# Implementation of Education and Bio-Occlusive Ocular Dressings in Robotic Hysterectomy Procedures for Corneal Abrasion Prevention: A Quality Improvement Project

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## Author Note

Disclosure of Conflict of Interest: None

This paper is based on the ongoing DNP Project as partial fulfilment of the Doctor of Nursing Practice degree with the guidance and supervision of the following:

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Table of Contents

## Abstract

Corneal abrasions are one of the most common ophthalmic complications associated with general anesthesia. These incidences are often attributed to drying of the cornea and direct trauma. Many risk factors exist that increase a patient's chance of acquiring a corneal abrasion including patient position, type of surgery, and method of eye closure after induction of anesthesia. The inconsistencies and variability amongst anesthesia providers with eye lid taping also increases the risk. The purpose of this DNP project is to implement education and the utilization of bio-occlusive dressings for ocular protection during robotic hysterectomies. The implementation of this DNP project aims to improve quality of care and patient safety while enabling a consistent evidence-based practice amongst anesthesia providers. The outcomes measured in this project will be enhanced knowledge and willingness to change practice along with documentation of increased utilization of bio-occlusive dressings as evident by a retrospective chart review of the electronic medical record. Data analysis will compare pre-implementation to post-implementation data utilizing standard t-tests and chi-square test. Results of this DNP project will be evaluated for validity and reliability, and then disseminated.


*Key words: corneal abrasion, corneal abrasion prevention, robotic surgery*

# Implementation of Education and Bio-Occlusive Ocular Dressings in Robotic Hysterectomy Procedures for Corneal Abrasion Prevention: A Quality Improvement Project

A corneal abrasion (CA) acquired in the perioperative period is an unanticipated event. There are many risk factors that contribute to the development of corneal abrasions. These can range from patient, provider, and procedure specific. There are also numerous methods utilized by anesthesia providers for ocular protection during surgery. These practices range from eye lid taping, goggles, bio-occlusive dressings, and eye lubrication. Each of these methods has benefits and limitations. However, in many institutions there is a lack of standardized ocular protection protocols amongst anesthesia providers. This places patients at an increased risk for acquiring corneal abrasions. The purpose of this DNP project is to generate a perioperative practice change based in evidence amongst anesthesia providers to prevent corneal abrasions. The practice change will consist of an educational component and implementation of bio-occlusive dressings for women undergoing robotic hysterectomies. The contributions of this DNP project will be a reduction in corneal abrasions, quality improvement, and dissemination of evidence-based practice amongst anesthesia providers.

# Chapter 1: Introduction and Overview of the Problem of Interest

## Background and Significance

Corneal abrasions have been found to be the most common ophthalmic injury occurring during the perioperative period (Nagelhout & Elisha, 2018; Anesthesia Quality Institute, 2017). The incidence of CA's has been found to be as high as 44% (Verma, 2019). The mechanism of injury is believed to result from the drying of the exposed cornea or from direct trauma (Nagelhout & Elisha, 2018). Drying of the exposed cornea occurs during general anesthesia due to lagophthalmos (incomplete eyelid closure) and the reduced amount of tear production (Dixon et al., 2019; Lee et al., 2016). Direct trauma occurs when an anesthesia-mask, anesthesia providers watch or ID badge, surgical drapes, and masks directly encounter the cornea or when the patient rubs their eyes (Nagelhout & Elisha, 2018; Lee et al., 2016).

The risk of corneal abrasions increases based on several factors including type of surgery (operations on the head and neck; robotic surgeries), patient position (lateral, prone, steep Trendelenburg), age, race, length of surgical procedure (>90minutes), amount of fluids administered (>2 liters), supplemental oxygen en route to or in the post-anesthesia care unit and incomplete closure of eyes (Dixon et al., 2019; Fang, 2017; Sampat et al., 2015; Lamberg, 2017). Of concern, the risk of CA's during laparoscopic hysterectomies increases nearly 4-fold, and this risk increases to 6.5-fold during robotic hysterectomies (Sampat et al., 2015). Patients undergoing robotic hysterectomies are at highest risk of developing a CA due to the robotic assistance, steep Trendelenburg position, prolonged surgical time, and increased ocular pressure in conjugation with the inhibition of normal physiologic responses during general anesthesia.

According to Nagelhout and Elisha (2018), ensuring that the eyelids are closed and secured with tape should provide satisfactory protection to the cornea. However, research has demonstrated that there are superior protection methods of securing the eyes closed and preventing CA amongst patients undergoing robotic surgeries with bio-occlusive dressings rather than eye tape alone (Tourinho-Barbosa et al., 2018; Kan, Brown, & Gainsburg, 2015). The significance of inconsistent methods of securing the eyes closed contributes to the development of corneal abrasions. When these adverse events occur, they contribute to patient discomfort and pain. The pain associated with the cornea can be intense since it contains a high density of sensory nerve endings (Dixon et al., 2019). Furthermore, CA's can prolong length of stay, increase cost of care to the patient, and increase the risk of long-term visual disturbances. This DNP project is expected to demonstrate that the use of education will change current practice from a variety of eye lid taping methods to a single evidence driven method that will correlate with a reduction in corneal abrasions amongst patients undergoing robotic hysterectomies.

**PICO Question**

The combination of education and proper ocular closure using bio-occlusive dressings in robotic hysterectomies is paramount for patient safety. Women undergoing robotic hysterectomies fall into a vulnerable patient population, due to the use of robotic assistance, advanced age, increased number of chronic conditions, steep Trendelenburg position, and increased ocular pressure (IOP) (Sampat et al., 2015). This DNP project will examine, amongst anesthesia providers, does the implementation of education and utilization of bio-occlusive dressings in robotic hysterectomy procedures demonstrate a change from a variety of eye protection methods to a single evidence-driven method over one month?

**System and Population Impact**

This project will positively impact women undergoing robotic hysterectomy procedures who are statistically at a higher risk of acquiring a corneal abrasion perioperatively. In addition, anesthesia providers will benefit through the attainment of evidence-based education aimed at preventing corneal abrasions. The organization will indirectly benefit as there is the potential for cost savings in the form of decreased length of stay and negating the need and cost associated with the fluorescein eye exam needed to diagnosis corneal abrasions. Furthermore, with a decreased incidence of corneal abrasions using bio-occlusive dressings, patients would not incur additional costs such as topical eye drops, antibiotics, and analgesics.

It is important to note that the increased utilization of bio-occlusive dressings instead of tape may increase the purchase of tegaderms by the hospital in the long-term. However, the use of bio-occlusive dressings instead of tape for eye closure has been shown to reduce the incidence of corneal abrasions in robotic hysterectomies, a larger expense incurred by the hospital. Ultimately, the benefit of this DNP project is improved quality of care and safety to the patients undergoing robotic hysterectomy procedures.

**Purpose, Aim, and Objectives**

The purpose of this DNP project is to implement education and the utilization of bio-occlusive dressings for ocular protection during robotic hysterectomies. The aim is to change current practice from a variety of eye lid taping methods to a single evidence driven method. The objective of this project is to enhance knowledge about corneal abrasion prevention in a high-risk patient population and to facilitate a practice change from a variety of eye lid taping methods to bio-occlusive dressings in robotic hysterectomy procedures amongst anesthesia providers. The objectives will be measured by comparing pre- and post- implementation data. To attain this

objective anesthesia providers will be recruited to participant in this DNP project and will be given an educational PowerPoint presentation. A pre-and post-education quiz will be dispersed to participants over a period of two-weeks. Analysis of practice change will be conducted over a two-week period after the educational component has been completed.

# Chapter 2: Review of the Literature

## Search Methodology

A review of the literature was conducted through the electronic databases CINAHL, PubMED, ECBSCOhost, and Google Scholar. The search terms used are as follows: corneal abrasion, robotic surgery, and corneal abrasion prevention. The Boolean phrase "AND" was used to separate the search terms. Advanced search settings included linked full text, published date between the years 2015 to 2021, peer reviewed, and English language. The literature search was further narrowed based on relevance to answering the DNP project PICO question as it relates to education and bio-occlusive dressing utilization and comparison to different eye protection methods. In addition to the database search, references in the literature were also utilized to find relevant articles. The search yielded 5,392 articles with a high number of these articles not addressing the DNP project topic. Ten articles were chosen based on their relevance to the use of bio-occlusive dressings and corneal abrasion education.

## Findings

The literature review identified two themes: (1) the implementation of an educational intervention effectively reduces the incidence of corneal abrasions, and (2) the use of transparent, bio-occlusive dressings (tegaderm) effectively reduces the incidence of corneal abrasions in robotic surgeries. The common intervention amongst current literature is the utilization of a bio-occlusive dressing compared to eye lid taping. In the systematic review conducted by Tourinho-Barbosa, Tobias-Machado, Castro-Alfaro, Ogaya-Pinies, Cathelineau, and Sanchez-Salas (2018), the use of occlusive dressing as opposed to standard eye tape was found to play a role in minimizing the risk of corneal abrasions. This was supported in a case-control study by Vetter, Ali, and Boudreaux (2012) who used an aqueous-based gel in addition to a clear occlusive

dressing to reduce corneal abrasions. Furthermore, in Kan, Brown, and Gainsburg (2015) literature review they identified several studies that demonstrated the effectiveness of transparent occlusive dressings as opposed to standard tape protected the eye better and reduced the incidence of corneal abrasions.

During the literature review, studies that compared various eye protection strategies to identify the best methods to prevent corneal abrasions in robotic prostatectomies were also included. This is because both robotic hysterectomies and robotic prostatectomies use robotic assistance during the surgical procedure, and both require the patient to be in a steep Trendelenburg position. In a study conducted by Grixti, Sadri, and Watts (2013) they found no corneal abrasions with the use of Tegaderm alone during robotic prostatectomy in the steep Trendelenburg position, compared to an abrasion rate of 2.3 percent in patients who received lid taping and ocular lubricants. The benefits associated with the use of bio-occlusive dressings as opposed to standard eye lid closure with tape is that occlusive dressings can maintain complete uniform lid closure and create a moist environment by reducing tear film evaporation (Grixti, Sadri, & Watts, 2013).

In addition to the utilizing bio-occlusive dressings, implementation of an educational intervention to anesthesia providers has been found to reduce the incidence of corneal abrasions. In a case-control study by Martin, Weingarten, Gunn, Lee, Mahr, Schroeder, and Sprung (2009) a 45-minute lecture focused on postoperative corneal injury awareness, understanding of risk factors, and methods of prevention was implemented. The results of the study found a reduction in corneal injury incidence from 1.51 per 1,000 pre-implementation to 0.79 per 1,000 post-implementation (Martin et al., 2009). This study was replicated 10 years later by Ely, Goerlitz-Jessen, Scott, Lehman, Ali, Kerchner, and Liang (2019) who was also able to demonstrate a

decrease in corneal injury incidence from 0.37% pre-implementation to 0.19% post-implementation.

**Limitations**

Although there is sufficient evidence that identifies the effectiveness of utilizing education and bio-occlusive dressings to prevent corneal abrasions, there are limitations that need to be addressed. One limitation being that half of the articles are greater than 5 years old with the oldest being Martin et al. (2009). This is likely due to a lack of abundant research conducted in this specific patient population subset. Although there were several systematic and randomized control trial studies included in the literature review, there were two case control studies. In the case control study conducted by Martin et al. (2009) it is unclear the exact mechanism of injury, corneal exposure versus abrasion. Another limitation is that there was no identified accrediting body or anesthesia association that recommends bio-occlusive dressings as the first line of protection in patients undergoing anesthesia. The American Association of Nurse Anesthesiology (AANA) (2021) has identified that a lack of standardized eye care protection under anesthesia plays a direct role in corneal abrasion development. Although Nagelhout and Elisha (2018) and the AANA (2021) identify that taping the eyes closed after induction with tape should be sufficient to protect the eyes, the continued incidence of corneal abrasions indicates the need for alternative methods.

**Conclusions**

The review of literature demonstrates the following ongoing themes:

1. Transparent occlusive dressing compared to standard eye tape reduces corneal abrasions in robotic surgical cases

2. Implementing eye lubrication with transparent occlusive dressings decreases corneal abrasions
3. Transparent occlusive dressings protect the eyes against fluids leaking onto the cornea
4. The implementation of education designed to prevent perioperative corneal injuries statistically reduces the incidence of corneal abrasions

# Chapter 3: Organizational Framework of Theory

## Conceptual Definitions of Theoretical Framework

The Iowa Model of Evidence-Based Practice (EBP) framework was selected for this DNP project (Appendix A). The Iowa Model of EBP is a dissemination and implementation model that guides the clinical decision-making and EBP process from both the clinician and systems perspectives (Iowa Model Collaborative et al., 2017). The intended users of this model are point of care clinicians who seek a systematic EBP approach to improve health care (Iowa Model Collaborative et al., 2017). This framework was chosen because of its ability to use research findings and a multidisciplinary systematic approach to help improve patient care.

This model has historically undergone revisions to ensure validity through the continuum of health care changes (Iowa Model Collaborative et al., 2017). The Iowa Model of EBP hopes to answer a problem that is an organizational priority. The aim of this DNP project is to facilitate a practice change amongst anesthesia providers that will result in enhanced knowledge and a subsequent decrease in corneal abrasions. The models application-oriented guide of steps helps to identify the issue, research solutions, and implement changes in the EBP process (Iowa Model Collaborative et al., 2017).

## Application of Theoretical Framework

The model consists of eight steps which include (1) identifying a problem, (2) determining if the problem is an organizational priority, (3) forming a team, (4) gathering and analyzing research, (5) critiquing and synthesizing the research, (6) deciding whether to implement the

practice change, (7) implementing the change into a pilot program, and (8) evaluating and disseminating results (Brown, 2014).

The problem identified at a not-for-profit Level 1 Trauma Center located in South Central Pennsylvania was an increased incidence of corneal abrasions in robotic hysterectomy procedures. After discussions with organizational stakeholders, it was identified that resolution of this problem was a priority. The DNP team was formed and includes the DNP student (principal investigator), the DNP Chair, DNP anesthesia faculty member, and the DNP Mentor. A comprehensive literature review and evidence synthesis was conducted to meet the Iowa Model of EBP steps 4-5. The decision to implement the practice change was determined by Institutional Review Boards (IRB) approval at the Level 1 Trauma Center and Cedar Crest College School of Nursing.

Following the Iowa Model of EBP, the DNP project was implemented as a pilot program with consented anesthesia provider participants. A retrospective chart audit was conducted to gather current practice data on eye protection methods. A pre-test questionnaire was sent and collected from consented participants to assess baseline knowledge. Implementation of the educational module was delivered to anesthesia providers through a PowerPoint presentation and a post-test was sent to assess knowledge improvement. A post-implementation chart audit was conducted to evaluate a change in practice from a variety of eye protection methods to a single evidence driven method. Post data collection and statistical analysis, the results of this project will be disseminated.

# Chapter 4: Project Design

The DNP project design was created to address the importance of utilizing a single evidence-based method of ocular occlusion during robotic hysterectomy procedures in response to a variety of ocular occlusion methods by anesthesia providers and a perioperative increase in corneal abrasions amongst those undergoing these procedures. A gap analysis at the level 1 trauma center was completed in November 2020. Analysis indicated that there was a need for quality improvement based on the corneal abrasion incidence. After completion of a literature review and PICOT finalization, discussions with stakeholders commenced to create awareness and buy-in.

Beginning in December 2020, monthly meetings and discussions were held with key stakeholders including the health care institutions student nurse-anesthetist coordinator, perioperative Clinical Nurse Specialist, and Director of Nursing Research and Science. The project design required flexibility around the lasting impact of the COVID-19 pandemic. In-person meetings were not possible, so the design incorporated the online platform by implementation of an educational PowerPoint module that could be sent directly to participants through email.

## Institutional Review Board (IRB) Approval

Prior to submitting for IRB approval, the principal investigator completed an online Collaborative Institutional Training Initiative (CITI) program. Once completed, IRB approval was first obtained at the Level 1 Trauma Center in South Central Pennsylvania on July 22nd, 2021 (Appendix B). The IRB process required a formal online submission of the DNP projects

proposal to the IRB committee. This was accomplished with the assistance of the institutions Director of Nursing Research and Science.

The DNP project proposal reviewed both the risks and benefits of this project. The project does not increase the patient's risk of adverse events from the risk of patients receiving standard anesthesia care. The benefits associated with this project include potential cost savings to the organization, in the form of decreased length of stay, decreased incidence of corneal abrasions, and decreased additional cost to the patient in the form of topical eye drops, antibiotics, and analgesics. Furthermore, the potential benefits include negating the need and cost associated with the fluorescein eye exam needed to diagnosis corneal abrasions.

After an expedited review, the Chair of the Level 1 Trauma Centers Institutional Review Board determined that the project did not meet criteria for research and was approved. The project then obtained Cedar Crest College (CCC) Internal Review Board approval on September 13, 2021 (Appendix C), before initiation of the DNP Project on October 3rd, 2021.

**Implementation Plan**

The implementation of this DNP project follows the steps outlined by the Iowa Model of EBP framework. After approval of the project by both governing IRB bodies the project was implemented as a pilot program. The implementation plan involved a pre-implementation retrospective chart audit to gather current practice data on eye protection methods on September 16th, 2021. Key stakeholders helped raise awareness about the project while the investigator sent emails to all certified registered nurse anesthetists (CRNAs) to facilitate buy-in. A display set up

in the anesthesia break room with participant consent forms helped gain interest and participation.

The plan involved dispersing the pre-test to participants via email through SurveyMonkey on October 3rd, 2021. Thereafter, the plan involved disseminating the educational PowerPoint presentation and the post-test via email to participants on October 12th, 2021. The implementation plans required flexibility for unforeseen technological barriers and participants schedules. It was important that anesthesia providers had direct communication with the principal investigator for implementation guidance throughout the entire implementation period. The immediate implementation of bio-occlusive dressings (Tegaderm), to the eyes prior to intubation was emphasized since current evidence supports this intervention.

The post-implementation plan involved another retrospective chart audit to evaluate a change in practice. This was to be evident by an increased documentation of bio-occlusive dressings for ocular protection in robotic hysterectomy procedures. Once the data was collected and statistically analyzed the results were to be disseminated.

**Data Collection Tools**

Pre-test and post-test survey tools were utilized for data collection. SurveyMonkey was the data collection platform used. This platform provided the means to upload surveys, maintain anonymity of participant responses, disseminate surveys, and collect survey data. The surveys were assessed by DNP team members for validity, reliability, and appropriateness prior to dissemination. The pre-test included 17 questions and the post-test included 20 questions. The additional questions in the post-test assessed a willingness to change practice, a written response

section to determine why participants wouldn't change their practice, and lastly assess the perceived benefit of the educational module.

The pre-implementation and post-implementation ocular protection method as documented by anesthesia providers in the EPIC charting system was collected into an Excel spreadsheet. Data collection did not include patient or provider specific indicators. The data collected included the date, the number of robotic hysterectomy cases, and the ocular protection method. The data was kept only by the principal investigator in a password protected device until the completion of the statistical analysis.

### Resources Needed

The resources needed to complete this DNP project included personnel, supplies, and technology. The personnel needed for the project design included hospital stakeholders and a DNP team to create awareness, buy-in, support, and assistance navigating obstacles. The supplies needed for the completion of the DNP project included laminator sheets for the visual reminders placed in the three operating rooms. Lastly, the most important resource needed for success of this project was technology. Specifically, access to SurveyMonkey software, Excel spreadsheet, PowerPoint, Microsoft Teams application, and a laptop computer.

### Budget Justification

The project required minimal monetary support by the principal investigator. The only financial requirements for this project included laminator sheets and a SurveyMonkey subscription. These fees were paid out of pocket, the investigator did not require financial support from outside entities.

## Chapter 5: Implementation Procedures and Processes

Prior to implementation of the project, the number of robotic hysterectomies occurring each day with the corresponding type of eye protection method was collected over the course of two-weeks. The implementation of this project was conducted via email recruitment of CRNAs from the designated clinical site. The recruitment email titled "Implementation of Education and Bio-Occlusive Ocular Dressings in Robotic Hysterectomy Procedures for Corneal Abrasion Prevention: A Quality Improvement Project" contained a description of the project, instructions describing when and how to take the pre- and post-test via Survey Monkey, instructions describing that the educational module would be emailed to each participant, the time frame participants had to take the pre-test and the length of the project, attached informed consent, directions on where to find the physical copy of the project description and informed consent, directions on what to expect post-implementation involving clearly documenting the type of eye closure method in EPIC, as well as the benefits and goal of the project. Participants were made aware that their involvement was anonymous and voluntary.

After all informed consents were collected, each participant was sent the pre-test (Appendix D) via Survey Monkey. Scheduled reminders were sent to participants via Survey Monkey during the designated timeframe (one-week) for pre-test completion. Once all pre-tests were collected in the designated time frame the educational PowerPoint module and post-test survey (Appendix E) was sent via email to participants. Those who did not complete the pre-test in the designated timeframe were excluded from the project. Participants had two-weeks to complete the educational module and were instructed to only complete the post-test after completion of the educational module.

The educational module reviewed the projects background, problem, significance, anatomy of the eye, signs and symptoms of a corneal abrasion, preventable risk factors, high risk patient populations, general anesthesia risk factors, complications, current literature, and prevention strategies. Reminders were sent via Survey Monkey to complete the post-test to all participants during the designated timeframe for completion. Participants who did not complete the post-test survey by the end of the designated timeframe were excluded from the project.

After completion of the post-test survey, participants were instructed to document the exact type of eye protection utilized during robotic hysterectomy cases at the health care institutions Women's and Babies Hospital by making a comment in the eye protection section in EPIC for the next two-weeks. Example comments may include but are not limited too; "paper tape", "clear tape", and "tegaderm". Visual aids were placed in each operating room on the side of the anesthesia computer screen as a cognitive reminder. The visual aids were laminated to be easily cleaned between cases to prevent infection.

Data collected from the pre- and post-test surveys were tracked via Survey Monkey. GraphPad Prism 9.3.1 was used to analyze the data. A descriptive statistic was used to measure the change in knowledge as evident by comparing the pre-and post-test surveys. A willingness to change practice was measured by participants selecting either "yes" or "no" in the post-test survey. For the following two-weeks post-implementation, data of the number of robotic hysterectomies each day and the corresponding type of eye protection method were collected. The Chi-square test was used to analyze the statistical significance of the project by comparing the pre-implementation data to the post-implementation data. A p value $\leq 0.05$ indicates that the implemented intervention did affect Tegaderm use. A p value $> 0.05$ indicates that the

intervention did not affect Tegaderm use. Although this DNP project did not yield high numbers of participants, the values will be greater than five which is necessary to utilize a Chi-Square Test. The change in practice was determined to be a success if the average use of and documentation of Tegaderm in robotic hysterectomy cases by anesthesia providers increased by 50% after implementation.

# Chapter 6: Evaluation and Outcomes

The pre-implementation retrospective chart audit data collection spanned two-weeks, from September 2nd, 2021, until September 15th, 2021. The implementation phase for this project spanned a one-month period, from October 3rd, 2021, until November 3rd, 2021. This period allowed sufficient time for participants to complete the pre-test, educational module, and post-test. After the implementation phase was complete data collection from the tests occurred through Survey Monkey™ and was transferred to a Microsoft Excel™ spreadsheet. The post-implementation retrospective chart audit data collection spanned two-weeks, from November 4th, 2021, until November 23rd, 2021. The pre- and post- implementation retrospective chart audit data was collected into a Microsoft Excel™ spreadsheet. The data was reviewed by the principal investigator. A Chi-square test was performed for the pre- and post- implementation retrospective chart audit data to determine if there was a significant relationship between two nominal variables, the number of robotic hysterectomies and tegaderm use. An unpaired t-test was performed for all the knowledge-based questions to determine if there was a significant difference between the means of the pre- and post- tests. The t-test was unpaired because the data from the tests were not matched. Data analysis was conducted using GraphPad Prism 9.3.1.

## Sample

Following approval by IRB approval, a convenience sample of 60 CRNAs were recruited by email to participate in this project. There was an overall response rate of 33% (n=20) who volunteered to participate. The final response rate for the pre-test was 90% (n=18) and the final response rate for the post-test was 94% (n=17).

## Evaluation

The pre-test and post-test means were evaluated using an unpaired t-test. An unpaired t-test was selected because the means of the two samples have no natural pairing. The pre-test was not associated with each post-test, thereby limiting the capacity to analyze individual improvement. However, the unpaired t-test was used to determine if the difference between the two groups means is greater than one would expect to see by chance. A 95% confidence level ($\alpha = 0.05$) was selected to evaluate the significance of the results.

The unpaired t-test was conducted using GraphPad Prism 9.3.1 (Figure 1).

**Figure 1**

*Unpaired t-test*

Unpaired t test - Notepad

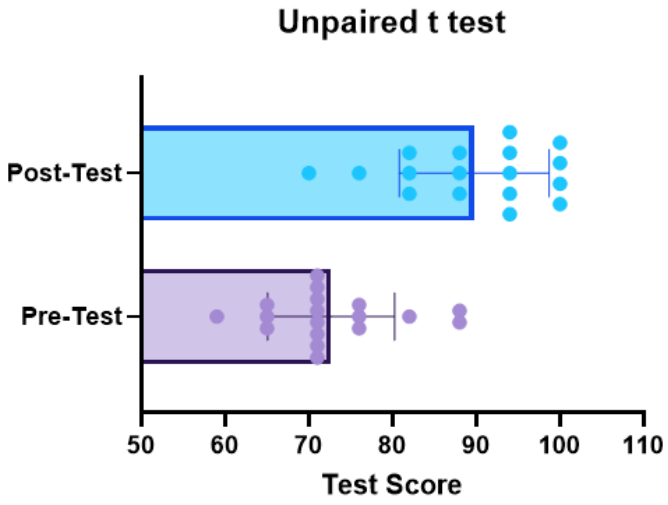
File Edit Format View Help

```
Table Analyzed  Col: Unpaired t test

Column B        Post-Test
vs.     vs.
Column A        Pre-Test

Unpaired t test
    P value     <0.0001
    P value summary     ****
    Significantly different (P < 0.05)? Yes
    One- or two-tailed P value? Two-tailed
    t, df       t=6.116, df=33

How big is the difference?
    Mean of column A    72.67
    Mean of column B    89.76
    Difference between means (B - A) ± SEM      17.10 ± 2.796
    95% confidence interval     11.41 to 22.79
    R squared (eta squared)     0.5313

F test to compare variances
    F, DFn, Dfd 1.392, 16, 17
    P value     0.5050
    P value summary     ns
    Significantly different (P < 0.05)? No

Data analyzed
    Sample size, column A       18
    Sample size, column B       17
```

The pre-test mean was 72.67% (n=18) and the post-test mean was 89.76% (n=17). The p value of the unpaired t-test was <0.0001 indicating that there was a statistically significant difference between the pre-test and post-test results. Furthermore, there was a 11% increase in lowest total score (59% to 70%) and a 12% increase in highest total score (88% to 100%). Individual values were graphed using a scatter plot and bar graph (Figure 2).

**Figure 2**

*Unpaired T-Test Individual Values Scatter Plot with Bar Graph*




The Chi-square test of independence was performed for the pre- and post- implementation retrospective chart audit data. This test was used to determine if there was a statistically significant difference between the expected frequencies and observed frequencies between two nominal variables, the number of robotic hysterectomies and tegaderm use.

The first step of calculating the Chi-square test was to create a contingency table. The rows of the contingency table included the number of robotic hysterectomies pre-intervention, number of robotic hysterectomies post-intervention, and total. The columns of the contingency table included the number of tegaderms used, the number of tegaderms not used, and total. The observed frequencies (O) based on the data collection were inputted into the contingency table. The next step involved calculating the expected frequency (E). Expected frequency was determined by multiplying the row total by the column total and dividing by the overall total (n=34) (Figure 3).

**Figure 3**

*Chi-Square Test of Independence*

| | **Tegaderm Used** | **Tegaderm Not Used** | Total |
|---|---|---|---|
| Number of Robotic Hysterectomies Pre-Intervention | O = 0<br>E = 1.76 | O = 10<br>E = 8.23 | 10 |
| Number of Robotic Hysterectomies Post-Intervention | O = 6<br>E = 4.2 | O = 18<br>E = 19.76 | 24 |
| Total | 6 | 28 | 34 |

Finally, the Chi-square test formula was used to measure the difference between observed frequencies and expected frequency of each of variable (Figure 4).

**Figure 4**

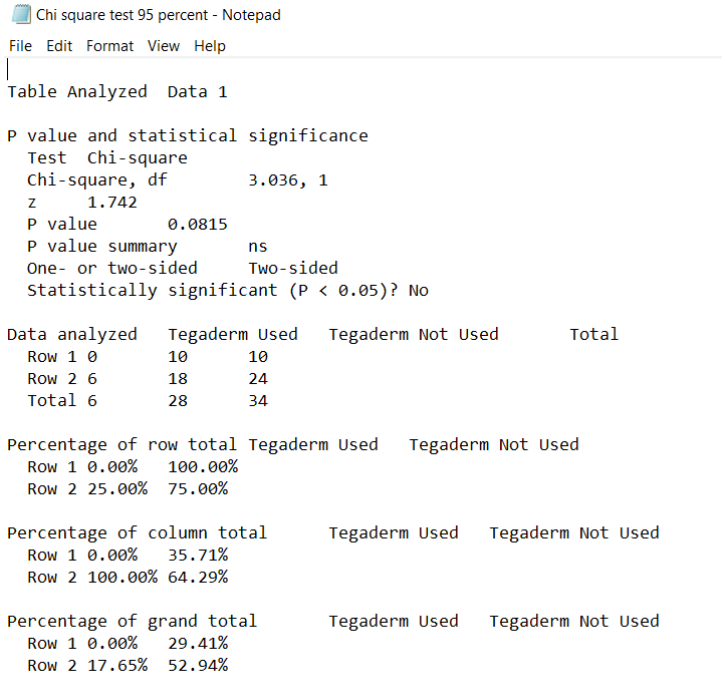
*Chi-Square Test Formula*

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

The Chi-square results were $\chi 2 = 3.06$ (p-value = 0.08). The results of the calculated chi-square test of independence were verified by using GraphPad Prism 9.3.1 (Figure 5).

**Figure 5**

*Chi-Square Test of Independence: 95% Confidence Level*



Chi square test 95 percent - Notepad

File Edit Format View Help

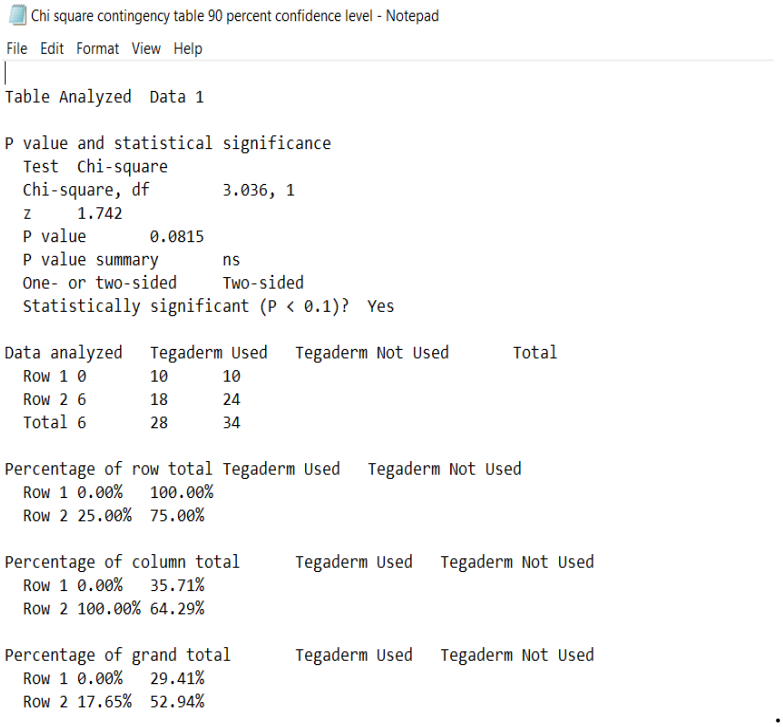
```
Table Analyzed  Data 1

P value and statistical significance
  Test  Chi-square
  Chi-square, df        3.036, 1
  z     1.742
  P value       0.0815
  P value summary       ns
  One- or two-sided     Two-sided
  Statistically significant (P < 0.05)? No

Data analyzed   Tegaderm Used   Tegaderm Not Used       Total
  Row 1 0       10      10
  Row 2 6       18      24
  Total 6       28      34

Percentage of row total Tegaderm Used   Tegaderm Not Used
  Row 1 0.00%   100.00%
  Row 2 25.00%  75.00%

Percentage of column total      Tegaderm Used   Tegaderm Not Used
  Row 1 0.00%   35.71%
  Row 2 100.00% 64.29%

Percentage of grand total       Tegaderm Used   Tegaderm Not Used
  Row 1 0.00%   29.41%
  Row 2 17.65%  52.94%
```

A 95% confidence level ($\alpha = 0.05$) was selected to evaluate the significance of the results. Based on the results (p-value > 0.05) indicates that the implemented intervention did not affect

tegaderm use result and is not statistically significant at a 95% confidence level. However, the chi-square result (p value = 0.08) is less than a p value of 0.10 indicating that the results are statistically significant at a 90% confidence level (Figure 6).

**Figure 6**

*Chi-Square Test of Independence: 90% Confidence Level*



Chi square contingency table 90 percent confidence level - Notepad

File Edit Format View Help

```
Table Analyzed  Data 1

P value and statistical significance
  Test  Chi-square
  Chi-square, df        3.036, 1
  z     1.742
  P value       0.0815
  P value summary       ns
  One- or two-sided     Two-sided
  Statistically significant (P < 0.1)?  Yes

Data analyzed   Tegaderm Used   Tegaderm Not Used       Total
  Row 1 0       10      10
  Row 2 6       18      24
  Total 6       28      34

Percentage of row total Tegaderm Used   Tegaderm Not Used
  Row 1 0.00%   100.00%
  Row 2 25.00%  75.00%

Percentage of column total      Tegaderm Used   Tegaderm Not Used
  Row 1 0.00%   35.71%
  Row 2 100.00% 64.29%

Percentage of grand total       Tegaderm Used   Tegaderm Not Used
  Row 1 0.00%   29.41%
  Row 2 17.65%  52.94%
```

## Outcomes

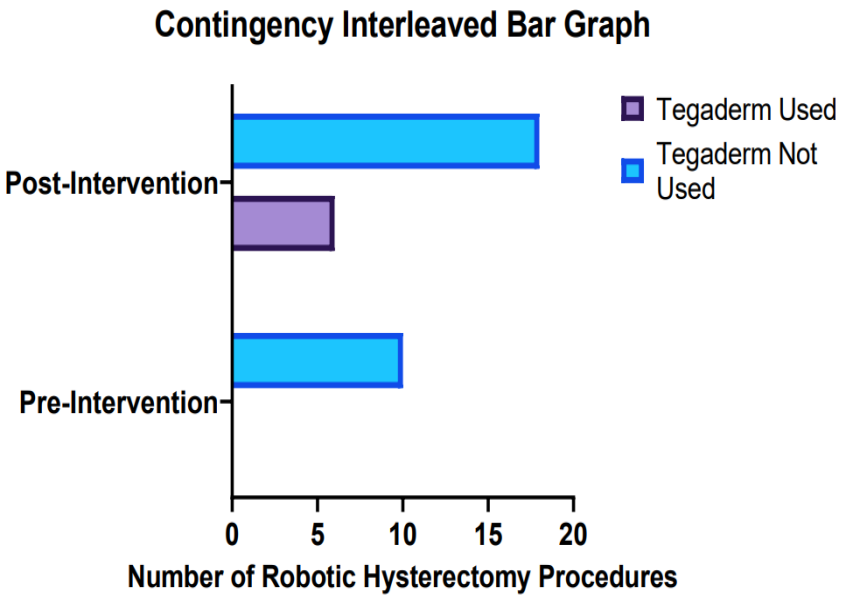
The focus of this project pertained to corneal abrasion prevention in robotic hysterectomy procedures by implementing an educational module with an emphasis on bio-occlusive dressing utilization. The goal of this project was to facilitate a practice change amongst anesthesia providers from a variety of ocular securement methods to one standard method that has been supported by research. By creating a practice change supported by research, the long-term goal

of this project was to observe a reduction in corneal abrasion incidence in robotic hysterectomy procedures post-implementation.

The educational module proved to enhance knowledge amongst anesthesia providers as evident by a statistically significant increase in mean test scores. Although the Chi-square test results were found to be not statistically significant at a 95% confidence level, they were found to be statistically significant at a 90% confidence level. In addition, the clinical significance of the educational module post-implementation is evident. Pre-implementation retrospective chart audit data found no tegaderm use in robotic hysterectomies (n = 0/10) compared to the post-implementation retrospective chart audit which found 24% of robotic hysterectomies now had tegaderm utilization by anesthesia providers (n = 6/24). This is a clinically significant increase in tegaderm utilization by anesthesia providers. A Chi-square interleaved bar graph depicts this outcome (Figure 7).

**Figure 7**

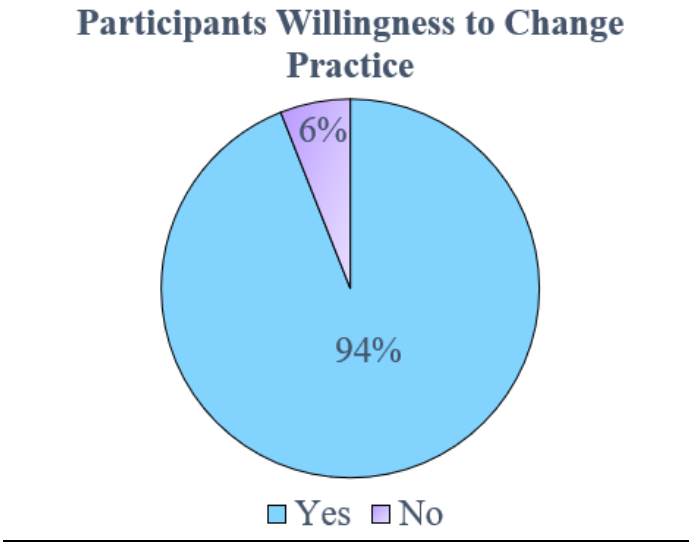
*Chi-Square Interleaved Bar Graph*



This outcome correlates with the anesthesia providers response to the post-implementation survey question assessing whether the provider will change their practice after the educational module. Results from this question found that 94% of participants (n = 16/17) stated that they would change their practice (Figure 8).

**Figure 8**

*Participant's willingness to change current practice*




**Discussion**

The Level 1 Trauma Center experienced 17 corneal abrasions between 2019 and 2020. The incidence was found to be 10 corneal abrasions in 2019 and 7 corneal abrasions in 2020. Of these, 13 (76%) occurred in robotic hysterectomy procedures. The latest data analysis by the hospital demonstrated that in 2021 the organization experienced a total of 4 corneal abrasions. This is a 60% reduction from the year 2019 and a 42% reduction from the year 2020. The last corneal abrasion occurring in a robotic hysterectomy procedure was on March 3rd, 2021.

Since project implementation, there were no corneal abrasions in robotic hysterectomy procedures as of January 6th, 2022. Compared to the previous 13 corneal abrasions that occurred in robotic hysterectomies from 2019 and 2020, the number of corneal abrasions occurring in robotic hysterectomies in 2021 demonstrates a 92% reduction.

Based on the data from the unpaired t-test it can be concluded that implementation of an educational module enhances knowledge amongst anesthesia providers as evident by statistically significant increases in test scores. Additionally, we can conclude that participants were willing to change current practice after obtaining evidence-based educational material. This was clinically evident by the increased utilization of tegaderm for ocular closure during robotic hysterectomies.

Despite not achieving statistically significant results at a 95% confidence level, we can conclude that we are 90% confident that the implemented intervention did affect tegaderm use. To reach a 95% confidence level, changes could be made to strengthen this project if it were to be done again. The most important change would be to increase awareness of the project to achieve stakeholder buy-in at the site of implementation. Most of the participant recruitment occurred at the main hospital location. Emails, project description, and consents were sent and placed in the anesthesia work room at the Women's and Babies Hospital. However, a lack of principal investigator presence at the implementation site could have negatively impacted the number of participants and overall outcomes.

Another change that could strengthen this project would include working with the hospitals IT department to create a "Tegaderm" button like the "Eyes Taped" button in the EPIC charting system. Laminated reminders were placed on each anesthesia machine for the post-

implementation time frame. However, this required anesthesia providers to manual type in the comment box that tegaderm was utilized. This could have hindered participation and compliance.

# Chapter 7: Implications for Nursing Practice

## Implications for Practice

The DNP is designed to enhance clinical practice, influence policy, inform science, and impact best practices (Boland & Loos, 2020). It goes beyond clinical competency to prepare clinicians to be scholars and system leaders (Boland & Loos, 2020). The impact this DNP project has for future nursing practice includes its contribution to evidence-based practice and quality improvement to improve patient outcomes. Unique to this project is its successful integration of evidence-based literature into practice. This was demonstrated by provider willingness to change practice, an increase in provider knowledge, and a change in provider practice. In addition, this project demonstrated a clinically significant reduction in corneal abrasion incidence which correlates with current literature. It is unclear if the increased utilization of bio-occlusive dressings contributed to a reduction in corneal abrasions or if an increased awareness/knowledge did, or both. For this reason, additional research is recommended for future nursing practice.

## Strengths and Limitations of the Project

The strengths of this project included its cost effectiveness. The implementation of this project did not require additional funding or expenditure by the healthcare institution. The utilization of free trials for survey and data collection, as well as, data analysis, reduced out of pocket expenses by the PI. Another strength included the projects educational module design. Distributing pre/posttest surveys and educational module by email to participants provided flexibility to complete the project requirements at the participants leisure. The total participation time was less than 30 minutes with the average time to complete the pre-test being 2 minutes and the post-test being 3 minutes. Lastly, retrospective chart auditing for this project provided

independent verification that the ocular protection methods were a fair representation of the current provider practices.

There are several limitations of this project that must be addressed. First, there is significant lack of evidence-based practice literature specifically dealing with corneal abrasion prevention education for robotic hysterectomy procedures for anesthesia providers. This gap mandated the PI focus closely on the interventions in corneal abrasion prevention and the adverse patient outcomes to validate the lack of corneal abrasion prevention knowledge among clinicians. There is no standard tool that exists to assess the deficit of corneal abrasion prevention knowledge and education. Hence, the educational module and surveys were created by the PI and were previously untested for internal validity.

Additional limitations included a small sample size and lack of clinician diversity. The sample size of the educational intervention was 18 certified registered nurse anesthetists. The sample size of the pre-implementation number of robotic hysterectomy procedures was 10 and the post-implementation number of robotic hysterectomy procedures was 24. These sample sizes do not allow for generalization of data to a larger population and thus reduces the power of the study.

Bias cannot be ruled out and is an important limitation to address. Bias occurs when systematic error is introduced into sampling or testing by encouraging one outcome or answer over others (Pannucci & Wilkins, 2010). Bias can occur at any phase of research and can be categorized as pre-trial bias, bias during trial, and bias after trial (Pannucci & Wilkins, 2010). While the PIs pre-implementation project goals were to create awareness, achieve stakeholder buy-in, and obtain participant recruitment, it is likely that pre-trial bias occurred during this time. A large percentage of participants (78%) answered the following pre-test question correctly:

"According to current literature, which technique of ocular closure effectively reduced the incidence of corneal abrasions in robotic hysterectomy procedures?", the answer being bio-occlusive dressings. It is unknown if those who selected this answer truly knew the correct answer or if they were influenced by bias to select that answer.

## Linkage to DNP Essentials

This project addresses the eight foundational DNP essentials that are core to the advanced nursing practice role.

### *Essential I: Scientific Underpinnings for Practice*

This essential was met by using a science-based theory to determine the significance of a health care delivery phenomenon. Specifically, the Iowa Model was the scientific underpinning used throughout this project. This model guided clinical decision-making and evidence-based practice implementation from both the PI and the organizational perspectives. This essential was met by analyzing evidence-based research and applying it to practice through the implementation of an educational module for anesthesia providers. Furthermore, the utilization of the Iowa Model facilitated the integration of nursing science with knowledge to enhance patient care, enhance provider knowledge, and evaluate clinical outcomes.

### *Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking*

This essential was met by collaboration with organizational stakeholders and anesthesia leadership to identify and address current and future needs of a patient population. The PI assessed the impact of current practice and identified a knowledge gap as evident by a lack of tegaderm utilization in robotic hysterectomy procedures and an increased incidence of corneal

abrasions in this patient population. The PI analyzed the cost-effectiveness of the practice initiative and accounted for risk through collaboration with the organizations institutional review board. An evidence-based quality improvement educational module focused on addressing the current knowledge gap was developed and distributed to participating anesthesia providers. The effectiveness of the educational module was evaluated with a post-test survey, post-implementation retrospective chart audit, and follow-up corneal abrasion incidence monitoring with the organization's leadership.

### *Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice*

This essential was met by a comprehensive literature review that was conducted over several research platforms. The analytic methods used to critically appraise the existing evidence to determine best practices included key search terms, Boolean phrases, and advanced search settings. The literature search was further narrowed based on relevance to answering the DNP project PICO question as it relates to education and bio-occlusive dressing utilization and comparison to different eye protection methods. The relevant findings of the analysis were used to develop practice improvement recommendations. The findings from the evidence-based practice research were disseminated to participating anesthesia providers through an educational module. Dissemination of the project results occurred on March 3rd, 2022, with a poster presentation at the Philadelphia Advisory Group of Nurse Anesthesia Programs District 3 "CRNA/SRNA Virtual Professionalism lecture". Dissemination will also occur on April 11th, 2022, at the Doctor of Nursing Practice Scholarly Project Presentations hosted by Cedar Crest College and at the Pennsylvania Association of Nurse Anesthetists Spring Symposium on April 28th, 2022, to further fulfill this essential.

### *Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care*

This essential was met using a combination of information system technology and patient care technology for the improvement and transformation of health care. The information system technology used included Survey Monkey to distribute pre- and post- test surveys, as well as the educational module. Data collection and analysis used Survey Monkey, Microsoft Excel, and GraphPad Prism 9.3.1. The patient care technology used was the institutions EPIC charting system. The EPIC charting system was used to analyze and compare the pre-implementation anesthesia provider ocular protection methods to the post-implementation methods as evident by documentation in the surgical procedure note. Throughout this project no patient or anesthesia provider identifiers were used and therefore patient and participant privacy were maintained throughout the entirety of this project.

### *Essential V: Health Care Policy and Advocacy in Health Care*

This essential was met by the development of an evidence-based quality improvement educational module. Anesthesia providers were the target audience of this intervention to improve patient outcomes. Although the educational module was not an established health care policy, it did consist of research, values, and advocacy that aim to achieve specific health care goals within a patient population (World Health Organization [WHO], 2020). An effective health policy defines a vision for the future, outlines priorities and expectations, establishes targets and points of references, and can communicate this information to people (WHO, 2020). The educational module successfully incorporated these key points.

### *Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes*

This essential was met by conducting interprofessional meetings with CRNAs, managers, and institutional stakeholders to achieve the project goals. The PI collaborated with both CRNA leadership and the perioperative nurse manager to identify areas for improved patient and population health outcomes. It was during these meetings that corneal abrasions in women undergoing robotic hysterectomies was found to be an institutional problem and priority. Consultation with the organizations Director of Nursing Research and Science assisted in submitting the project proposal for IRB submission. Finally, collaboration with anesthesia provider leadership commenced again prior to, and during, the implementation period. Doing so created project awareness and obtained participation from anesthesia providers.

### *Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health*

This essential was met by focusing on current adverse patient outcomes that anesthesia providers can prevent. Research analysis found that the incidence of corneal abrasions is highest among patients undergoing robotic surgeries, amongst these robotic hysterectomies. This correlated with the status of the corneal abrasion incidence in this patient population. Clinical prevention of these adverse patient safety events involved the implementation and evaluation of interventions that addressed corneal abrasion prevention. These evidence-based interventions focused on increasing anesthesia provider knowledge and facilitating a practice change to improve a specific patient population outcome. The dissemination of this project at anesthesia conferences will further fulfill this essential for improving the nation's health.

***Essential VIII: Advanced Nursing Practice***

This essential was met by conducting a patient safety needs assessment in current anesthesia practice. In addition, this essential was met by designing, implementing, evaluating, and disseminating evidence-based interventions based on nursing science to improve patient outcomes. Furthermore, the PI developed partnerships with anesthesia providers and organizational stakeholders to help guide and support the organization who had never previously had a DNP project conducted.

# Chapter 8: Summary of Project

## Summary and Conclusions

Improper securement of the eyes and direct trauma results in corneal abrasions that contribute a significant burden to both patients and health care systems (Nagelhout & Elisha, 2018). The incidence of these adverse events increases significantly in robotic hysterectomies due to the combination of risk factors ranging from steep Trendelenburg position, length of procedure lasting longer than 90 minutes, and increased intraocular pressure in conjugation with the inhibition of normal physiologic responses during general anesthesia (Dixon et al., 2019; Fang, 2017; Sampat et al., 2015; Lamberg, 2017). The use of education and utilization of bio-occlusive ocular dressings in robotic hysterectomies has been found to reduce the incidence of corneal abrasions (Tourinho-Barbosa et al., 2018; Kan, Brown, & Gainsburg, 2015).

The purpose of this project was to educate anesthesia providers about current evidence-based practice recommendations and create a practice change in robotic hysterectomy procedures to reduce the incidence of corneal abrasions. This was achieved through the creation and dissemination of an evidence-based information educational PowerPoint presentation. The Iowa Model of Evidence-Based Practice framework was used to guide the dissemination and implementation of this project. This framework incorporated the use of research findings and a multidisciplinary systemic approach that helped enhance knowledge amongst anesthesia providers and change practice to improve patient care.

The findings of this project were consistent with current best practice recommendations aimed at reducing corneal abrasions in robotic hysterectomy procedures. Although anesthesia providers are aware that the incidence of corneal abrasion are highest amongst patients

undergoing robotic hysterectomies, most anesthesia providers secured the patients eyes closed with tape. Furthermore, there is inconsistent ocular securement methods amongst anesthesia providers during robotic hysterectomies.

The objectives of this project were met by a statistically significant increase in knowledge, as evident by improvement in post-test survey scores, and a practice change did occur by some anesthesia providers, as evident by documentation of tegaderm for ocular securement in post-implementation retrospective chart audits. The full impact of this project in the reduction of corneal abrasions amongst women undergoing robotic hysterectomies is unclear due to the short period of this project. Follow-up at 6-months and 1-year post-implementation will be necessary to assess the long-term reduction in corneal abrasions and clinical significance of this DNP project.

**Dissemination Plans**

This project was disseminated as a virtual poster (Appendix F) presentation on March 3rd, 2022, at the Philadelphia Advisory Group of Nurse Anesthesia Programs District 3 "CRNA/SRNA Virtual Professionalism lecture". Presenting at this lecture provided the opportunity to disseminate this project to both student and certified anesthesia providers across Pennsylvania. This project will also be disseminated on April 11th, 2022, at the Doctor of Nursing Practice Scholarly Project Presentations hosted by Cedar Crest College and at the Pennsylvania Association of Nurse Anesthetists Spring Symposium on April 28th, 2022.

**Future Ideas**

The findings of this project were consistent with current literature regarding corneal abrasion prevention in robotic hysterectomy procedures. However, it is unclear if the increased utilization

of bio-occlusive dressings contributed to a reduction in corneal abrasions or if an increased awareness/knowledge did, or both. For this reason, future recommendations include an increased length of data analysis over several months. In addition, increasing retrospective chart audit data collection period would help identify if the practice change was sustainable and statically contributed to a reduction in corneal abrasions. Furthermore, in hospitals that do not utilize bio-occlusive dressings in robotic hysterectomy procedures, future projects should aim to identify and address barriers implementing this method of ocular securement into current practice. These barriers include, but are not limited to, anesthesia provider willingness to change practice, availability, and access to bio-occlusive ocular dressings in each operating room, and method of documentation.

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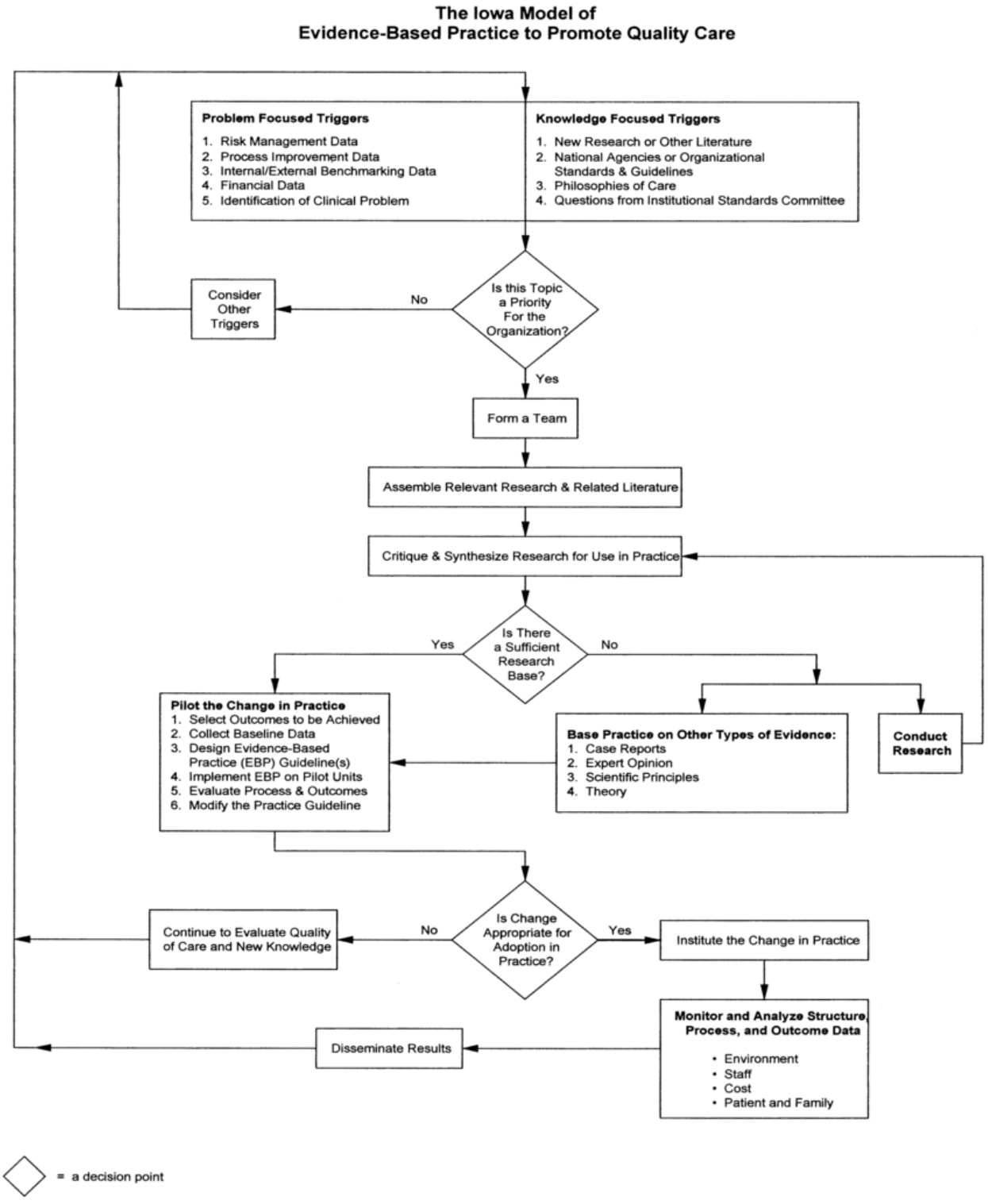
# Appendix A


The Iowa Model of
Evidence-Based Practice to Promote Quality Care
Problem Focused Triggers
1. Risk Management Data
2. Process Improvement Data
3. Internal/External Benchmarking Data
4. Financial Data
5. Identification of Clinical Problem
Knowledge Focused Triggers
1. New Research or Other Literature
2. National Agencies or Organizational Standards & Guidelines
3. Philosophies of Care
4. Questions from Institutional Standards Committee
Is this Topic a Priority For the Organization?
No
Consider Other Triggers
Yes
Form a Team
Assemble Relevant Research & Related Literature
Critique & Synthesize Research for Use in Practice
Is There a Sufficient Research Base?
Yes
No
Pilot the Change in Practice
1. Select Outcomes to be Achieved
2. Collect Baseline Data
3. Design Evidence-Based Practice (EBP) Guideline(s)
4. Implement EBP on Pilot Units
5. Evaluate Process & Outcomes
6. Modify the Practice Guideline
Base Practice on Other Types of Evidence:
1. Case Reports
2. Expert Opinion
3. Scientific Principles
4. Theory
Conduct Research
Is Change Appropriate for Adoption in Practice?
No
Yes
Continue to Evaluate Quality of Care and New Knowledge
Institute the Change in Practice
Monitor and Analyze Structure, Process, and Outcome Data
• Environment
• Staff
• Cost
• Patient and Family
Disseminate Results
= a decision point

## Appendix B

INSTITUTIONAL REVIEW BOARD

July 22, 2021

Miranda Connolly, RN, BSN, CCRN-CMC, SRNA
Nurse Anesthesia Program
Cedar Crest College
100 College Drive
Allentown, PA 18104

Re: Implementation of Education and Bio-Occlusive Ocular Dressings in Robotic Hysterectomy Procedures for Corneal Abrasion Prevention: A Quality Improvement Project
**Protocol Number:** 2021-58

Dear Ms. Connolly:

On July 21, 2021, a designee representing the Chair of the Institutional Review Board (IRB) of the [redacted] conducted an expedited review of the above-mentioned project. The designee determined the project does not constitute human subjects' research. Although the project is systematic in its design, it is not intended to provide generalizable knowledge. It does not meet criteria for research, as it is a quality/process improvement project. Therefore, 45 CFR part 46 does not apply. This project is not subject to further IRB review unless you modify the project.

Sincerely,

[redacted]
Chair, Institutional Review Board

DWB:tp

CC: Rachel Lengle, DNP, CRNA
Anesthesia Services, LGH

Institutional Review Board
555 North Duke Street | P.O. Box 3555 | Lancaster, PA 17604-3555 | Office: 717-544-5091 | Fax: 717-544-1781
Antoinette.Phelan@pennmedicine.upenn.edu

# Appendix C

CEDAR CREST COLLEGE

**Request for Institutional Review Board**
**Approval for Research Involving Human Subjects**

**IRB Request Number**

362 2021

**Date Submitted:**

08/29/2021

**Lead Researcher:**

Miranda Connolly

**Lead Researcher Email**

mcooper@cedarcrest.edu

**Confirm Lead Researcher Email**

mcooper@cedarcrest.edu

IRB Workflow Event and Note Logging

IRB Request Form Emailed to mcooper@cedarcrest.edu - 8/29/2021 Advisor Arrival Email Sent - - 8/30/2021 Advisor Approval Email Sent - 9/2/2021 Approval Email Sent - 9/3/2021 - EXTENDED REVIEW APPROVAL NOTES - 9/13/2021 - Trendelenburg Approved Email Sent - 9/13/2021

**Title of Research:**

Implementation of Education and Bio-Occlusive Ocular Dressings in Robotic Hysterectomy Proce

For the following field enter the first few characters of the last name and select the name from the drop down that appears.

**Project Advisor/Supervisor:**

Karen Bensinger

**# of Additional Researchers**

0

**1st Additional On-Campus Researcher(s):**

**2nd Additional On-Campus Researcher(s):**

**3rd Additional On-Campus Researcher(s):**

**4th Additional On-Campus Researcher(s):**

## Appendix D

*Pre-Test Questions*

1. What is the average payment for a corneal abrasion?
    a. $1,000
    b. $3,000
    c. $5,000
    d. $7,000
2. At [redacted] which surgical procedure yields the highest incidence of corneal abrasions?
    a. Anterior Cervical Fusion
    b. Thyroidectomy
    c. Carotid Endarterectomy
    d. Robotic hysterectomy
3. The cornea has three modes of protection which include all the following EXCEPT:
    a. Mechanical protection
    b. Transport protection
    c. Light protection
    d. Thermal protection
4. All the following are signs or symptoms of a corneal abrasion EXCEPT:
    a. Pain
    b. Decreased sensitivity to light
    c. Headache
    d. Redness

5. Which of the following is a risk factor for a corneal abrasion?
    a. Surgical procedures <90 minutes
    b. Reverse Trendelenburg position
    c. Limiting IV fluids to <2 liters
    d. High flow rates of supplemental oxygen in PACU
6. True or False. The risk of corneal abrasions is higher in robotic hysterectomy procedures compared to laparoscopic hysterectomies.
    a. True
    b. False
7. What is the only antiseptic skin preparation that can be applied to eye?
    a. Benzoin
    b. Chlorhexidine gluconate
    c. Preservative-free povidone iodine 10% aqueous solution
    d. Iodophor solution
8. How quickly can the cornea lose its epithelial integrity during hypoxic conditions?
    a. 1 minute
    b. 5 minutes
    c. 15 minutes
    d. 30 minutes
9. True or False. General anesthesia has no effect on the Bell's phenomenon.
    a. True
    b. False

10. How fast can eye erosion occur during general anesthesia?
    a. 30 minutes
    b. 60 minutes
    c. 100 minutes
    d. 120 minutes
11. Complications associated with corneal abrasions include all the following EXCEPT:
    a. Corneal ulcer
    b. Bacterial keratitis
    c. Glaucoma
    d. Permanent loss of vision
12. According to current literature, which technique of ocular closure effectively reduced the incidence of corneal abrasions in robotic hysterectomy procedures?
    a. Bio-occlusive dressings (Tegaderm)
    b. Adhesive tape
    c. Goggles
    d. Adhesive tape and lubrication
13. When should the eyes be secured closed?
    a. Pre-induction
    b. Post-intubation
    c. Post-induction
    d. Post-face mask ventilation
14. Which finger should the pulse oximeter be applied?
    a. Index

b. Middle

c. Ring finger

15. True or False. Current recommendations favor the use of multiple-dose lubricants.

    a. True

    b. False

16. Which lubricant carries the risk of edema, blurred vision, and is flammable?

    a. Paraffin-based

    b. Methylcellulose-based

17. True or False. Implementing a single evidence drive method for securing the eyes closed during robotic hysterectomy procedures can effectively reduce the incidence of corneal abrasions.

    a. True

    b. False

## Appendix E

*Post-Test Questions*

1. What is the average payment for a corneal abrasion?
    a. $1,000
    b. $3,000
    c. $5,000
    d. $7,000
2. At [redacted] which surgical procedure yields the highest incidence of corneal abrasions?
    a. Anterior Cervical Fusion
    b. Thyroidectomy
    c. Carotid Endarterectomy
    d. Robotic hysterectomy
3. The cornea has three modes of protection which include all the following EXCEPT:
    a. Mechanical protection
    b. Transport protection
    c. Light protection
    d. Thermal protection
4. All the following are signs or symptoms of a corneal abrasion EXCEPT:
    a. Pain
    b. Decreased sensitivity to light
    c. Headache
    d. Redness

5. Which of the following is a risk factor for a corneal abrasion?
    a. Surgical procedures <90 minutes
    b. Reverse Trendelenburg position
    c. Limiting IV fluids to <2 liters
    d. High flow rates of supplemental oxygen in PACU
6. True or False. The risk of corneal abrasions is higher in robotic hysterectomy procedures compared to laparoscopic hysterectomies.
    a. True
    b. False
7. What is the only antiseptic skin preparation that can be applied to eye?
    a. Benzoin
    b. Chlorhexidine gluconate
    c. Preservative-free povidone iodine 10% aqueous solution
    d. Iodophor solution
8. How quickly can the cornea lose its epithelial integrity during hypoxic conditions?
    a. 1 minute
    b. 5 minutes
    c. 15 minutes
    d. 30 minutes
9. True or False. General anesthesia has no effect on the Bell's phenomenon.
    a. True
    b. False

10. How fast can eye erosion occur during general anesthesia?
    a. 30 minutes
    b. 60 minutes
    c. 100 minutes
    d. 120 minutes
11. Complications associated with corneal abrasions include all the following EXCEPT:
    a. Corneal ulcer
    b. Bacterial keratitis
    c. Glaucoma
    d. Permanent loss of vision
12. According to current literature, which technique of ocular closure effectively reduced the incidence of corneal abrasions in robotic hysterectomy procedures?
    a. Bio-occlusive dressings (Tegaderm)
    b. Adhesive tape
    c. Goggles
    d. Adhesive tape and lubrication
13. When should the eyes be secured closed?
    a. Pre-induction
    b. Post-intubation
    c. Post-induction
    d. Post-face mask ventilation
14. Which finger should the pulse oximeter be applied?
    a. Index

b. Middle

c. Ring finger

15. True or False. Current recommendations favor the use of multiple-dose lubricants.

    a. True

    b. False

16. Which lubricant carries the risk of edema, blurred vision, and is flammable?

    a. Paraffin-based

    b. Methylcellulose-based

17. True or False. Implementing a single evidence drive method for securing the eyes closed during robotic hysterectomy procedures can effectively reduce the incidence of corneal abrasions.

    a. True

    b. False

18. After this educational module will you change your practice?

    a. Yes

    b. No

19. If you do not plan to change your practice, what is the reason?

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20. How beneficial was this educational module?

    a. Very beneficial

    b. Somewhat beneficial

    c. Not beneficial

## Appendix F

# Implementation of Education and Bio-Occlusive Ocular Dressings in Robotic Hysterectomy Procedures for Corneal Abrasion Prevention

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### Background

- Corneal abrasions (CAs) have been found to be the most common injury occurring after general anesthesia (Nagelhout & Elisha, 2018; Anesthesia Quality Institute, 2017).
- Corneal abrasions are an adverse patient safety event that contributes to patient discomfort and pain, prolonged length of stay, increased cost of care, and increased risk of long-term visual disturbances (Dixon et al., 2019).
- The risk of CAs increases based on several factors including type of surgery (operations on the head and neck; robotic surgeries), patient position (lateral, prone, steep Trendelenburg), age, race, length of surgical procedure (>90minutes), amount of fluids administered (>2 liters), supplemental oxygen en route to or in the post-anesthesia care unit and inconsistent methods of taping the eyes (Dixon et al., 2019; Fang, 2017; Sampat et al., 2015; Lamberg, 2017).
- Of concern, the risk of CAs during laparoscopic hysterectomies increases nearly 4-fold, and this risk increases to 6.5-fold during robotic hysterectomies (Sampat et al., 2015).
- Research has demonstrated that there are superior protection methods of securing the eyes closed and preventing CAs amongst patients undergoing robotic surgeries with bio-occlusive dressings rather than eye tape alone. (Tourinho-Barbosa et al., 2018; Kan, Brown, & Gainsburg, 2015).
- EBP recommendations include taping the eyelids after induction, utilization of bio-occlusive dressings (tegaderm) for ocular securement during robotic hysterectomy procedures and developing educational initiatives to increase anesthesia providers knowledge on CA risk factors (Tourinho-Barbosa et al., 2018; Kan, Brown, & Gainsburg, 2015; Grixti et al., 2013).

### PICO

Amongst anesthesia providers, does the implementation of education and utilization of bio-occlusive dressings in robotic hysterectomy procedures demonstrate a change from a variety of eye protection methods to a single evidence-driven method?

### Objectives

1. To improve anesthesia providers knowledge on corneal abrasion prevention through a PowerPoint educational intervention
2. Create a practice change from a variety of eye lid taping methods to a single evidence driven method based on EBP recommendations
3. Reduce the incidence of corneal abrasions amongst patients undergoing robotic hysterectomies

### Methodology

- Needs assessment and collaboration conducted with institutional anesthesia stakeholders, coordinators, and department leaders
- Literature search conducted through: CINAHL, PubMED, EBSCOhost, and Google Scholar
- Search terms used: corneal abrasion, robotic surgery, and corneal abrasion prevention
- Advanced search settings: linked full text, published date 2015 to 2021, peer reviewed, and English language.
- Search yielded 5,392 articles
- 10 research articles selected based on their relevancy to answering the PICO question
- Examined current ocular securement methods by anesthesia providers via retrospective chart audits
- The Iowa Model of EBP, a dissemination and implementation model, was selected to guide this project
- Educational module: corneal abrasion prevention PowerPoint with emphasis on current best practices
- Pre-test/post-test survey design to compare providers knowledge
  - Pre-test 17-item: 17 knowledge-based questions
  - Post-test 20-item: 17 knowledge-based, 1 willingness to change practice, 1 open-ended, and 1 benefit of education question
- Implemented over 1-month from October 3rd, 2021, to November 3rd, 2021, to permit adequate time to complete module and surveys
- A convenience sample of 60 anesthesia providers were invited via email to participate

### Results


- There was an overall response rate of 33% (n=20) who volunteered to participate. The final response rate for the pre-test was 90% (n=18) and the final response rate for the post-test was 94% (n=17)
- A 95% confidence level ($\alpha$= 0.05) was selected to evaluate the significance of the results
- The pre-test mean was 72.67% (n=18) and the post-test mean was 89.76% (n=17). The p value of the unpaired t-test was <0.0001 indicating that there was a statistically significant difference between the pre-test and post-test results
- The Chi-square test of independence was performed for the pre- and post- implementation retrospective chart audit data
- The Chi-square results were $\chi 2 = 3.06$ (p-value = 0.08) indicating that the implemented intervention did not affect tegaderm use result and is not statistically significant at a 95% confidence level
- **Clinical Significance:** Compared to the previous 13 corneal abrasions that occurred in robotic hysterectomies from the calendar years 2019 and 2020, there has been a 92% reduction in CAs and compared to the cumulative 17 corneal abrasions that occurred from the calendar years 2019 and 2020, there has been a 76% reduction in CAs overall

### Recommendations for Practice

- Based on the statistically significant results of this project, recommendations for practice include implementation of EBP education to improve anesthesia provider knowledge and willingness to change practice for corneal abrasion prevention.
- Current literature supports the utilization of bio-occlusive dressings to prevent corneal abrasions in robotic hysterectomy procedures. It is unclear if the increased utilization of tegaderms contributed to a reduction in corneal abrasions or if an increased awareness/knowledge did, or both. For this reason, additional research is recommended.

### Conclusion

- A 17% increase in average test scores after reviewing the educational module infers that participants knowledge increased related to corneal abrasion prevention
- When anesthesia providers are provided with evidence-based recommendations, providers are willing to change practice
- Increased knowledge based on the educational module and utilization of bio-occlusive dressings can lead to a reduction in corneal abrasions as evident by no CAs since project implementation
- Limitations include small sample size, lack of generalizability, research design, and validity of data collection tool

### References