely due to the time required to complete the pre-implementation survey (1 minute) compared to the time to complete the pre- and post-intervention surveys and educational presentation (10-15 minutes). Based on the pre-implementation survey, it was anticipated that pre-intervention understanding of concepts related to preoperative urine pregnancy testing would be lower than were reported, though this may be due to the number of RNs who participated in both surveys.

**Impact on People and Systems**

As discussed previously, a gap in knowledge of perioperative RNs was made apparent by responses to a pre-implementation survey sent to OR RNs regarding their knowledge on preoperative urine pregnancy testing. The responses were concerning and led to questioning if the autonomy and safety of the defined population was being protected through the appropriate use of preoperative urine pregnancy testing when indicated. The goal of the intervention was to increase this knowledge, and therefore increase patient safety and autonomy by ensuring OR RNs were knowledgeable about the recommendations for preoperative urine pregnancy testing, who should receive the test per the institutional policy, and how to locate that information in the EHR. The result of the intervention was an increase of knowledge by RNs in these areas which will potentially impact patient care in this microsystem. RNs who understand the importance and appropriate use of preoperative urine pregnancy testing, and ensure they are obtained when indicated, protect the safety and autonomy of their patients through thorough patient assessment prior to undergoing surgical procedures.
*Congruence with Current Literature*

To the knowledge of the project lead, there have been no studies or quality improvement projects that have examined the knowledge of OR nurses as it relates to preoperative urine pregnancy testing. The study by Lamb et al. (2019) found low compliance rates to preoperative urine pregnancy testing procedures by pre-operative RNs and recommended that education be provided to RNs to increase compliance. The findings from this quality improvement project may support the recommendation by Lamb et al., (2019) that education is beneficial in improving compliance rates to preoperative urine pregnancy testing as this project demonstrated an increase in knowledge by OR RNs on this topic. Although studies have found the costs for diagnosing a single pregnancy pre-operatively to be between $1,500 and $49,000, the potential cost of operating on a pregnant patient, such as compromising patient and fetal safety, complications requiring hospitalization and treatment, and legal retribution, far outweighs the cost of utilizing preoperative urine pregnancy testing among the defined population (Gong & Poterack, 2018; Lamb et al., 2019; Hutzler et al., 2014).

*Contextual Implications on the Specific Aim*

The specific aim of this quality improvement project to improve baseline pre-intervention knowledge to a 50% overall increase in knowledge post-intervention in each competency was not directly met. However, the mean response to two survey questions had a greater than 50% increase in knowledge pre- to post-intervention. Additionally, every question within each competency saw an increase in the mean response post-intervention compared to pre-intervention responses, indicating an increase in understanding of the competencies assessed.
Limitations

The findings from this project cannot be generalized to all ORs or all RNs in the OR due to the potential for sampling bias. This quality improvement project was conducted in the OR at one facility in New Hampshire and findings were interpreted based on the responses from 11 RNs pre-intervention and 10 RNs post-intervention, which is not representative of the entire population of perioperative RNs. Based on the nature of Likert-type questions, response bias may result in the actual knowledge of perioperative nurses being misrepresented. Efforts were made to decrease the chance of bias by simplifying and specifying survey questions to attain the most accurate representation of knowledge in specific competencies related to preoperative urine pregnancy testing. Additionally, the education received by RNs regarding policy and documentation were specific to the facility where this project was conducted and would require alteration for use at other facilities. The findings from this project may be useful for guiding further investigation into the knowledge of RNs regarding preoperative urine pregnancy testing and the use of education to improve that knowledge.

Conclusions

Sustainability and Usefulness

The results of this quality improvement project indicate that there is a gap in knowledge which may be improved by continuing education for the perioperative nurse as it pertains to preoperative urine pregnancy testing. The virtual presentation created for this quality improvement project will continue to be used by the Nurse Educator in the microsystem for in-service RN education on preoperative urine pregnancy testing. This presentation may also be used for additional RN training and on-boarding purposes and could be altered for the function
of further education in other areas of preoperative urine pregnancy testing not covered in this project.

**Implications for Practice**

This project has highlighted multiple areas where updates to practice pertaining to preoperative urine pregnancy testing may be necessary. First, as described previously, the idea for this project stemmed from the discovery that the DOS additional needs document was ambiguous. This document has led perioperative RNs to question whether preoperative UPTs are being obtained appropriately from the defined population. It may be helpful to OR RNs for this document to be updated, allowing preoperative RNs to explicitly state whether a UPT specimen was obtained and reasons for exclusion.

Considerations should be given to creating a tab or adding UPT status to a currently existing tab in the Intraoperative workflow in the EHR. The addition of this information should allow for perioperative RNs to more easily and readily review whether a patient has received a UPT and reasons for omission in the EHR. Currently, the UPT status is only available to the OR RN by navigating out of the Intraoperative workflow and in to the Preoperative or Results Review workflow. Additionally, it should be explored whether a hard-stop in the Intraoperative workflow would be beneficial for ensuring UPT status is addressed prior to beginning surgery.

Another implication for practice is the use of universal preoperative urine pregnancy testing. As mentioned by one participant in the post-intervention survey, *Could the UPT be a standing order for patients 12-55 who are scheduled for surgery?* In the study by Gong & Poterack (2018), it was found that the low yield of positive pregnancy tests and high yields of false negatives at one facility utilizing universal pregnancy testing warranted reconsideration of
the protocol. However, a current literature review of universal preoperative urine pregnancy is necessary for a better understanding of its efficacy.

**Spread to other Contexts**

Although the findings of this project are limited to the OR where the intervention took place, it would be beneficial for other facilities to explore the knowledge base of OR RNs as it pertains to preoperative urine pregnancy testing. Additionally, education may be tailored to RNs in the preoperative environment to assess their knowledge on the topic and process. As well, this project did not include RNs at the institution’s ambulatory surgery center. This facility obtains preoperative UPTs according to a separate policy, and documentation for UPTs differs and does not include the DOS additional needs document used by the MOR. Analysis of perioperative nurse knowledge on preoperative urine pregnancy testing at this facility may uncover similar findings to the MOR.

**Next Steps**

The survey data collected in this project showed statistically significant changes between knowledge pre- and post-intervention related to risks and recommendations, institutional policy, and documentation in the electronic health record. Continued monitoring of the perioperative RNs knowledge on preoperative urine pregnancy testing in these select areas is important. Through use of the presentation created for this project, the Nurse Educator may continue to provide continued education on the topic. It would be valuable if the microsystem continued to assess the outcomes of the education provided via survey or other means. Additionally, monitoring of the positive and negative yields of UPTs, omissions of UPTs, and sentinel events related to preoperative urine pregnancy testing should be explored and addressed to better
understand the current situation in the microsystem. Furthermore, exploring the compliance rate to preoperative urine pregnancy testing in the preoperative setting of this microsystem is vital. These findings may allow the Clinical Nurse Leaders to aim future quality improvement towards ensuring pregnant patients and fetuses are protected in the OR.
References


Appendix A: Preoperative Urine Pregnancy Testing Policy

I. Purpose of Procedure

The purpose of this procedure is to ensure that all individuals able to become pregnant are screened for possible pregnancy before undergoing any procedure where possible fetal injury may occur as a result of the procedure or exposure to anesthesia, other medications or radiation.

II. Procedure Scope

This procedure applies to all [Wildcat Hospital] staff in Perioperative Services and Same Day Program. Individuals requiring screening are able to become pregnant prior to procedures requiring anesthesia, or exposure to potentially harmful medications or radiation at [Wildcat Hospital] in Perioperative Services.

III. Definitions

Defined Population: Individuals able to become pregnant between the ages of 12-55, excluding those undergoing emergency surgery, scheduled for a procedure related to pregnancy (e.g. ectopic or early pregnancy loss), or other factors that might impair participation in the assessment.

Procedure: In this document, Procedure refers to multiple care settings to include, but not limited to surgery, radiology exams, medication infusion areas, etc.

DOS: Day of Surgery

POCT: Point of Care Test for Urine Pregnancy

IV. Equipment

Point of care urine pregnancy test

V. Procedure

The RN or other [Wildcats Hospital] employee assesses all individuals able to become pregnant for the risk of pregnancy prior to the patient undergoing any procedure with anesthesia or exposure to radiation (see department specific procedure). If the patient will be exposed to known teratogenic agents or to radiation, the specific risk will be discussed with the patient.

1. For individuals able to become pregnant between 11 to 18 years of age, the nurse or provider should screen for the possibility of pregnancy with the help of a Child Life Specialist, if available.
2. All patients 18 and older with the ability to become pregnant are screened during their pre-op phone call. If there is a possibility of pregnancy, the chart is flagged with “POCT Urine Preg” to signify need of test DOS and protocol order should be placed by RN doing the pre-op call.

3. On the DOS, all female patients 11 years or older are asked the following questions and responses are documented in [electronic medical record]:
   a. “Are you menstruating?”
   b. “When was the date of your last menstrual period?”
   c. “Is there any chance you could be pregnant?”

4. The [Wildcat Hospital] employee conducts the screening with the patient separate from family, friends, or other visitors as to protect the patient’s privacy, whenever possible.

5. Point of Care urine pregnancy test is performed if there is a possibility of pregnancy
   a. The RN confirms with the patient that a pregnancy screening test is indicated, based on the patient’s answers to the screening questions, and obtains verbal consent to proceed with pregnancy test.
      ● For example, if a patient says she is not menstruating and there’s a chance she could be pregnant, a pregnancy test should be performed.
      ● Or, if she says she is menstruating, but her last menstrual period was > 28 days ago, she may need a pregnancy test.
   b. The RN places a “POCT Urine Preg” order in [electronic medical record] per protocol.
   c. The ordering provider is the physician performing the procedure
   d. The RN or other [Wildcat Hospital] employee documents the results within the [electronic medical record]

6. Test results
   a. If the result is negative, the surgical procedure occurs as scheduled.
   b. If the result is positive, the proceduralist or surgeon and anesthesiologist are notified.
c. If the patient who is pregnant is less than 18 years old, whose parents are unaware of the pregnancy, the RN consults Case Management and the Child Life Specialist to assist with patient and family communication

7. If the patient answers yes to chance of pregnancy but declines the test:

a. The anesthesia provider and the proceduralist counsels the patient on the risks of proceeding and a collaborative decision is made with the patient.

b. A note is placed in the patient record reflecting this discussion and the decision made.
Appendix B: Pre-Implementation Survey

Q1: How well do you understand the policy on and indications for preoperative urine pregnancy testing?
   Extremely well
   Very well
   Moderately well
   Slightly well
   Not well at all

Q2: Would you benefit from a short educational piece about preoperative urine pregnancy testing?
   Yes
   No

Q3: If you answered “Yes” to Question 2, is there a specific topic you would like covered?
   Yes: ____________________
   No

Q4: If you answered “Yes” to Question 2, how would you prefer the material be delivered?
   Emailed PowerPoint
   In-Service education session
   Paper handout
   Emailed handout
   Other: ____________________