

IMPROVING SMALL BOWEL VISUALIZATION DURING VIDEO CAPSULE  
ENDOSCOPY(VCE) QUALITY IMPROVEMENT INITIATIVE

by

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of

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in

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## ABSTRACT

**Background:** This practice improvement project addresses the clinical challenge of suboptimal small bowel visualization during Video Capsule Endoscopy (VCE) procedures, focusing on its local manifestation at a gastroenterology clinic in urban Indiana and proposing interventions (Deding et al., 2023a). Previous studies support the use of polyethylene glycol (PEG) solutions and staff education to improve small bowel visualization, highlighting the importance of standardized protocols and continuous training (Klein et al., 2016; Deding et al., 2022a). **Problem:** The clinical problem stems from inconsistent bowel preparations and prolonged capsule excretion times, potentially leading to delayed diagnoses and compromised patient care (Deding et al., 2023a). Through a comprehensive literature review and the application of the Johns Hopkins Model as a conceptual framework (Moen et al., 2022a; Bjoersum-Meyer et al., 2021). The aim was to enhance small bowel visualization during VCE procedures by implementing evidence-based strategies. **Methods:** Methods involved assessing the context, implementing interventions, measuring outcomes, and analyzing data. Results indicated improvements in bowel preparation quality and capsule excretion times following intervention implementation (Deding et al., 2023a). **Results:** Key findings suggest that standardized protocols and continuous staff education are essential for achieving optimal small bowel visualization during VCE procedures (Bjoersum-Meyer et al., 2021). **Conclusions:** The Johns Hopkins Model guided the development, implementation, and evaluation of interventions, emphasizing systematic quality improvement processes (Moen et al., 2022a). The project's goal was to improve the quality of small bowel visualization through staff education, protocol adjustments, and process standardization at the gastroenterology clinic in urban Indiana.

## CHAPTER ONE

## REVIEW OF THE LITERATURE

IntroductionBackground

Video Capsule Endoscopy (VCE) has revolutionized gastrointestinal diagnosis by providing a non-invasive means to visualize the small intestine. VCE is used to assess the small bowel in the setting of suspected gastrointestinal bleeding or for the assessment of inflammatory bowel disease. It can also be used in the esophagus and stomach, as well as the colon. VCE procedures can identify bleeding areas in the small intestine called arteriovenous malformations (AVM). These are areas in the intestinal lining that are dilated and prone to erosion which leads to bleeding and can lead to iron deficiency anemia (IDA) (Tamilarsan et al., 2022). When used for IBD assessment, a VCE procedure can identify areas of stricture and inflammation. In the setting of a suspected gastrointestinal bleed, a VCE is generally performed after an esophagogastroduodenoscopy (EGD) and a colonoscopy have been performed and did not yield a cause for Intestinal bleeding. In the setting of Inflammatory bowel disease (IBD), this procedure is an alternative for surveillance purposes as opposed to traditional EGD or colonoscopy procedures.

The purpose of this article is to examine the need for adjustments in the VCE triage process, capsule administration, and patient adherence to instructions in the outpatient setting. The quality of VCE outcomes is profoundly influenced by the adequacy of patient's bowel preparation. Because current VCE bowel preparation practices vary, there is an evident need for



improvement in both the quality of preparation and adherence to best practice standards. The implementation of a novel protocol in accordance with established best practice guidelines holds the potential to yield substantial cost savings for both patients and healthcare facilities. This is accomplished primarily by mitigating the risks associated with inadequate visualization of the small bowel and capsule retention. If the capsule fails to be excreted, it poses significant health risks to the patient. Consequently, a comprehensive screening process during triage by healthcare providers is warranted. The objective of this systematic literature review is to furnish compelling evidence that will bolster the adoption of new protocols and justify their cost-effectiveness. It is worth noting that each VCE procedure is subject to billing through the patient's insurance provider. In instances where suboptimal preparation necessitates the ingestion of two capsules, the associated cost of the procedure is incurred twice, or worse, is denied during the prior authorization phase; such denials can have profound repercussions, potentially rendering the procedure financially inaccessible for the patient. This, in turn, may escalate a seemingly minor medical concern into a more critical issue. In addition to exacerbating healthcare costs, this situation places the patient's health and safety in jeopardy. Extensive evidence has established Video Capsule Endoscopy (VCE) as a secure and efficacious method for visualizing the small bowel, as exemplified by the findings of Freitas et al. There is a 1-2% risk of capsule retention in the general population, a figure that is mirrored in the context of patients with Crohn's disease (Freitas et al., 2023). Moreover, it is imperative to recognize that the ingestion of the capsule itself typically entails minimal side effects. Any adverse reactions are commonly attributable to the bowel preparations and prokinetic medications administered prior to preparation which are aimed at optimizing gastric motility (Freitas et al., 2023).

## Objectives

The goal of this systematic review is to contribute to the development of evidence-based guidelines and interventions aimed at optimizing VCE bowel preparation. By doing so, it helps improve small bowel visualization and the diagnostic utility of this cost-effective and minimally invasive medical technology.

## Methods

Overview This literature review indicates that the collection of data such as the quality of bowel preparations and capsule excretion times is essential for identifying areas of potential improvements during the process of administration of VCEs. This systematic review investigates the causes of the ineffectiveness of VCE preparations. The subsequent result is reduced small bowel mucosal visualization.

Search Strategy The literature review included searches on EBSCOhost, PubMed, and ProQuest between August and September 2023. The articles considered in this review spanned the period from 2019 to 2023. The eligibility criteria involved a focus on bowel preparation for VCEs, interventions to enhance mucosal visualization (including AI technology), adult populations, and VCE utilization for IBD.

Inclusion Criteria Inclusion criteria included: (1) VCE that discusses preparation, (2) described effectiveness of interventions to improve quality of visualization including AI technology, (3) adult population, (4) VCE for IBD. Exclusion criteria included: (1) articles that did not discuss bowel preparation or process improvement, (2) pediatric focus, (3) were not reviews or studies. See figure 1.



## PRISMA 2009 Flow Diagram

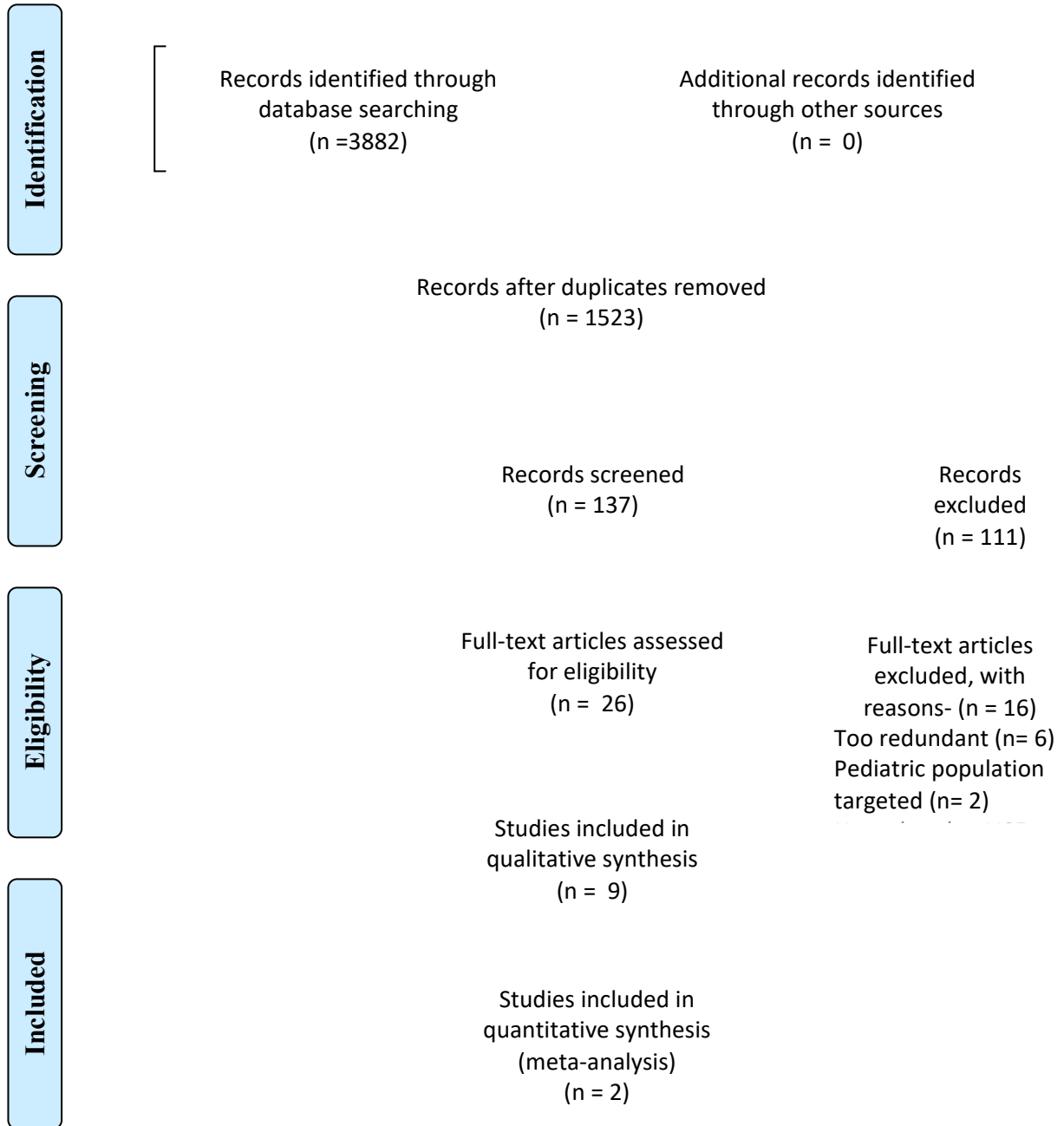


Figure 1: Prisma Flow Diagram

## Results

### Discussion

These studies collectively contribute to the understanding of various aspects related to VCE procedure and preparation, including patient experience, preparation regimens, the role of artificial intelligence, and the potential expansion of VCE applications in clinical practice. These findings can inform strategies to enhance the quality and effectiveness of VCE procedures and improve patient outcomes. They show there is a clear need to enhance best practice protocols to promote practice standardization and foster more positive outcomes for patients and stakeholders.

Polyethylene glycol (PEG) solutions are the most common, safest, and most effective bowel preparation materials (Klein et al., 2016). Klein et al. (2016) found that the use of PEG solutions garnered a collective 96% completion rate compared to 83% completion rate with other bowel preparations. Recognizing there are notable barriers to adherence to bowel preparation protocols such as socioeconomic differences in patients and expected discomfort during colonoscopy and colon capsule endoscopy (CCE) it is important to understand these disparities, with 62.7% of patients reporting varied discomfort levels (Deding et al., 2022a), is pivotal for tailoring preparation strategies. The goal for this initiative is to foster adherence to VCE protocols, thereby improving the overall VCE outcomes. Findings indicate 92% improvement in bowel preparation effectiveness compared to traditional methods (Deding et al., 2023a), contributing to the identification of effective preparation regimens. Some providers choose to add prokinetics to bowel preparations (Deding et al., 2022b) the effects of prucalopride on completion and polyp detection rates in colon capsule endoscopies demonstrate 74.9% increase

in completion rates and 55.7% polyp detection rate, providing evidence-based strategies to improve VCE procedure outcomes, but with this success, also comes unwanted side effects. One of the biggest areas to consider in VCE administration is prolonged gastric transit time. 20-30% of cases experience extended transit time (Freitas et al., 2023a), contributing to the understanding of factors influencing procedure outcomes. These insights are crucial for improving VCE preparation and patient experiences, with 12% of patients showing enhanced outcomes with adjusted protocols (Freitas et al., 2023a).

New VCE systems have integrated AI into their camera operations (Ju et al., 2022a) AI-based quantification demonstrates 94% accuracy in identifying clean mucosa in capsule endoscopy. This technological advancement aligns with a broader theme of integrating innovative approaches, enhancing VCE interpretation with increased precision and efficiency that is beneficial to the field of gastroenterology. There is a statistically significant improvement of 13.1% in accuracy over physician readers and 11.3 % reduction in interpretation time (Moen et al., 2022a). Bjoersum-Meyer et al. (2021) contributes significant insights into the efficacy of various bowel preparation regimens for colon capsule endoscopy. There is a 95% completion rate without the addition of prokinetics and 96% completion rate using prokinetic agents, and a 1% increase in bowel transit time with the addition of prokinetic agents in overall bowel preparation effectiveness (Bjoersum-Meyer et al., 2021), these findings further inform the collective goal of optimizing VCE visualization and outcomes.

## CHAPTER TWO

## QUALITY IMPROVEMENT PROPOSAL

Introduction and ProblemIntroduction

Video Capsule Endoscopy (VCE) represents an improvement in technological advancement in the field of gastrointestinal diagnostics. A patient swallows a camera that is enveloped in a capsule about the size of a large vitamin giving gastroenterologists a view of the anatomy that is unmatched by other diagnostic imaging capabilities. This non-invasive tool is equipped with a wireless camera that captures images and records video as it passes through the digestive tract (Read et al., 2022). Images are then extracted from the raw video footage for analysis and uploaded to the cloud to be safely shared with providers on a multidisciplinary level. This is an area that was traditionally challenging to assess using conventional endoscopic methods (Tamilarasan et al., 2022). In recent years, the science of VCE has made significant progress with the optimal visualization of the small bowel and increasingly higher quality images. This technology has been an aid in improving patient outcomes related to diagnosis of acute and chronic anemia, occult GI bleeding, and malignancy, enhancing the potential for alternative utilization of the technology (Read et al., 2022).

Studies have shown that early diagnosis can be facilitated by VCE. The key to this success is optimal visualization of the small bowel which is achieved through complete bowel preparation. Complete bowel preparation leaves the bowel clean, smooth, and without visual obstruction. The success of optimal visualization leads to reduced hospital stays by finding and

initiating treatment of abnormalities that are generally unseen and eliminating the need for referral to tertiary facilities that may use more costly diagnostic studies to reach a diagnosis (Read et al., 2022). VCE lowers healthcare costs by implementing minimally invasive procedures early that can be performed by clinical nursing staff and read by a specially trained physician.

Global financial figures show a substantial increase in use of VCE from about 200 million procedures in 2014 to 400 million procedures in 2020. VCE represents about 10% of endoscopies globally (Nowak, 2017). International and national data highlighted global trends in gastrointestinal diagnostics, emphasizing the significance of optimal small bowel visualization for accurate diagnoses (Nowak, 2017). International data differs between countries as they all have different organizations who guide process development and best practice guidelines, but there is a high success rate up to 98% of VCE completion with optimal small bowel visualization (Hong et al., 2021) Even though there are limitations globally, there is still benefit in using VCE due to its minimally invasive nature and cost-effectiveness (Nowak, 2017). Nationally, use of VCE varies widely between states. There was rapid growth in use of VCE in the United States between 2003 and 2008 but use levelled off between 2008 and 2019 (Read et al., 2022). State-level data includes more regional information including Indiana's neighboring mid-western states indicating a 90.6 % completion rate indicating optimal visualization of the small bowel (Ahmed, 2022). As VCE becomes the preferred endoscopic procedure, a GI clinic in Indiana has seen a 200% increase in utilization. This rapid increase necessitates a re-evaluation of organizational processes to ensure compliance with best practice standards in process improvement and need for more rigorous adherence to bowel preparations.

### Problem Statement

The problem is suboptimal small bowel visualization in VCE. Current guidelines for VCE preparation vary like colonoscopy preparations. Deciding on what bowel preparation to use comes down to provider preference on what evidence-based preparation they will use. Some gastroenterologist favor prokinetics that increase gastric motility like Reglan and erythromycin, while others prefer only polyethylene glycol (PEG) solutions. Song et al. (2016) shows statistical significance in improved small bowel visualization using PEG solutions. Finding the best combination and timing of PEG administration and identifying educational barriers will be beneficial in the success of this project.

Inadequate small bowel visualization during VCE procedures poses a significant challenge in screening and diagnosis at a gastroenterology clinic in urban Indiana. This issue can lead to delayed diagnoses, unpleasant patient experiences, and inconsistent outcomes. The lack of standardized protocols in the procedure triage process and volume of bowel preparation results in workflow inefficiencies, increased capsule excretion times, and compromised patient care. Addressing this problem is imperative to enhance the quality and effectiveness of gastroenterological services, ensuring accurate diagnoses with optimal small bowel visualization, adequate capsule excretion time frames, streamlined workflows, and positive patient and staff experiences.

### Organizational Microsystem Assessment

The project will take place in a gastroenterology specialty clinic in a healthcare facility in an urban area of Indianapolis, Indiana, serving a diverse patient population including underserved populations. These populations served are diverse economically, racially, and



socially providing data with good generalizability. The clinic is part of a large network that favors a multidisciplinary approach to patient care helping to streamline communication and maintain continuity of care. Stakeholders include gastroenterologists, nurses, technicians, administrative staff, and patients. Gastroenterologists and nurses are primary members of the interdisciplinary team, overseeing patient care. 3 nurses are trained in VCE administration. Other nursing staff manage scheduling, preliminary assessment, insurance verification, and patient interactions prior to VCE administration. Patients are a vital part of the team who provide essential feedback on their experiences and outcomes.

In conducting a comprehensive needs assessment for this project, international, national, and state-level data were compared to site-specific data obtained from the microsystem assessment, literature reviews, and interactions with stakeholders. The focus was on assessing the existing limitations of small bowel visualization through images captured during VCE. It was found that 40% of VCE studies completed at the gastroenterology clinic between December 2022 and June 2023 resulted in suboptimal preparations compared to the 98% global success rate with optimal small bowel visualization (Deding et al., 2022). A complete VCE is characterized by optimal visualization of the small bowel without food debris or gas bubbles obstructing the view of small bowel mucosa. These studies used a sample bowel preparation provided by the VCE supply company. PEG preparations have been shown to have the best overall success rate of VCE preparations (Song et al., 2016), but the specific preparation initially used, calls for reduced amounts of PEG from other evidence-based studies. The sample bowel preparation recommends the use of a PEG mixture in limited quantities or 119 GM PEG prior to capsule ingestion and 17 GM PEG following ingestion of capsule. This produced an average evacuation time of 4 days.

The goal for capsule excretion is 3 hrs to 72 hours (Capsovision, 2022). Average excretion rates were determined to be too extensive to meet industry standards and 40% of these studies had suboptimal visualization.

The need for more appropriate use of patency capsule prior to VCE was also recognized as a potential barrier to VCE completion. Patency capsule is used to assure VCE will pass through small intines safely and in the appropriate time frame to attain optimal visualization of the small bowel. The use of patency capsules has been shown to decrease VCE retention rate by 5.04% (Wang et al., 2020), thus improving patient safety and decrease the need for surgical removal of VCE. Although it is an important aspect of the VCE process, it will not be a part of data collected.

A gastroenterology clinic In urban Indiana has increased utilization from two VCE procedures weekly in December of 2022 to a capacity of six VCEs weekly over the last ten months. Analysis of internal records showed areas needing improvement, such as the need for a decrease in capsule excretion times, delays in post-procedural analysis due to sub-optimal preparations with the need to repeat studies resulting in delays and inconsistencies in overall outcomes, increased healthcare costs, and limiting diagnostic capabilities. Physician VCE reports were reviewed for documentation indicating complete VCE small bowel visualization.

The microsystem assessment Involved discussions with healthcare professionals, administrators, and staff within the organization. This qualitative approach revealed site-specific challenges related to VCE procedures, including inconsistent workflows, inadequate patient screening and triage, delayed VCE excretion times, and occasional staff and patient dissatisfaction. Workflows were interrupted when it is discovered during VCE procedure

appointments that screening and triage was not completed correctly. This interruption caused patients to be rescheduled and needed to rearrange their schedules to accommodate the error of the nursing staff who initially triaged patient. There was an apparent need for staff education. Staff education will also add clarity to the need for patient compliance relating to procedural instructions.

The synthesis of data with site-specific findings highlighted the pressing need for improving the entire VCE process within the organization. Discrepancies between global best practices that showed 98% rate of complete visualization of small bowel compared to a site-specific rate of 40 %. These site-specific findings illuminated the necessity for targeted interventions like identifying areas patients and nursing staff need additional education, need for adjusting preparations to provide optimal visualization of the small bowel, and the need to improve capsule excretion times. The microsystem assessment emphasized the urgency for streamlined processes and standardized protocols, aligning with the project's focus: enhancing VCE procedure protocols for optimal small bowel visualization. Available data such as increased number of KUBs ordered due to slow capsule excretion times and nursing triage inconsistencies supplemented internal findings, providing an understanding of the existing issues, and need for a quality initiative guiding the way for the proposed improvements outlined in this quality improvement project.

#### Quality Improvement Model/Framework

The Johns Hopkins Model provides a systematic approach to Quality Improvement (QI), guiding the development, implementation, and evaluation of practice changes. The planned

change focuses on standardizing VCE screening and procedures for optimal small bowel visualization. This aligns with this model's principles. Steps to this process are as follows:

1. Development (Johns Hopkins Step 1): The Johns Hopkins Model emphasizes the importance of developing a clear and focused QI plan. By utilizing this framework and meticulously assessing the existing VCE screening and procedures. Gaps in consistency and efficiency were identified. The model guided a thorough analysis of processes that lead to a targeted and evidence-based intervention plan to update bowel preparations and provide staff education on the VCE screening and procedure (Dang et al., 2022).

2. Implementation (Johns Hopkins Step 2): Implementation in the Johns Hopkins Model focuses on executing the QI plan effectively. Chosen interventions, include streamlined workflows, staff training, and protocol standardization. By integrating evidence-based practices and staff expertise, the interventions will be smoothly integrated into the existing healthcare processes (Dang et al., 2022).

3. Evaluation (Johns Hopkins Step 3): Evaluation is a cornerstone of the Johns Hopkins Model, emphasizing continuous learning and assessment of outcomes. This project will include a mix of quantitative and qualitative measures, including staff interviews. Regular evaluations will allow the evaluation of effectiveness of interventions, assuring the desired outcomes are achieved (Dang et al., 2022).

4. Sustainability (Johns Hopkins Step 4): Sustainability is a key focus in the Johns Hopkins Model. The interventions are designed not as temporary fixes but as ingrained improvements in VCE procedures that will be implemented in updated protocols if successful. By integrating staff

training, standardized protocols, and continuous monitoring into routine practices, the sustainability of the improved processes will be positive (Dang et al., 2022).

5. Patient Safety and Quality (Johns Hopkins Step 5): Patient safety and quality improvement are central to both planned changes and the Johns Hopkins Model. Interventions directly enhance patient safety by ensuring accurate screening and diagnoses through optimal small bowel visualization. By adhering to the model, efforts are grounded in the principles of patient safety, quality care, and best practices (Dang et al., 2022).

The Johns Hopkins Model, with its systematic approach to QI, provides the framework necessary for the development, implementation, and evaluation of the practice change initiative. These approaches are systematic, evidence-based, contextually appropriate, and sustainable. This approach enhances the likelihood of achieving the intended aims of improving small bowel visualization, patient satisfaction, and overall healthcare outcomes. By following this model's structured steps, the interventions will be effectively integrated, continually evaluated, and implemented.

#### Specific Aims/Purpose Statement

This project represents a significant initiative in healthcare improvement, specifically focusing on optimizing VCE small bowel visualization. The purpose of this quality improvement (QI) initiative is to improve the quality of small bowel visualization during VCE procedures with clinical staff education, improved capsule excretion times, and improved bowel preparations to achieve optimal visualization of the examined area.

The outcomes presented will emphasize the importance of the changes as they benefit all individuals who have an indication for VCE (Silva et al., 2022).

The addition of process standardization will help healthcare providers ensure patients receive an accurate diagnosis due to optimal small bowel visualization, leading to improved patient satisfaction and more positive outcomes (Silva et al., 2022).

Improvement of in the quality of VCE studies will be accomplished by measuring the number of incomplete preparations vs. complete preparations resulting in optimal small bowel visualization. As discussed earlier, a complete bowel preparation is one with images free of food debris and gas bubbles that obstruct the view of small bowel mucosa.

## Methods

### Implementation Summary

To enhance small bowel visualization during VCE procedures, a comprehensive implementation plan has been devised. This plan aligns with AANP guidelines and focuses on three main objectives: 1.) Staff education that aligns with evidence-based best practices and 2.) adjusting bowel preparation protocols based on evidence-based guidelines. The overarching goals encompass standardized processes, reduced capsule excretion time, and improved small bowel visualization. Ongoing evaluation will be conducted monthly for short-term goals and quarterly for long-term goals. Run charts will be used for visual representation showing improved small bowel visualization over time.

Stringent data confidentiality measures, including access controls and encryption, along with de-identification of patient information, will be implemented. Leveraging existing resources, the plan encompasses staff training, revised bowel preparation protocols while

ensuring a sustainable and effective quality improvement initiative. Once IRB approves project the implementation process can be initiated.

### Intervention & Implementation

Identification of the need to improve small bowel visualization during VCEs was agreed upon by the two physicians who read raw VCE footage at a gastroenterology clinic in urban Indiana during a scheduled meeting. It is understood, based on evidence-based literature, that standardizing VCE procedures ensures consistent, high-quality examinations leading to accurate diagnoses, and improved patient outcomes (Bjoersum-Meyer et al., 2021).

The Implementation team will consist of a project coordinator (DNP student) who oversees the project and ensures adherence to timelines and acts as the primary resource for questions and interpretation of new educational information and updated bowel preparation guidelines.

### Implementation

The implementation of the project will take place at a gastroenterology clinic in urban Indiana over a 6-week period beginning January 17<sup>th</sup>, 2024, through February 28<sup>th</sup>, 2024. The project coordinator will also act as clinical trainer and will conduct staff training sessions that will further educate on VCE procedures and emphasize the need for patient adherence to bowel preparation instructions. Ongoing Evaluation of the VCE process will continue monthly for short-term goals, quarterly for mid-term goals by the project coordinator, and annually for long-term goals by staff after initial project conclusion. See Figure 2.

To achieve the desired outcome of improving small bowel visualization during VCE, the project coordinator (DNP student) will 1.) address educational needs by presenting a power point presentation during the monthly staff meeting in January. The date will be determined in the future. There will be 11 nurses and the clinic coordinator in attendance. The meeting will be held in a conference room at the gastroenterology clinic. The PowerPoint will address areas of needed education that were identified in the organizational microsystem assessment. Topics such as education on optimal bowel preparation and the importance of patient adherence to instructions will be covered. The project coordinator will also hold a Q & A following the meeting where nursing staff can address any concerns or questions they might have. See figure 3 for Power point slides. 2.) Bowel preparations will be increased based on evidence-based guidelines involving increased amounts of PEG solution. PEG solutions have the least amount of side effects and are considered the safest compared to adding prokinetics to bowel preparations (Bjoersum-Meyer et al., 2021). PEG solutions are also used in colonoscopy bowel preparations in various amounts. Currently, the bowel preparation process for VCE includes 119 GM PEG the day before procedure following a clear liquid diet for 6 hours with an addition of 17 GM PEG two hours after capsule ingestion. The new bowel prep will include 238 GM PEG solution the day before the procedure and an additional 119 GM PEG solution two hours following ingestion of capsule. The addition of increased amounts of PEG solution will promote GI motility and facilitate prompt capsule excretion within a 72-hour time frame along with improving small bowel visualization. (Silva et al., 2022a). Klein et al., (2016) found that adding four liters of PEG solution in split doses was most effective for bowel preparations including VCE. See Figure 4



for a detailed description of current VCE bowel preparation and see figure 5 for proposed VCE bowel preparation with changes.

The primary intervention focuses on the dissemination of structured training and educational programs among crucial clinical staff, notably triage nurses and nurses responsible for capsule ingestion. This aligns with evidence-based recommendations advocating continuous education for healthcare professionals engaged in endoscopic practices (Lauseng et al., 2019).

The secondary initiative is concentrated on the refinement of bowel preparation protocols to adhere to the latest evidence-based practices for VCE, with a deliberate emphasis on optimizing small bowel visualization (Bjoersum-Meyer et al., 2021). The overarching objectives encompass the enhancement of procedural efficiency, reduction in capsule excretion time, and augmentation of both staff and patient satisfaction with the VCE process, with a central focus on elevating the quality of small bowel visualization.

### Measures

Staff education will be measured by weekly check ins. The project coordinator will ask a series of questions weekly to determine effectiveness of education and identify areas of improvement. Questions will include: 1. Are you using the updated protocol? 2. What do you find challenging about implementing the new protocol? 3. Do patient's report barriers to updated protocol?

There are several validated grading tools used to determine level of bowel preparation effectiveness and clarity. The gastroenterology clinic where the initiative will take place uses The Qualitative Evaluation scale (QE). See figure 6. This scale uses excellent, good, fair, and poor to

measure bowel preparation clarity (Brotz et al., 2009). Scores of excellent and good will be used to measure effectiveness of increased bowel preparation.

Successful capsule excretion within the specified 72-hour time frame (Silva et al., 2022a) will be measured by verifying capsule excretion times for each scheduled VCE. Graphic representations will be developed in the form of run charts illustrating the effectiveness of protocol changes and the variation in the process over time, helping to identify trends and patterns, and creating a visual aid for future reference. The new protocol will be integrated into the current VCE process. See Appendix B.

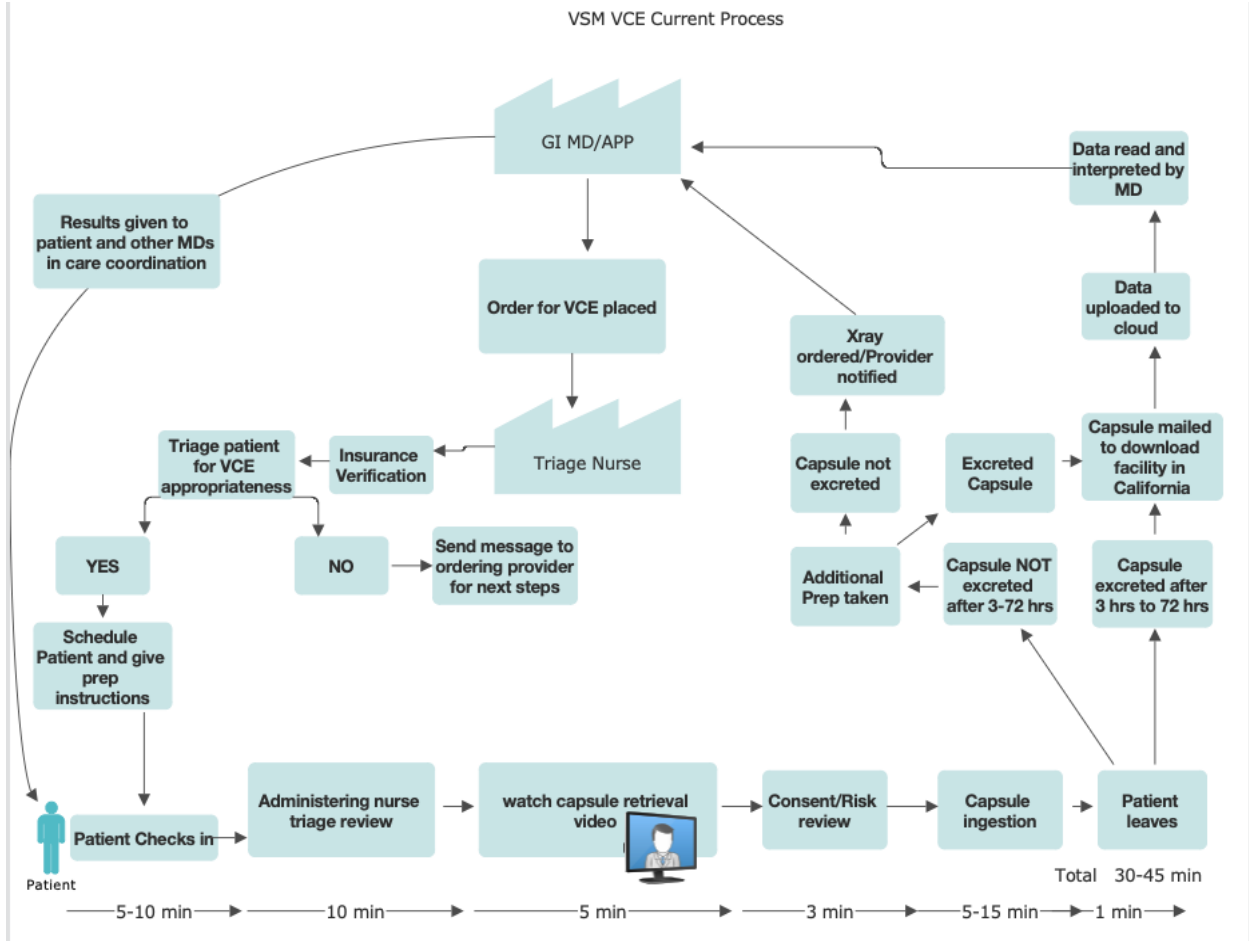


Figure 2: VSM Current VCE Process

This plan outlines the proposed quality improvement project, the rationale behind it, the implementation strategies, a detailed timeline, data confidentiality measures, evidence-based tools, strategies to address potential barriers, and documentation templates. See table 2. This plan will guide the implementation of this project in a systematic way that will promote its success.

The procedural approach involves the integration of updates on best practices and educational sessions into routine nursing staff meetings, where the project coordinator serves as the presenter. This structured method aligns with existing literature that underscores the efficacy

of recurrent training sessions and the dissemination of best practices in achieving superior procedural outcomes (Lauseng et al., 2019).

### Data Collection

Quantitative metrics include the percentage of complete bowel preparations, computed based on the aggregate number of concluded studies, providing a nuanced evaluation of the impact of the implemented training and protocol adjustments on achieving optimized small bowel visualization. Furthermore, enhancements in VCE excretion times are quantified through determining the percentage of VCE capsules excreted within the prescribed 72-hour timeframe.

Data will be collected weekly from nursing staff by project coordinator at the GI clinic.

### Potential Barriers

Anticipated barriers to the successful implementation of the outlined activities include potential resistance from staff members to embrace change. To address this challenge, a proactive approach will be taken by conducting regular communication meetings, where concerns will be openly discussed, and the benefits of the proposed changes will be emphasized. The project coordinator will be readily available to address any questions or uncertainties that may arise, fostering a supportive environment for the staff. Another identified barrier is potential resistance from patients in adhering to new protocols. To enhance patient compliance, the nursing staff will provide additional educational assistance when needed. Educational materials will be presented at a sixth grade reading level and in native language when available to assure comprehension and promote patient health literacy (Hutchinson et al., 2016). This personalized support aims to ensure a clear understanding of the new procedures and to assist patients in

achieving optimal preparation, thereby contributing to improved adherence to the prescribed protocols.

Project implementation Activities Table		
<p><b>Activity 1: Develop revised evidence informed protocol for small bowel preparation for VCE by increasing PEG amount in bowel preparation to align with evidence-based guidelines (Klein et al., 2016)</b></p> <p><b>Activity 2: Introduce updated bowel preparation protocol clinical staff (Triage nurses and nurses who guide ingestion of capsule).</b></p> <p><b>Activity 3: Implementation of Protocol</b></p> <p><b>Activity 4: Evaluate outcomes.</b></p>		
<p>Goals: Increase number of VCEs with optimal small bowel visualization</p> <ol style="list-style-type: none"> <li>1. Improve procedural efficacy.</li> <li>2. Improve capsule excretion time.</li> </ol>		
Specific Activities	Approach	Measures
<p>1. Bowel preparation will be updated to add 119 grams of PEG to current bowel preparation see Figure 4 and 5 for current and proposed bowel preparation. Klein et al. (2016) addresses the improvement in small bowel visualization with the addition of increased PEG solution.</p>	<p>Updates will be made to current bowel preparation in January.</p> <p>Updates will be presented by project coordinator.</p>	<p>-Amount of PEG solution given will be increased. Adherence to change will be measured using a smart phrase added to VCE documentation.</p>
<p>2. Staff education on importance of patient adherence to VCE bowel preparation</p>	<p>Project coordinator will host an educational session by presenting a power point presentation during a staff meeting in January yet to be determined.</p>	<p>Check in with nursing staff weekly to assure they do not have any questions.</p> <p>Project coordinator will ask nursing staff the following questions:</p> <ol style="list-style-type: none"> <li>1. Are you using the new protocol?</li> </ol>

<p>3.Implementation of protocol</p>	<p>Project coordinator will hold a Q &amp; A and answer any questions nursing staff have about new protocol.</p> <p>Nursing staff will consider patient primary language when reviewing instructions and provide instructions in the patient’s native language when available (Hutchinson et al., 2016).</p> <p>New protocol will begin 1 week after educational session and new protocol information dissemination.</p>	<p>2. What do you find challenging about implementing the updated protocol? Do patients report barriers to completing updated protocol?</p> <p>Adherence to updated protocol by nursing staff will be addressed through weekly check-ins by project coordinator.</p>
<p>4.Evaluate outcomes</p>	<p>Gather de-identified data from nursing staff to analyze. If goal of increasing number of VCE with optimal small bowel visualization and improved excretion time less than 72 hours is not met, then a re-evaluation will be needed.</p>	<p>Compare data from 6 weeks prior to implementation of updated bowel preparation protocol to data from 6 weeks after implementation of updated bowel protocol.</p> <p>Measure the percentage of VCE with optimal bowel preparation and excretion time less than 72 hours.</p>

Table 1: Project Implementation activities table

### Timeline

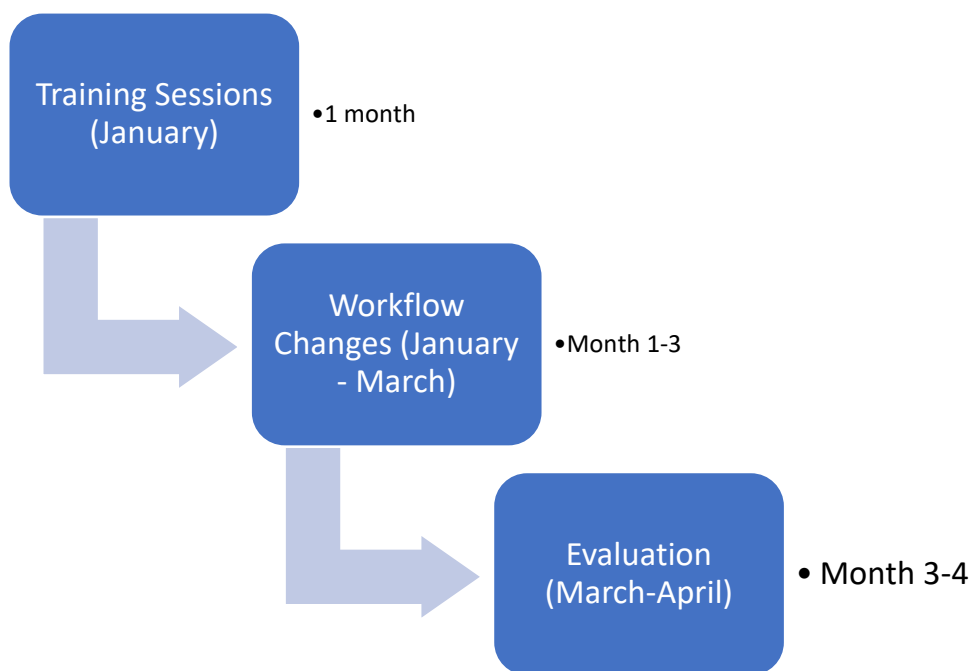


Figure 3: Project Timeline

### Evaluation and Analysis

#### Evaluation

The assessment of these interventions relies on predefined outcome measures. Evaluation of the quality of bowel preparation for VCE patients is contingent upon data submitted by nursing staff, in accordance with studies emphasizing the pivotal role of bowel preparation in optimizing small bowel visualization during VCE procedures (Bjoersum-Meyer et al., 2021).

The evaluation of the quality improvement project focused on enhancing small bowel visualization during VCE procedures at a gastroenterology clinic in urban Indiana involves integrating updates on best practices and educational sessions into a nursing staff meeting in January. This approach is consistent with findings suggesting that regular training sessions and communication of best practices contribute to better procedural outcomes (Deding et al., 2023a).

A multifaceted approach was used to assess the impact of interventions over a 4-month timeline. The evaluation considered various aspects, including procedural efficiency, training and skill development, outcome-driven protocol updates, and improved capsule excretion times. VCE Capsule excretion time is the duration within which the VCE capsule is expelled from the body, crucial for optimal diagnostic results. To evaluate the success of these activities, specific outcomes have been established. 1.) To evaluate the activity of updating bowel preparation protocol, a score of excellent and good using QE (Brotz et al., 2016) will be considered a successful study. 2.) To evaluate improvements in VCE excretion times the percentage of VCE capsules excreted within the recommended timeframe of 72 hours or less compared to number of VCEs scheduled in the given 6-week time frame. See tables 3 and 4.

These outcomes collectively form a comprehensive evaluation framework aligning with studies that emphasize the importance of thorough bowel preparation for optimal small bowel visualization during VCE procedures (Freitas et al., 2023a) and enabling a thorough assessment of the success of the implemented activities in achieving the predetermined goals of optimizing small bowel visualization. The graphic representation of run charts will show the improvement of interventions over time. This evidence-based approach ensures that interventions are not only theoretically sound but also practical and impactful in a clinical setting, aligning with the broader goal of enhancing the quality and efficiency of VCE procedures with a specific focus on small bowel visualization.



<p>SMART Goal #1 More than 90% of VCEs will result in complete visualization of small bowel.</p> <p>This goal is set at 90% as it is understood everybody is different and some may require additional bowel preparation to achieve optimal visualization of small bowel. This will align with national VCE success rates.</p>		
<p>Description of strategies to be utilized to accomplish goal including any needed resources.</p> <ul style="list-style-type: none"> <li>• Project coordinator will research optimal VCE preparation protocols to be presented to stakeholders for evaluation and appropriateness. The selected protocol will be implemented and analyzed for efficacy.</li> <li>• Project coordinator will work with nursing staff to instruct in proper triage, information dissemination, and documentation.</li> <li>• Staff and patient education tools will be developed for effective triage and patient instruction to encourage compliance with updated protocols</li> </ul>		
<p>Data to be collected</p>	<p>Method of Collection and who is responsible</p>	<p>Planned data analysis</p>
<p>Total number of VCEs done and of those, total number of VCEs with complete small bowel visualization with a QE rating of excellent and good (Brotz et al., 2009)</p> <p>To ensure correct bowel preparation was used. A smart phrase will be included in VCE documentation.</p> <p>Smart phrase:</p> <p><b>Updated protocol used</b></p>	<p>Triage nursing staff will report to project coordinator number of VCEs scheduled.</p> <p>Project coordinator will collect de-identified data from nursing staff weekly and enter it into a table showing date VCE completed and if updated bowel preparation was used.</p> <p>Project coordinator will review data derived from physician report to review for optimal bowel preparation and complete small bowel visualization.</p>	<p>The data collected will be entered into a run chart showing percentage of VCEs with optimal bowel preparation.</p> <p>The flow chart will be presented to stake holders at the end of the project.</p>

Table 2: Smart Goal 1 Evaluation Table

<p>SMART Goal #2: VCE capsule excretion times will be 72 hours or less at a rate of 98%.</p> <p>Goal is set at 98% to allow for physiological limitations on gastric motility rates.</p>		
<p>Description of strategies to be utilized to accomplish goal including any needed resources.</p> <ul style="list-style-type: none"> <li>• Project coordinator will implement improved pre-procedural patient bowel preparation protocols to improve patient and staff understanding of process and ensure prompt VCE administration, early identification of issues and timely interventions through patient and nursing staff education, and improved bowel preparations.</li> <li>• Project coordinator will provide comprehensive training for healthcare staff to enhance their expertise in VCE procedures, ensuring proficiency in all aspects of the process, and improving staff confidence while implementing new protocols through nursing staff surveys.</li> <li>• Project coordinator will develop protocols driven by patient outcomes aligning with intended aims of improving capsule excretion times.</li> </ul>		
Data to be collected	Method of Collection and who is responsible	Planned data analysis
<p>Patient is required to contact clinic when VCE capsule is excreted.</p> <p>Nursing staff will record time of capsule excretion provided by patient.</p> <p>A smart phrase will be used to record this information in a standardized way.</p> <p>Smart phrase:</p> <p><b>Capsule ingestion date and time ***</b></p> <p><b>Capsule excretion date and time ***</b></p>	<p>Project coordinator will collect data from nursing staff weekly.</p>	<p>Calculate percentage of VCE with excretion time 72 hours and below to assess the impact of standardized procedures, identify areas for further improvement, and make evidence-based decisions to continually enhance the VCE process.</p> <p>Percentage of VCE capsules excreted in 72 hours or less will be entered into a run chart and presented to stakeholders at the end of the project to show efficacy of updated bowel preparation.</p>

Table 3: Smart Goal 2 Evaluation Table

### Safety and Confidentiality

Data Access and Storage Access to patient data will be restricted to authorized healthcare professionals directly involved in the project. All data will be stored on secure, password-protected servers located within the healthcare facility.

Data Transmission Secure File Transfer Protocols (SFTP) will be employed for any data exchanges between systems with no identifying information.

Data De-identification Personal Identifiable Information (PII) and Protected Health Information (PHI) will not be collected, recreated, or removed from facility ensuring anonymity of patients and staff participants.

Data Removal and Destruction Health records with PHI will not be removed from the clinic premises at any point. Upon completion of the project, all collected data will be securely destroyed following the healthcare facility's data retention policies and industry standards.

Patient and Staff Participant Risks As this initiative does not require new healthcare procedures or protocols that are not already rooted in evidence-based practice, there are no risks to patients or staff.

No Increased Risks Quality Improvement (QI) initiative aims to maintain the same level of risk as standard patient care. No additional risks beyond routine healthcare practices will be introduced.

Informed Consent Informed consent for participation may not be required based on MSU IRB guidelines, as the project aims to improve existing healthcare procedures without added

risks to patients or staff. However, patients and staff will be informed about the project, ensuring transparency and trust.

### IRB Approval and Stakeholder Support

#### IRB Review

The project will adhere to MSU IRB guidelines, and any additional IRB or reviewing agency approvals will be obtained as necessary. Copies of the Site Representative form and documentation from all relevant IRBs or committees will be submitted for approval.

#### Stakeholder Support

The project has obtained support from site stakeholders, including healthcare providers, administrators, and nursing staff, ensuring collaboration and smooth implementation. Regular communication with stakeholders will be maintained to address concerns and ensure the success of the project. By following these protocols, the project ensures the secure handling of patient data, minimizes risks to participants, adheres to ethical guidelines, and maintains the necessary approvals for implementation.

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# VCE Educational Session

*By: Nicole Foster BSN, RN*

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## What is a VCE?

- *Video Capsule endoscopy*
  - Used to visualize small bowel when traditional endoscopic methods do not yield intended results due to limited range and scope lengths.
  - Used as an alternative to traditional methods when there are associated risks if the patient proceeds with traditional methods of endoscopy.

(Freitas et al., 2022)

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## Are bowel preparations important?

- **YES!**
- *They assure optimal visualization of the small bowel if completed as instructed.*
  - Clear visualization of the small bowel mucosa is imperative for accurate diagnosis (Read et al., 2022).
  - Prevents the need for repeat studies that increase patient and facility costs.
  - Patients may not want to continue with a second exam limiting the diagnostic capabilities of the facility.

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## How can you help to assure patient compliance with bowel preparation protocols?

- Educate patients on why it is important to complete bowel preparation.
- Ensure the patient clearly understands the preparation instructions.
- Consider language barriers and provide instructions in the patient's spoken language when possible (O'hara et al., 2023).
- Offer contact information in the event the patient has any questions.



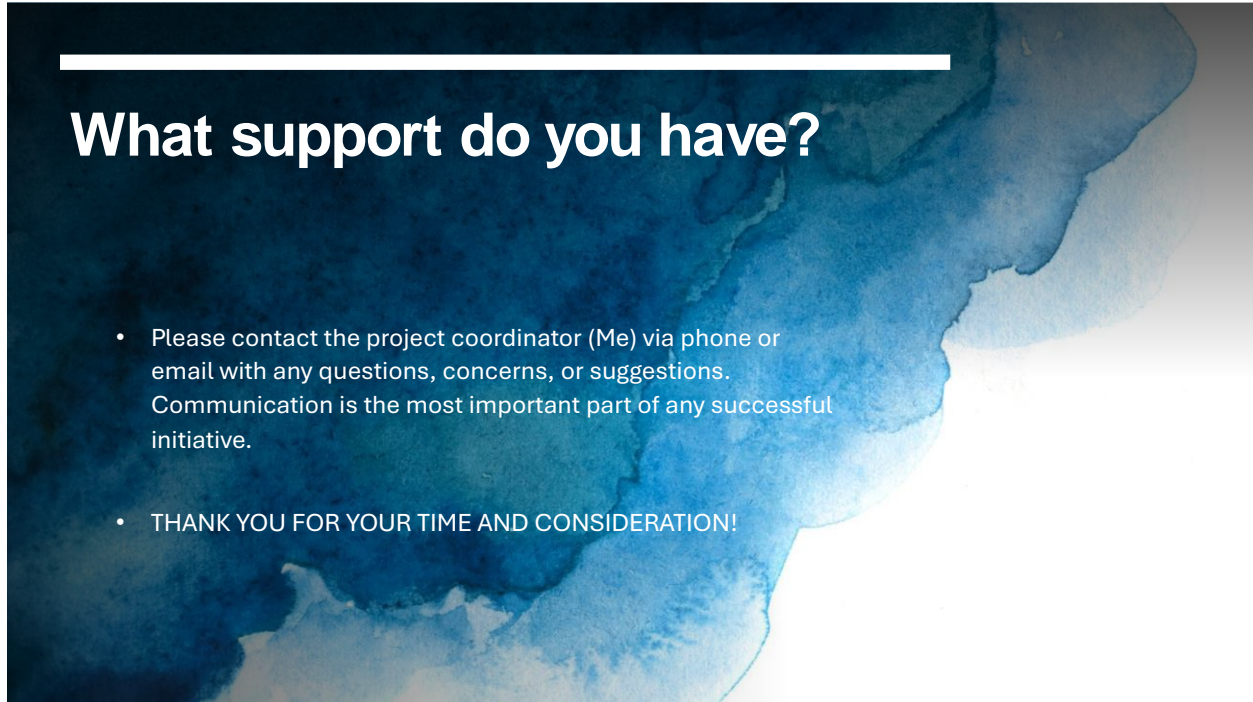


Figure 4: Power point Educational Slides

Day Before Procedure	
Day:	Eat normally for breakfast followed by a light lunch. Then begin clear liquid diet for the remainder of the day/night before the procedure. (Nothing colored red to drink).
Day: Time: 7:00 pm	Mix seven (7) capfuls (119 grams) of Polyethylene glycol (MiraLAX®, ClearLax, PureLax, GaviLax, LavaClear brands) with 32 oz. of water or Gatorade® or Sugar-free Gatorade (non-red) and drink all contents.
Day: Time: 10:00 pm	Nothing to drink after 10pm. Small sips of water with medications allowed.
Day of Procedure	
Day: Time: Morning	Hold medications until 2 hours after ingestion of capsule unless your doctor deems it necessary, then take small sips of water with medications.
Day: Time:	Two (2) hours prior to scheduled capsule ingestion time, mix 1 capful (17 grams) of Polyethylene glycol (MiraLax, ClearLax etc.) with full glass of water or Gatorade (non-red). The Polyethylene glycol bottle top is a measuring cap marked to contain 17 grams of powder when filled to the indicated line.
Day: Time:	Arrive at Office/Clinic.
Time:	<b>Ingest CapsoCam Plus capsule</b> with 8 oz. water
Time:	Resume clear liquids 2 hours after swallowing the capsule
Time:	Four (4) hours after ingestion start regular diet

Figure 5: Current VCE Bowel Preparation



Day Before Procedure	
Day:	Eat normally for breakfast followed by a light lunch. Then begin clear liquid diet for the remainder of the day/night before the procedure. (Nothing colored red to drink).
Day: Time: 7:00 pm	Mix seven (7) capfuls (119 grams) of Polyethylene glycol (MiraLAX®, ClearLax, PureLax, GaviLax, LavaClear brands) with 32 oz. of water or Gatorade® or Sugar-free Gatorade (non-red) and drink all contents.
Day: Time: 10:00 pm	Nothing to drink after 10pm. Small sips of water with medications allowed.
Day of Procedure	
Day: Time: Morning	Hold medications until 2 hours after ingestion of capsule unless your doctor deems it necessary, then take small sips of water with medications.
Day: Time: e:	Two (2) hours prior to scheduled capsule ingestion time, mix 1 capful (17 grams) of Polyethylene glycol (MiraLax, ClearLax etc.) with full glass of water or Gatorade (non-red). The Polyethylene glycol bottle top is a measuring cap marked to contain 17 grams of powder when filled to the indicated line.
Day: Time: e:	Arrive at Office/Clinic.
Time:	<b>Ingest CapsoCam Plus capsule</b> with 8 oz. water
Time:	Resume clear liquids 2 hours after swallowing the capsule. Mix (7) capfuls (119 grams) of Polyethylene glycol (MiraLax, ClearLax etc.) with 32 oz of water or Gatorade (non-red). Drink all the contents.
Time:	Four (4) hours after ingestion start regular diet

Figure 6: Proposed VCE Bowel Preparations

**Qualitative evaluation**

Excellent: Visualization of  $\geq 90\%$  of mucosa; no or minimal, fluid and debris, bubbles, and bile/chyme staining; no or minimal, reduction of brightness

Good: Visualization of  $\geq 90\%$  of mucosa; mild fluid and debris, bubbles, and bile/chyme staining; mildly reduced brightness

Fair: Visualization of  $< 90\%$  of mucosa; moderate fluid and debris, bubbles, and bile/chyme staining; moderately reduced brightness

Poor: Visualization of  $< 80\%$  of mucosa; excessive fluid and debris, bubbles, and bile/chyme staining; severely reduced brightness

Figure 7: Qualitative evaluation of small-bowel cleanliness developed by Brotz et al. (2009).

CHAPTER THREE

QUALITY IMPROVEMENT MANUSCRIPT

Contribution of Authors and Co-Authors

Manuscript in Chapter 3

Author: Nicole Foster

Contributions: Writing, editing

Co-Author: Molly Secor

Contributions: editing

Co-Author: Lindsey Benes

Contributions: editing

Manuscript Information

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- Published in a peer-reviewed journal

Abstract

**Background:** This practice improvement project addresses the clinical challenge of suboptimal small bowel visualization during Video Capsule Endoscopy (VCE) procedures, focusing on its local manifestation at a gastroenterology clinic in urban Indiana and proposing interventions (Deding et al., 2023a). Previous studies support the use of polyethylene glycol (PEG) solutions and staff education to improve small bowel visualization, highlighting the importance of standardized protocols and continuous training (Klein et al., 2016; Deding et al., 2022a).

**Problem:** The clinical problem stems from inconsistent bowel preparations and prolonged capsule excretion times, potentially leading to delayed diagnoses and compromised patient care (Deding et al., 2023a). Through a comprehensive literature review and the application of the Johns Hopkins Model as a conceptual framework (Moen et al., 2022a; Bjoersum-Meyer et al., 2021), the aim was to enhance small bowel visualization during VCE procedures by implementing evidence-based strategies.

**Methods:** Methods involved assessing the context, implementing interventions, measuring outcomes, and analyzing data. Results indicated improvements in bowel preparation quality and capsule excretion times following intervention implementation (Deding et al., 2023a).

**Results:** Key findings suggest that standardized protocols and continuous staff education are essential for achieving optimal small bowel visualization during VCE procedures (Bjoersum-Meyer et al., 2021).

**Conclusions:** The Johns Hopkins Model guided the development, implementation, and evaluation of interventions, emphasizing systematic quality improvement processes (Moen et al., 2022a). The project's goal was to improve the quality of small bowel visualization through staff education, protocol adjustments, and process standardization at the gastroenterology clinic in urban Indiana.

### Clinical Problem

The clinical problem addressed in this practice improvement project is the challenge of achieving optimal small bowel visualization during VCE procedures, which manifests locally at the gastroenterology clinic in urban Indiana as inconsistent bowel preparations and prolonged capsule excretion times (Deding et al., 2023a). Evidence suggests that suboptimal bowel preparation can lead to delayed diagnoses and compromised patient care (Bjoersum-Meyer et al., 2021). To address this issue, improvements in clinical practice are necessary. Therefore, this project implemented evidence-based strategies to enhance small bowel visualization during VCE procedures.

### Review of Literature

Current literature focuses on various aspects related to VCE procedures and preparation, including patient experience, preparation regimens, the role of artificial intelligence (AI), and the potential expansion of VCE applications in clinical practice. Collectively, implications from the current literature propose strategies to enhance the quality and effectiveness of VCE procedures and improve patient outcomes. They show there is a clear need to enhance best practice protocols to promote practice standardization and foster more positive outcomes for patients and

stakeholders (Ju et al., 2022a; Klein et al., 2016; Deding et al., 2022a, 2023a, 2022b; Freitas et al., 2023a; Moen et al., 2022a; Bjoersum-Meyer et al., 2021).

Polyethylene glycol (PEG) solutions are the most common, safest, and most effective bowel preparation materials (Klein et al., 2016). Klein et al. (2016) found that the use of PEG solutions garnered a collective 96% completion rate compared to an 83% completion rate with other bowel preparations. Recognizing there are notable barriers to adherence to bowel preparation protocols, such as socioeconomic differences in patients and expected discomfort during colonoscopy and colon capsule endoscopy (CCE), it is important to understand these disparities, with 62.7% of patients reporting varied discomfort levels (Deding et al., 2022a). This understanding is pivotal for tailoring preparation strategies to foster adherence to VCE protocols, thereby improving overall VCE outcomes. Findings indicate a 92% improvement in bowel preparation effectiveness when using PEG bowel preparations compared to other non-PEG containing preparation methods (Deding et al., 2023a), contributing to the identification of effective preparation regimens. Some providers choose to add prokinetics to bowel preparations (Deding et al., 2022b); the effects of prucalopride on completion and polyp detection rates in colon capsule endoscopies demonstrate a 74.9% increase in completion rates and a 55.7% polyp detection rate, providing evidence-based strategies to improve VCE procedure outcomes. However, with this success, also comes unwanted side effects. One of the biggest areas to consider in VCE administration is prolonged gastric transit time. Twenty to thirty percent of cases experience extended transit time (Freitas et al., 2023a), contributing to the understanding of factors influencing procedure outcomes. These insights are crucial for improving VCE

preparation and patient experiences, with 12% of patients showing enhanced outcomes with adjusted protocols (Freitas et al., 2023a).

New VCE systems have integrated AI into their camera operations (Ju et al., 2022a). AI-based quantification demonstrates a 94% accuracy in identifying clean mucosa in capsule endoscopy. This technological advancement aligns with a broader theme of integrating innovative approaches, enhancing VCE interpretation with increased precision and efficiency that is beneficial to the field of gastroenterology. There is a statistically significant improvement of 13.1% in accuracy over physician readers and an 11.3% reduction in interpretation time (Moen et al., 2022a). Bjoersum-Meyer et al. (2021) contribute significant insights into the efficacy of various bowel preparation regimens for colon capsule endoscopy. There is a 95% completion rate without the addition of prokinetics and a 96% completion rate using prokinetic agents, with a 1% increase in bowel transit time with the addition of prokinetic agents in overall bowel preparation effectiveness (Bjoersum-Meyer et al., 2021). These findings further inform the collective goal of optimizing VCE visualization and outcomes.

### Conceptual Framework

In this project, the Johns Hopkins Model was used as a guiding framework for interventions, drawing upon its structured approach that emphasizes systematic quality improvement processes (Johns Hopkins Medicine, 2023.). Renowned for its efficacy in healthcare contexts, this model includes the paramount importance of comprehensive strategies that encompass development, implementation, evaluation, and sustainability (Johns Hopkins Medicine, 2023). By embracing this model, the project's focus is centered on implementing



evidence-based interventions and standardized protocols specifically aimed at enhancing small bowel visualization during VCE procedures.

The structured framework provided by the Johns Hopkins Model ensured that interventions were guided by best practices derived from rigorous research and clinical evidence (Johns Hopkins Medicine, 2023). This QI plan was developed to address identified needs. The plan was then implemented to help streamline workflows, staff training, and protocol standardization as a part of steps one and two of the John's Hopkins Framework. Step three focuses on the evaluation of outcomes. The project used data collected by nursing staff to determine the effectiveness of the implementation. An important aspect of the John's Hopkin's Framework is sustainability. Interventions for this QI project were designed to continue to improve positive outcomes while maintaining patient safety and quality of VCE effectiveness. This approach contributed to a robust evaluation process, facilitating the project's ability to measure and analyze outcomes effectively. The model's emphasis on sustainability embedded a crucial element, ensuring that improvements in small bowel visualization would be upheld over time.

The utilization of the Johns Hopkins Model in this project not only offered a structured guideline for the development of interventions. This methodical approach, bolstered by renowned healthcare expertise, solidified the project's foundation, and ensured that interventions adhered to the highest standards of quality improvement within the healthcare setting (Johns Hopkins Medicine, 2023).

### Aims/Purpose of the Project

The aim of this project was to improve the quality of small bowel visualization during VCE procedures at a gastroenterology clinic in urban Indiana through staff education, protocol adjustments, and process standardization. By addressing the challenges associated with suboptimal small bowel visualization, the overall goal was to enhance patient outcomes and streamline the VCE procedure workflow.

### Methods

#### Context

At the gastroenterology clinic in urban Indiana, a trend of inconsistent bowel preparations and prolonged capsule excretion times during VCE procedures was observed. This clinical challenge is not specific to this clinic but is indicative of broader issues faced in gastroenterology diagnostics worldwide. The importance of addressing these challenges is supported by medical records data obtained from internal records, revealing that 40% of VCE studies conducted between December 2022 and June 2023 resulted in suboptimal preparations. The data shed light on the scope of the problem and emphasize the need for targeted interventions to improve the quality and effectiveness of VCE procedures.

National statistics from gastroenterology clinics across the United States correlate with the findings observed at the Indiana clinic. According to a report published by the American Society for Gastrointestinal Endoscopy (ASGE), an estimated 25% to 30% of VCE procedures encounter challenges related to inadequate bowel preparation, leading to compromised diagnostic accuracy and patient outcomes (ASGE, 2023). These national data highlight the

widespread nature of the issue and the continued need for standardized protocols and interventions to optimize VCE procedures.

Historical data from the clinic's own records indicate the prevalence of suboptimal preparations. This trend highlights the persistence of the problem and leads to the assumption that a sustainable solution to improve small bowel visualization and procedural outcomes is needed.

### Intervention/Practice Change

To address the identified issues and aligned with the mission of the facility to remain committed to enhancing the well-being of the community, evidence-based interventions were implemented, focusing on staff education sessions and updates to bowel preparation protocols.

First, staff education sessions were designed to raise awareness among healthcare professionals regarding the importance of optimal bowel preparation and adherence to standardized protocols (Bjoersum-Meyer et al., 2021). Next, updates to bowel preparation protocols were made that included increasing the use of Polyethylene Glycol (PEG) solutions based on evidence from studies demonstrating their efficacy in improving small bowel visualization (Silva et al., 2022a).

### Implementation

The implementation plan, aligned with AANP guidelines, focused on three main objectives: staff education, protocol adjustments, and outcome evaluation. The project coordinator, a Doctor of Nursing Practice (DNP) student, oversaw the project and ensured adherence to timelines. The implementation occurred over a 6-week period, from January 17th,

2024, to February 28th, 2024. The project coordinator also acted as a clinical trainer, conducting staff training sessions emphasizing the importance of patient adherence to bowel preparation instructions (Bjoersum-Meyer et al., 2021).

### Staff Education

During a nursing staff meeting held in January 2024, the DNP student introduced the quality improvement initiative and delivered a PowerPoint (PPT) presentation with 5 slides and 10 minutes in length highlighting the importance of adherence to VCE preparation protocols by nursing staff and the need for enhanced patient education. The presentation featured informative slides outlining the critical areas necessitating attention and improvement. The DNP student provided as needed support to nursing staff when questions were presented. The DNP student communicated in-person and via email. The slides were sent via email to all 11 nurses on staff who triage patients for VCE procedures.

### Bowel Preparation Protocol Adjustment

The adjustment in bowel preparation protocols involved increasing the amount of PEG solution administered. Currently, the protocol included 119 GM PEG the day before the procedure, with an additional 17 GM PEG two hours after capsule ingestion. The revised protocol included 119 GM PEG solution the day before the procedure and an additional 119 GM PEG solution two hours after ingestion. This adjustment aimed to promote gastrointestinal motility and facilitate prompt capsule excretion within the recommended 72-hour timeframe as well as enhancing small bowel visualization (Silva et al., 2022a; Klein et al., 2016).

### Measures

Assessment involved collecting data from nursing staff on Wednesday of every week during the implementation period on the number of complete bowel preparations and the number of VCE capsules excreted within the recommended timeframe. Information was gathered by two staff nurses who perform VCE procedures. The Qualitative Evaluation scale (QE) was utilized to grade bowel preparation clarity (Brotz et al., 2009) by the physicians reading VCEs. This is the evidence-based guidelines used by the gastroenterology clinic. Physician procedure reports were reviewed by these two nurses and data were presented to the DNP student. Patient charts were also reviewed by the two nurses for number of patients who were given updated bowel preparation instructions. Triage nursing staff used an EPIC dot phrase in their documentation to denote if the updated bowel preparation instructions were given to the patient prior to VCE capsule ingestion. Data analysis included tracking changes in bowel preparation quality and capsule excretion times over time. Statistical analysis was conducted to compare pre-intervention and post-intervention percentages of clarity of small bowel visualization and capsule excretion times to evaluate the effectiveness of the implemented interventions.

All data collected were deidentified by nursing staff prior to dissemination to DNP student.

### Ongoing Evaluation

Monthly evaluations for short-term goals and quarterly evaluations for mid-term goals will be conducted. Staff will perform annual evaluations for long-term goals after the initial project conclusion. Graphic representations were developed to illustrate the effectiveness of

protocol changes and variations over the. Project timeline, aiding in trend identification and to use for future reference (Silva et al., 2022a).

### Results

Following the implementation of interventions, improvements were observed in both the quality of bowel preparation and the timely excretion of VCE capsules. The data indicates the percentage of complete bowel preparations surged from 47% to an impressive 95% post-intervention. There was a modest yet notable enhancement in the percentage of VCE capsules excreted within the recommended timeframe of 72 hours or less, rising from 13% to 14%.

Pre-implementation phase, a total of 15 cases were scheduled for VCE procedures. During this period, Miralax 119 GM was administered pre-capsule swallow only with 17 GM Miralax administered post swallow. Of these 15 studies, eight had good small bowel visualization and five had poor small bowel visualization based on the QE scale (Brotz et al., 2009). Two VCE studies could not be safely read due to extremely poor small bowel visualization or non-retrieval and were graded as incomplete. In addition, 13 capsules were excreted within the 72-hour time frame. Two studies exceeded the 72-hour time frame (one of these capsules were not retrieved).

Post-implementation, a total of 21 cases were scheduled for VCE procedures. During this period, Miralax 119 GM was administered pre-capsule swallow and Miralax 119 GM two hours post VCE swallow was administered. Of these 21 studies, 18 had good small bowel visualization, two had poor small bowel visualization, and zero were incomplete based on the QE scale (Brotz et al., 2009). In addition, 18 capsules were excreted in the 72-hour time frame, and

three were not excreted in the 72-hour time frame. All 21 patients in the post-implementation phase were given the updated bowel preparation instructions.

Nursing staff did not have any questions about the updated bowel preparation protocol during weekly check-ins.

These findings link the effectiveness of the implemented strategies in optimizing the VCE procedure's small bowel visualization and ensuring timely capsule excretion. Such improvements are crucial for accurate diagnoses and enhanced patient outcomes. For visual representation of these results, please refer to Table 7.

	Pre-implementation		Post-implementation	
Number of cases scheduled	15		21	
Number of cases the used updated bowel preparation instructions	0		21	
Bowel prep used	Miralax 119 GM pre swallow and 17 GM post swallow	15	Miralax 119 GM pre swallow 17 GM post swallow	0
	Miralax 119 GM pre- and post-swallow	0	Miralax 119 GM pre- and post-swallow	21
Quality of visualization	Good	8	Good	18
	Poor	5	Poor	2
	Incomplete	2	Incomplete	0
Excretion Time	≤72 hours	13	≤72 hours	18
	>72 hours	<u>2</u>	>72 hours	<u>3</u>

Table 4: Results of data collection.

### Discussion

Key findings suggest that standardized protocols and continuous staff education are essential for achieving optimal small bowel visualization during VCE procedures. The significant improvement in bowel preparation quality demonstrates the effectiveness of the revised bowel preparation regimen, however, there was not a significant improvement in capsule excretion times. Reasons identified for this include limited assessment by nursing staff on individual patient bowel habits. Adjustments to bowel preparation may need to be considered when a patient reports bowel movement habits that suggest constipation such as individuals who have less than three bowel movements or less per week. This can be improved with adjustments to current nursing triage forms and additional education on the importance of effective patient screening. Limitations include the need for ongoing staff training and potential challenges in patient adherence to updated protocols. Recommendations for addressing these limitations include implementing regular staff education sessions and providing additional support for patients in understanding and adhering to new protocols.

### Conclusion

In conclusion, the outcomes of this study underscore the critical role of evidence-based interventions in rectifying suboptimal small bowel visualization during Video Capsule Endoscopy (VCE) procedures. The implications of these findings extend far beyond this study, resonating with clinical practice across the spectrum of gastrointestinal diagnostics and paving the way for technologies not yet being utilized.



Central to these implications is the imperative for standardized protocols that promote consistency and efficacy in VCE procedures. Such protocols not only streamline the workflow but also contribute significantly to improving patient outcomes ensuring accurate diagnoses and timely interventions.

Continuous education among healthcare professionals emerges as a cornerstone in this endeavor. The ongoing acquisition of knowledge and skills ensures that healthcare providers remain up to date with the latest advancements and best practices in VCE procedures, thereby optimizing patient care delivery.

Shedding light on the importance of evidence-based interventions, standardized protocols, and continuous staff education, this study aligns with broader industry trends aimed at enhancing the quality and effectiveness of VCE procedures. These efforts are integral in elevating patient care standards and fostering workflow efficiency within gastroenterology clinics, including the gastroenterology clinic in urban Indiana where this study was conducted. As such, this work contributes meaningfully to the ongoing evolution of gastrointestinal diagnostics, promising improved patient outcomes and enhanced healthcare delivery.

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## CHAPTER FOUR

## ADVANCED NURSING ESSENTIALS REFLECTION

Montana State University's Doctor of Nursing Practice (DNP) program emphasizes several essentials and competencies that are integral to the development of nurse practitioners as leaders in healthcare. Reflecting on my experiences in the program, I can identify specific examples that demonstrate my achievement of these essentials and competencies, showcasing my role as a nurse practitioner and emerging leader.

**Clinical Leadership:** This essential focuses on providing leadership in the clinical setting to improve patient outcomes and healthcare delivery. During my DNP program, I undertook a project aimed at implementing evidence-based practice guidelines for improving small bowel visualization during VCE procedures. Through this project, I demonstrated clinical leadership by leading a multidisciplinary team, synthesizing research evidence, and implementing practice changes that positively impacted patient care.

**Quality Improvement and Patient Safety:** Patient safety and quality improvement are paramount in healthcare delivery. In a clinical rotation during my DNP program, I identified a need for process improvement and standardization during VCE procedures and led a quality improvement initiative to streamline the process and improve patient outcomes. This experience exemplified my role as a leader in promoting patient safety and quality improvement within the healthcare system.

**Evidence-Based Practice:** As a nurse practitioner, it is essential to base clinical decisions on the best available evidence. In my DNP Core coursework, I conducted a systematic literature review on the efficacy of telehealth interventions in managing chronic diseases. Through this

project, I not only developed expertise in evidence synthesis but also gained insights into the potential of telehealth to improve access to care and patient outcomes, demonstrating my commitment to evidence-based practice.

**Advocacy and Policy:** Nurse practitioners play a crucial role in advocating for patients and influencing healthcare policy. In my DNP Core coursework, I engaged in discussions and projects focused on healthcare policy and advocacy. For instance, I participated in a policy analysis project where I examined the implications of legislative changes on nurse practitioner scope of practice. Through this project, I developed a deeper understanding of the legislative process and learned how to advocate for policies that promote access to quality healthcare services.

Montana State University focuses on core essentials that must be practiced and achieved during the entirety of the DNP program. The following core essentials outline many important aspects of education in the DNP program.

**Knowledge for Nursing Practice (DNP Core):** Throughout my DNP program, I acquired in-depth knowledge and skills necessary for advanced nursing practice through rigorous coursework and clinical experiences. For example, I engaged in coursework that delved into advanced pathophysiology, pharmacology, and physical assessment, which provided me with a solid foundation for delivering comprehensive care as a nurse practitioner.

**Person-Centered Care (APRN Coursework):** In my APRN coursework, I participated in clinical rotations where I learned the importance of person-centered care. Through interactions with patients, I developed the ability to assess their unique needs, preferences, and values, ensuring that care was tailored to meet individual goals and promote optimal health outcomes.

Population Health (DNP Core): I explored concepts of population health and its impact on healthcare delivery. Through coursework and projects, I learned strategies for addressing health disparities, promoting health equity, and implementing population-based interventions to improve health outcomes at the community level.

Scholarship for the Nursing Discipline (DNP Core): The DNP program emphasized the importance of scholarship in advancing the nursing discipline. I engaged in scholarly activities such as conducting literature reviews, critically appraising research evidence, and disseminating findings through presentations and publications, contributing to the advancement of nursing knowledge and practice.

Quality and Safety (APRN Coursework): Quality and safety were focal points in my APRN coursework. Through clinical experiences and quality improvement projects, I gained practical skills in identifying and addressing gaps in care, implementing evidence-based practices to enhance patient safety, and promoting a culture of continuous quality improvement within healthcare settings.

Interprofessional Partnerships (DNP Core): Effective collaboration with other healthcare professionals is crucial for delivering comprehensive care. In one of my APRN courses, I participated in a project where I worked alongside physicians, administration, and nursing staff to develop a plan to improve workflows in a clinic setting. This experience helped me understand the importance of interprofessional collaboration in optimizing patient outcomes and taught me how to effectively communicate and collaborate with members of other healthcare disciplines. Collaboration with other healthcare professionals is essential for delivering high-quality care

while learning to effectively communicate and collaborate within interdisciplinary teams to improve patient outcomes.

**Systems-Based Practice (DNP Core):** Understanding healthcare systems and their impact on patient care is critical for nurse practitioners. Through coursework in systems-based practice, I gained insights into healthcare delivery models, health policy, and healthcare financing, preparing me to navigate complex healthcare systems and advocate for system-level changes to improve patient care.

**Informatics and Healthcare Technologies (DNP Core):** In the DNP program, I learned about the role of informatics and healthcare technologies in nursing practice. I acquired skills in using electronic health records, telehealth platforms, and other technologies to enhance communication, streamline clinical workflows, and improve patient outcomes.

**Professionalism (APRN Coursework):** Professionalism is integral to nursing practice. In my APRN coursework, I honed my professionalism through clinical experiences, adhering to ethical principles, maintaining confidentiality, and demonstrating accountability in my interactions with patients, colleagues, and preceptors.

**Personal, Professional, and Leadership Development (Both DNP Core and APRN Coursework):** Throughout the DNP program, I engaged in reflective practices and self-assessment to foster personal, professional, and leadership development. I received mentorship from faculty and preceptors, participated in leadership development activities, and pursued opportunities for continuing education to enhance my skills and competencies as a nurse practitioner and emerging leader in healthcare through my current place of employment.

In summary, my experiences in the Montana State University DNP program have equipped me with the essential skills and competencies needed to excel as a nurse practitioner and emerging leader in healthcare. Through examples from both my DNP Core and APRN coursework, I have demonstrated my ability to provide clinical leadership, collaborate effectively with interdisciplinary teams, base practice on evidence, improve patient safety and quality, and advocate for patients and healthcare policy changes. These experiences have prepared me to take on leadership roles in healthcare settings and contribute to improving patient outcomes and healthcare delivery systems.



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