

Fall 11-22-2021

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DOI: <https://doi.org/10.46409/sr.IYIT4422>



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Recommended Citation

Young, T. D. (2021). *Development and Implementation of an Evidence-Based Guideline for Spinal Cord Injury/Disorder Patients Requiring Colonoscopy*. [Doctoral project, University of St Augustine for Health Sciences]. SOAR @ USA: Student Scholarly Projects Collection. <https://doi.org/10.46409/sr.IYIT4422>

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**Development and Implementation of an Evidence-Based Guideline for
Spinal Cord Injury/Disorder Patients Requiring Colonoscopy**

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This Manuscript Partially Fulfills the Requirements for the

Doctor of Nursing Practice Program and is Approved by:

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Approved November 22, 2021

Abstract

Practice Problem: Colorectal cancer is one of the leading causes of preventable cancer death in the United States. Spinal cord injury/disorder (SCI/D) patients present with unique challenges for maximizing bowel prep and successful attainment of screening and therapeutic colonoscopy procedures. Current practice for bowel prep regimen does not take into consideration the specific needs of the SCI/D population resulting in significant patient dissatisfaction.

PICOT: The PICOT question that guided this project was in adult patients with spinal cord injuries/disorders requiring colonoscopy (P), how does the development and implementation of evidence-based guideline for the care of the spinal cord injury/disorder patient requiring colonoscopy (I) compared to usual practice (C) affect the rate of first attempt successful colonoscopy procedure completion (O) within eight weeks (T).

Evidence: SCI/D patients resulting neurogenic bowel increases difficulty with standard bowel prep tolerance. Quality bowel preparation is required for successful colonoscopy with inadequate bowel preparations present in 20-25% of all colonoscopies (Johnson et al., 2014). Evidence supports a clinical guideline for bowel preparation adapted to the needs of the SCI/D population.

Intervention: Development and implementation of an SCI/D bowel prep guideline enhanced clinical decision support and evidence-based tools for improved bowel prep with initial attempt.

Outcome: The rate of first-time colonoscopies for patients with SCI/D with the guideline improved by over 214% over pre-guideline time.

Conclusion: The evidenced-based guideline reinforced clinical practice for the SCI/D population related to their unique requirements. Clinically significant improvement was noted in successful bowel prep completion, first attempt colonoscopy completion, improved access to the endoscopy suite, and reduced length of stay. All combined improved both patient and provider satisfaction with the evidence-based practice change.

Development and Implementation of an Evidence-Based Guideline for Spinal Cord Injury/Disorder Patients Requiring Colonoscopy

Colorectal cancer is the second leading cause of cancer death in the United States. “Colorectal screening in special populations, such as spinal cord injury and disorders, present unique barriers and a potential higher risk of complications” (Hayman et al., 2013, p.436). The initial, and arguably most important, step in the colonoscopy procedure is adequate bowel preparation. Quality bowel preparation prepares the bowel for screening and therapeutic procedures by removing any contaminants that prevent visualization. Inadequate bowel preparations are seen in 20-25% of all colonoscopies (Johnson et al., 2014); however, for patients with spinal cord injuries and disorders (SCI/D) neurogenic bowel increases the difficulty of complete cleansing and often further prevents colorectal screening by colonoscopy from a successful exam on first attempt well beyond the 25% overall statistics. Utilizing the proper bowel prep is key to ensuring that these patients with decreased colonic motility do not need to repeat the colonoscopy procedure multiple times. To combat this issue, an evidence-based guideline that will outline the process for admitting the SCI/D patient and ordering the colonoscopy prep will be developed and implemented to improve communication and adherence to this population’s unique needs with providers caring for these patients. This paper will outline the guiding clinical question, evidence synthesis, implementation, and evaluation of the effectiveness of the evidence-based guideline for inpatients with SCI/D.

Significance of the Practice Problem

SCI/D patients experience healthcare disparities related to access, support, and throughput when seeking care for routine and therapeutic colonoscopy screening. A needs assessment determined that in the project facility a problem existed related to access to colorectal screening for patients with spinal cord injuries through limited access to appointments and high rates of inadequate preparation which inappropriately burdens systems through deficits resulting in repeated work. There was no current practice within the facility to guide the

care of these patients, and this variability imposed undue hardship on patients with SCI/D as they required frequent repetition the prep multiple times before achieving quality bowel cleansing for successful procedure completion. Without an evidence-based guideline patients experienced variability in diet, medication, and prep solution on a provider influenced regimen. The variability in prep resulted in uncoordinated efforts and plans of care, increased resource utilization, and increased costs for prolonged length of stay and medication usage. For instance, some providers chose to use bisacodyl tablets and MoviPrep while others use MoviPrep and GoLytely. Further, some providers use magnesium citrate along with the GoLytely and some use tap water enemas and nothing else. Highly variable practice resulted in highly variable outcomes, prolonged admissions that reduced patient's return to normal activities of daily living and family support routines. Additionally, related to the nature of the cleansing routine, as the patient underwent bowel preparation their diet was modified to no solid foods for two to three days, with unsuccessful preparations increasing the length of abstinence from their regular diet and increasing associated stressors from the diet change. This created patient dissatisfaction with the prep process, and frequent early termination of the preparation while in progress leading to eventual patient refusal to obtain screening or therapeutic colonoscopy.

Globally, 1.8 million cases of colorectal cancer were identified in 2017. This translated to a rate of 23 per 100,000 person-years (Colorectal Cancer Collaborators, 2019). Nationally, approximately 147,950 new cases of large bowel cancer are diagnosed annually, with approximately 104,610 diagnosed as colon cancer and the remaining diagnosed with rectal cancer (Macrae, 2020). Colorectal cancer is one of the few cancers that can be prevented with early polypectomy during the colonoscopy screening procedure. SCI/D patients have the same or greater risk due to test avoidance from difficult prep, creating an imperative that patients with SCI/D act vigilantly in getting screened for colorectal cancer. The SCI/D patient is prone to neurogenic bowel syndrome (unable to evacuate stool), which can lead to inadequate bowel cleansing and limit the endoscopist from seeing the entire colon (Solenberg et al., 2020).

The SCI/D patients need proper screening for colorectal cancer and to ensure this occurs, these patients need a bowel preparation that cleans the colon adequately and efficiently for the endoscopist to visualize the entire colon. By providing a detailed guideline to practice for bowel preparation, the patient with SCI/D will experience better procedure outcomes, reduction of prep times, reduction of hospital stays, and higher patient satisfaction.

PICOT Question

In adult patients with spinal cord injuries/disorders requiring colonoscopy (P), how does the development and implementation of evidence-based guideline for the care of the spinal cord injury/disorder patient requiring colonoscopy (I) compared to usual practice (C) affect the rate of first attempt successful colonoscopy procedure completion (O) within eight weeks (T).

The population for this project is adult patients with SCI/D undergoing preparation for a screening or therapeutic colonoscopy procedure. Due to SCI/D patient's neurogenic bowels, the colonoscopy prep must be specifically tailored to support this population. The unit currently does not have a successful standard practice for bowel prep for this population. Developing and implementing an evidence-based guideline for proper colonoscopy prep will result in patients with a spinal cord injury successfully receiving a colonoscopy with the first prep attempt. A guideline to practice will outline the recommended bowel preparation, including instructions for the nursing staff regarding appropriate administration practices for this population. Ideally, the patient will only receive the prep one time resulting in better outcomes the first time they undergo a colonoscopy procedure. Outcomes will be measured comparing the rate of successful first attempt from prior to the guideline to practice implementation to post-implementation after eight weeks.

Evidence-Based Practice Framework & Change Theory

The Johns Hopkins Nursing evidence-based practice framework guides the development of this evidence-based change project through three phases described as practice question, evidence, and translation (PET) (Dang & Dearholt, 2017). The first step in this process is to

develop and refine the evidence-based practice question. This includes building an interprofessional team to examine a practice concern and develop an EBP question. The evidence phase is the second step of the PET process. The project manager completes the search for evidence to support the change. The final phase in the PET process is translation. This consists of translating the evidence to ensure the patient-care decision is supported.

Increasing the potential for a successful change occurs when a sense of urgency for change is established; for this project it is urgently needed to ensure patients with SCI/D are appropriately screened for colorectal cancer. It is important to introduce the change needed to develop and implement a guideline to practice for the prep procedure allowing patients with SCI/D to successfully complete the colonoscopy procedure the first time. Using Kotter's 8-step model, a plan was developed to help leaders evolve during the change management process (Kotter, 1996). This model provides steps to effectively implementing transformation. The first step is creating a sense of urgency by showing the stakeholders and providers the impact that repeating the colonoscopy prep has on the patient through a brief but informative presentation. which leads to the second step of meeting with stakeholders, building a team, and identifying the common errors. Forming a strategic vision and creating a strategy such as creating a guideline to be implemented is the third step. The fourth and fifth steps allows you to identify and limit issues allowing for concise and accurate dissemination of information. In the sixth step, each short-term win highlights errors and helps focus on the needs of the project. Once the changes are evaluated, the seventh step is time to set new goals to help the project grow and become successful. With the final eighth step, the changes to the project can be set in stone by showing the stakeholders the results of the successful completion of colonoscopies on the first attempt. After submitting this information, the guideline will then become a policy to be followed by all SCI/D providers. This model helps to move along the project and allows the success of the project if the checklist is followed (Kotter, 1996).

Evidence Search Strategy

To support the PICOT for this project, a search of literature focusing on colorectal screening for patients with SCI/D was conducted. An evidence search strategy aids the development and implementation of new more efficient guideline to practice for patients with SCI/D requiring colonoscopy. Databases used to search for articles to support the PICOT are CINAHL complete, ERIC, ProQuest Central, PubMed, and DynaMed. Medical subject headings (MeSH) included colorectal screening. Database search terms included *best bowel prep*, *timing of bowel prep*, and *colonoscopy for patients with SCI/D* which identified approximately 2513 articles.

Boolean connectors helped decipher the connector in multiple phrases or terms in a single search expression. Those terms were *AND*, *ANY*, *AND/OR*, and *NOT*. The inclusion criteria for this project includes articles within the past five years, compare the treatment for colonoscopy prep, and SDI/C patient population. The exclusion criteria include no discussion of target population or practice, and not a results paper.

Evidence Search Results

Initial database search yielded 2513 articles using all the search words identified. Additional records searched through other sources yielded 2831 articles. Three thousand records were removed due to duplication, with another 1726 removed due to no relevance to target population of SCI/D patients or colorectal screening. Once the records were screened, there were 600 articles remaining for further review. Five hundred records were excluded based on exclusion criteria and 100 records with full text were assessed for eligibility. Further review of those full text articles resulted in 89 articles excluded because they did not fit the target population, were not a results paper, or did not deal with colonoscopy prep for colorectal screening. There were 11 studies included in the synthesis (see Figure 1).

The remaining articles were assessed using the Johns Hopkins EBP Model and were graded by level and quality (Dang & Dearholt, 2017). The search results used for this paper

ranged from Level I to Level V (see Figure 2). Five articles were Level I, three articles were Level II, one article that was a Level III, and two articles were Level V. Three articles had a grade C, five articles had a grade B, and three articles had a grade A. Two of the 11 articles were systematic reviews. The information assessed in the articles supports the practice recommendation of developing a guideline to practice for SCI/D patient's bowel prep. A summary table for all included research studies and systematic reviews can be found in Appendix A and Appendix B.

Themes with Practice Recommendations

A patient with a spinal cord injury undergoing a colonoscopy preparation varies in degrees of achievement depending on the method of preparation and the degree of injury. The synthesis of literature review findings acknowledged strategies that are reliable and consistent to developing a guideline that will provide details of how to order the colonoscopy preparation. Themes included the prep procedure, patient compliance, patient tolerance to the prep, and the level of SCI injury.

Prep Procedure

Patients with SCI/D have complicated colonoscopy preparations due to their neurogenic bowel. To address this, the literature supports recommendations for the bowel prep procedure within this population. Throughout the literature, it is shown that the length of time to achieve an adequate bowel prep for this population may be up-to three days versus the one day for patients without injury (Solenberg et al., 2020). This is challenging for the SCI/D patient to achieve without adequate support. The literature recommends for this population an inpatient admission for adequate preparation including medication administration, hygiene, and diet.

Prep materials include recommendations for polyethylene glycol-3350 along with the electrolyte colonic lavage solution (PEG-ELS) to prep the patient for a colonoscopy. The patients receiving colonoscopy prep need to be inpatient and placed on a clear liquid diet up to 3 days before the procedure and then nothing by mouth (NPO) at midnight the night of the

procedure (Clark et al., 2014; Song et al., 2018). Polyethylene glycol (PEG) invented in 1980, became one of the most used bowel preparation regimens (Jin et al., 2016). While PEG is the most common, the incorporation of MoviPrep has since been used to help facilitate the cleansing of the neurogenic bowels. The multiple combination of prep has been shown to be more effective than a single intervention (Gkolfakis et al., 2019).

Patient Compliance and Tolerance to Prep

Colonoscopy preparation in a patient with SCI/D can be complex since these patients have neurogenic bowels. A patient's tolerance of the prep is key to the success of the colonoscopy. The endoscopists needs to visualize the colonic mucosa, therefore the bowel preparation needs to be of the best quality. It is vital to understand the factors affecting the ability to detect adenomas and carry out a high-quality examination (Clark et al., 2014). The full bowel preparation has been tolerated by more than half of inpatients (Song et al., 2018). The patient must be compliant with drinking the solution for it to work properly. When a patient cannot tolerate the prep, alternatives can be used to help them with compliance. When there is poor tolerance, this leads to noncompliance which means the patient cleansing is ineffective leading to the failure of the procedure (Jin et al., 2016). The reasons that some do not adhere to the pre-procedural preparation varies, including concern for peri-procedural injury. Less than 1% of cases have serious complications after a colonoscopy and are almost never life threatening (Hayman et al., 2013).

Level of Injury

The level of injury is important when considering what the bowel prep should be for a patient with an SCI/D. A patient with a high SCI/D (C1-C4) is unable to drink the prep on their own. This can limit the amount of the prep that the patient intakes. For those patients who can use their arms the prep is easier to drink on their own. Each level of injury can determine the way the prep may go and the success or failure of the colonoscopy. "Sixty-eight percent of patients had a cervical level of injury and the majority were either American Spinal Injury

Association Impairment Scale A (41%) or D (43%)” (Song et al., 2018, p. 149). Each patient with a SCI/D has a neurogenic bowel and depending on the level of injury the patient may need more prep than another patient.

Practice Recommendations

The literature supports the development of a guideline for care facilitation in the SCI/D patients undergoing bowel cleansing for preparation of colorectal screening by colonoscopy. The supported contents of the guideline include recommendations for pre-procedure admission criteria to provide therapeutic support during preparation, diet, hygiene, and prep solutions clinical decision criteria.

The support further develops the practice recommendation to implement the guideline, once developed, to the SDI/D patient’s colonoscopy prep process to effectively screen for colorectal cancer.

Setting, Stakeholders, and Systems Change

The evidence-based project setting is the specialized population 71-bed acute and rehab care unit in Augusta, Georgia. The hospital provides a full range of medical services, and the spinal cord unit is the hub for all spinal cord units serving several states. In addition to inpatient care, the unit supports outpatient services including urodynamics, comprehensive annual res, care and routine follow up for acute medical problems, and SCI telehealth. Any person with spinal cord injury meeting eligibility requirement for specialized healthcare can receive care in the SCI Center. The mission of the VA is to care for those who shall have borne the battle and for their families and survivors (VA Augusta Health System, 2020).

The unit is divided between acute and rehab beds, with acute care housing 41 beds and the rehab housing 30 beds. The rehabilitation unit brings in patients who have been injured and teach the patient how to live with their injury. The patient undergoes through extensive rehabilitation, along with teaching the patient how to evacuate the bowels, and deal with their

neurogenic bladder. The acute care beds are for patients admitted for acute medical reasons such as pneumonia, annual exam, wounds, sepsis, and colonoscopies.

Stakeholders

The stakeholders are intrinsically involved in the health care system and are directly affected by transformations to the system. The stakeholders within SCI include the nursing staff (registered nurses, licensed practical nurses, and health technicians), providers, social workers, psychologists, dieticians, physical and occupational therapists, patients, families, caregivers, medical support assistants, chaplains, pharmacists, and visitors. For this project, the stakeholders also extend to the gastroenterology team of nurses, physicians, and coordinators.

System Change

The development and implementation of a guideline for bowel preparation for SCI/D patients undergoing colonoscopy is a meso-level change. This change will include team members within the healthcare organization (SCI unit, gastroenterology unit) as well as the patient and their support services.

SWOT

A SWOT analysis was completed to identify the strengths, weaknesses, external opportunities, and threats (see Figure 3). The strengths and opportunities will be continued while the weaknesses and threats will be alleviated. The strength of support from the administrator of the hospital, section chiefs, and the opportunities for decreasing length of stay along with improving the care will benefit the patient population. The weakness includes high variability in prep selection and process steps between providers. The external threat consists of sustaining the guideline to practice when a patient cannot tolerate the prep.

Implementation

The project plan began with the selection of a change model that guided the project through the stages of change management. The Kotter 8-step model helped the leaders of the facility make efficient and effective change. The project plan included the steps for change, the

role of stakeholders in the change, the financial budget, and timeline. To achieve success with this project, the project manager's role included effective communication, transparency, and trust.

Project Objectives

The objective of this EBP change project was to develop and implement a guideline for bowel preparation for colorectal screening for patients with SCI/D to increase the rate of success for first attempt colonoscopy screening by >50% compared to baseline by the end of the 8-week implementation period. The gastrointestinal physicians will grade the efficacy of the bowel prep and determine if the colonoscopy is complete on the first attempt. However, if the prep was not adequate, the patient will have to repeat the prep process and return to have the procedure done again. The development and implementation of the guideline increased the likelihood of success on first attempt by standardizing the plan of care for this population through a standard prep process, including clinical decision support through structured order sets, provider education, and screening for completion prior to the patient arriving to the endosuite.

Kotter's Change Theory

When creating a major change in a workplace it is essential to use a model that will help implement a change powerfully and successfully. Kotter's eight stage process for creating a major change is one of the most widely recognized models for change management (Pollack & Pollack, 2015). Each step helps create a project able to be implemented and sustained.

The first step created a sense of urgency through case audits that identified cases aborted, cancelled, or repeated due to inadequate quality bowel prep. The high volume of pre-guideline repeated preparations and procedure resource utilization prompted the team to become engaged in the change. This effort moved the concern from theoretical to tangible.

The second step, informed by the first, saw the stakeholders form a powerful coalition guided by the project manager. This coalition was comprised of nurses, providers, and other

stakeholders to understand and verify the process as developed remains sustainable. With each represented group reviewing the evidence from the literature and subsequently developed guidelines local support for the practice change grew and was championed. From these guidelines a paper standard order set was developed to address the two patient pathways (see Appendix C).

The third and fourth stage moved beyond the initial stakeholder group and provided the project manager an opportunity to promote the change to a larger audience, to show the vision of the project and ensure understanding of why the change was necessary to have evidence-based clinical decisions guiding practice. Understanding the capacity to standardize the process and reduce steps for the providers was important to developing buy-in, but ultimately the key message was to improve the patient experience and prompt successful cancer prevention services through an equitable process for the SCI/D patients. Consistent application of messaging, educational opportunities provided to all providers at varied intervals, and reinforcement of the need for change were communication strategies employed during the project.

The fifth step addressed identified barriers that need to be removed for successful implementation. The greatest barrier to success was past lived experience by the SCI/D patients and their lack of trust with the system. Like the messaging and education of the clinical providers, a communication process was developed for the patients to understand the new admission routine, expected length of time for the prep and procedure, and what their experience would look like under the new guidelines.

The sixth step encouraged the project team to celebrates the short-term wins, check the guideline implementation process for any barriers to facilitate improvement, and to continue with communication strategies to ensure momentum is maintained. Steps seven and eight were addressed during the analysis and evaluation of the change, as improvement was actualized and communicated and previously voiced concerns were addressed. Steps seven and eight

were essential for sustainability measures, including performance feedback, case auditing, and quality measure reporting for successful bowel cleansing. This sustainability of the improved process enhanced patient reported patient satisfaction with the prep process and reduced length of stay.

Barriers and Facilitators

EBP projects are expected to have barriers and facilitators which assist in identification of concerns related to achieving successful change. One barrier identified in this project was the need to create an EBP guideline that was specific to the SCI/D patients, but also flexible enough to ensure patient specificity for unique needs. This concern was addressed through the consensus building process with the guideline in which two clinical decision support order sets were developed for different prep solution needs based on the type and severity of the patient's SCI/D. Another barrier that was overcome during this change process was the habitual practice of provider dependent/varied preparation solution orders. Through standardization of the process, it provided consistency for the facility in terms of resource allocation (e.g., medication, staff, beds, procedure suites). Management support of the change process was fundamental in navigating the need to become standardized based on the best available evidence. This support facilitated the successful change, ensured product availability in a timely manner, and provided the ability to anticipate staffing resources for expected length of stay.

Project Schedule

Approval from the EPRC from the University of St. Augustine for Health Sciences (USAHS) must be obtained before implementation of the DNP EBP project. After the approval of USAHS is given, the project will be submitted to Augusta VA hospital for review. Each of the providers received information about the new guideline to practice for bowel preparation in the SCI/D population and its importance. The intervention included clear goals, policy review, and potential outcomes if utilized appropriately. The project implementation should occur over the course of eight weeks. A detailed project timeline is presented in Appendix D.

Budget and Resources

While preparing for a colonoscopy, there are certain items needed for the process prep. The providers needing education about the guideline will receive this during work hours with limited to no additional expense anticipated. Supply budgets include the cost of the medication for prep (between \$286-302 per medication), cost of inpatient services, and cost of procedure services (facility and professional) The goal of this project is to reduce the expenditure of duplicate and repetitive services due to inadequate preparation. The savings of a prep being done only once is approximately \$2588 dollars in direct costs, this is the cost of prep and an additional hospital stay. The budget and resources are identified in Table 1.

Project Management Role and Leadership Skills

The project management role is vital to the success of the EBP. The role of the project manager is to demonstrate leadership skills crucial to the project such as being flexible, open minded, a good communicator, and an efficient listener. The project manager for this project will develop the EBP change, educate providers and staff to the new guideline, assist the team with meeting the time frame of the project, effectively manage the budget, and realize the scope for implementation to reach the goals.

Educational Plan

A virtual educational offering was provided to the providers and clinical staff. This offering included synopsis of the evidence used to construct the guideline and a thorough review of the practice change including new associated workflows based on the new guidelines for prepping a SCI/D patient for colorectal screening through a colonoscopy (Johnson et al., 2014). The intervention included an overview of colorectal screening, pathophysiology, and current evidence-based recommendations for appropriate treatment through the usage of the new guidelines. For anyone unable to attend the live broadcast, a recording was made available. Pre- and post-survey of knowledge transfer was obtained to validate understanding of concepts and new practice expectations. The pre-event survey to understand baseline

understanding of the needs of the SCI/D patient undergoing colonoscopy prep was made available prior to the live-stream and recorded educational offering, and the post-event survey was distributed after completion.

Types of Measures

Measurement is a critical part of testing and implementing changes because measures tell a team whether changes, they make lead to improvement (Institute for Healthcare Improvement [IHI], 2020). There are three types of measures that are used as a balance set of measures for improvement efforts. The main outcome measure for this project is to achieve better access to colorectal screening and assure the patient must only be prepped once. The process measures are the steps that help guide the project to the optimal outcome (IHI, 2020). The measures are outlined in the guideline that will assist in reaching the overall outcome of this project. The balancing measures looks at a problem from all different directions. When a patient fails the colonoscopy the first time it is vital to look at what went wrong in the process. The financial measures look at the direct and indirect expenses related to the project. The cost of each prep and how much is needed for a colonoscopy is looked at against how much prep was used for each colonoscopy. See Appendix E for additional details.

Evaluation Design

Frequencies and percentages were calculated for means passed/failed. The percentages were calculated using a descriptive analysis. The Intellectus Statistics software was used to calculate descriptive statistics on pass or fail. Data from the pre- and post-guideline implementation period was used to compare the success rate of the colonoscopies.

Validity and Reliability

To determine the reliability of the project the project manager will set standardized collection and interpretation methods. The project manager along with a statistician will supervise the quantitative data collection process. This will help safeguard project data analysis.

The validity will be determined if the project can be duplicated again. If the guideline is used as outlined, will show the reliability and the validity of the project (Middleton, 2021).

Data Collection

Data were collected on SCI/D patients who were scheduled for a colonoscopy, with refusal to participate in bowel prep regimen (and ultimately the colonoscopy procedure) as an exclusion criterion. No additional demographic indicators were collected. For those patients identified as meeting inclusion criteria (SCI/D patient who completed prescribed bowel prep), each patient was identified on the data collection tool by a randomly assigned letter by the procedure admissions nurse and was rated per quality standards by the endoscopist for bowel prep completion as pass or fail. Those classified as fail had to repeat the bowel prep process. Results of the pass/ fail rate was entered by the admissions nurse at the conclusion of the procedure and stored securely in a locked room without general access. Data tools were then collected and transcribed by the project manner onto a secure, password protected system in a locked room. Data security, HIPAA, and hospital privacy standards were maintained at all times. See Appendix F for data collection tool.

Results

The aim of this project was to improve the success rate of completion of colonoscopy on first attempt for patients with SCI/D through a standard approach to bowel preparation with support. The initial needs assessment validated varied clinical practice, patient dissatisfaction, and avoidance of screening for early detection of colon cancer due to disparities in access to resources included support during bowel preparation for SCI/D patients. An evidence-based guideline was created to facilitate the bowel prep process to successful completion of the colonoscopy. During the eight-week evaluation period, sixteen patients met the inclusion criteria to participate in the project. The number of successful colonoscopies before the guideline and after the guideline was compared.

Data Analysis

Evaluation of knowledge transfer was completed using two-portion z-test to determine if there was a significant difference between the proportion of pre- and post- education knowledge based on survey results. The result of the two proportions z-test was significant based on an alpha value of 0.05, $z = -3.60$, $p < .001$, 95% CI = [-0.82, -0.24], indicating the null hypothesis can be rejected. This result provides suggestion that the post- survey was significantly different than the pre-survey, with the pre-survey significantly lower than the post-survey. This indicates a knowledge transfer occurred. The 95% confidence interval for the difference between the proportions of Pre and Post is -0.82 to -0.24. Table 2 presents the results of the two sample proportions z-test.

During the data collection period from July 25, 2021, to Sept 19, 2021, 16 patients met the inclusion criteria and were prepped for colonoscopy. Two patients were excluded for refusal. Aggregate pre-implementation data averaged successful colonoscopies on first attempt for SCI/D patients at a rate of 25%. Approximately 75% of the patients with SCI/D required repeat of the prep process, longer length of stay, additional appointment for colonoscopy, and expressed dissatisfaction with the procedural preparation process and care experience. After the implementation of the evidence-based guideline, the rate of successful colonoscopies on the first try increased by 214%. This data supports that there was a significant change once the evidence-based guideline was implemented.

Table 2

Two Proportions z-Test for the Difference between Pre and Post

Samples	Responses	<i>n</i>	Proportion	<i>SD</i>	<i>SE</i>
Pre	5	20	0.25	0.43	0.10
Post	11	14	0.78	0.41	0.11

Note. $z = -3.60$, $p < .001$, 95% CI: [-0.82, -0.24]

Project Significance

The clinical project demonstrated the evidence and need for the evidence-based guideline to be implemented permanently into the order set for the providers to use. The PICOT outcome of the project was to increase the success of colonoscopies on the first trial. The intervention achieved a 214% increase of patients passing their colonoscopy the first time. As a result, this EBP project was recognized as an improved clinical significance for the patients who have SCI/D (see Appendices F and G). This clinical significance not only increased the rate of successful colonoscopies along with decreasing length of stays and increasing the patient satisfaction. With increasing the successful colonoscopies, it also reduces the cost of materials. Additionally, with the success of the colonoscopy EBP the hospital is using the evidence-based guideline is being implemented into the order set for Spinal Cord.

Impact

The goal of this project was to address the issue of prepping patients with SCI/D for colonoscopies. This project was developed because so many of the patients were having to repeat their prep multiple times. There were limitations that started out during the project that were perceived at the beginning of the project. The buy-in from the providers was difficult to achieve in the beginning. Educating the providers along with the nursing staff was the only way to help the providers understand how important providing the prep in a certain way would make a difference for our spinal cord patients. Before the project implementation, the providers were not putting in consistent orders. Since the education and implementation, both the providers and the nurses understood that due to the neurogenic bowels of the SCI/D patient it is imperative that following the guideline was best for the patients.

The intervention showed a 214% improvement over pre guideline time. This was a significant measure of success for the project but more importantly it was a significant improvement in screening access equity for the patients who are impacted by a spinal cord injury/disorder. The primary action of this project was to provide a guideline that would help with

the prep so that patients do not have to repeat the prep multiple times. The project increased awareness of the providers, nurses, and stakeholders. The providers and nurses educated the patients about the importance of taking the prep as it was ordered. Even with the standardization and improved efficiency, patient autonomy remained respected for those patients who decided to forego the bowel prep and screening procedure.

Aside from the initial limitation of the provider buy-in there were identified resource gaps with produce availability. This caused delay in timely administration of prep. Additionally, there was an opportunity identified to improve clarity regarding diet orders surrounding whether to continue with prep solution administration or to hold when prep was ordered for 4 AM after a previously entered “nothing by mouth after midnight” diet order was entered. This resulted in a new order sentence of “nothing by mouth after midnight except for bowel prep”. Additional clarifications will continue as part of the sustainability process as more patients experience the new process.

To sustain the improvements realized in this project, the facility is shifting the guideline from a paper order set as during the pilot to an electronic SCI/D order set informed by the guideline. This will allow the providers to utilize the CPOE process to enter orders, decrease duplicate efforts, and provide advantages of automated support such as allergy checking. Additionally, as new providers onboard the established process will be readily available to adapt into practice when presented as the established practice of the facility. The process will be monitored by the chief of spinal cord as well as the chief of gastroenterology.

Dissemination

At the end of a project whether successful or not there is a need to disseminate the outcome to the stakeholders, team members, and the institution. With the success of this project, it was very rewarding to be able to share the outcome with everyone so that they could see that the guideline was indeed helpful for the spinal cord injury patients who need colorectal screening. Data analysis validated a 214% improvement to successful colonoscopy completion

at the initial attempt compared to 3 in 4 failing initial colonoscopy attempts prior to guideline implementation.

Project outcomes were disseminated to key internal stakeholders including department chiefs, hospital administration, and project team members. Further dissemination to all internal providers and clinical staff occurred through a brief article published in Spinal Cord Monthly newsletter outlining the project, outcomes, and next steps. Oral poster presentation for project dissemination completed at University of St. Augustine Health Sciences for nursing faculty and students. For additional dissemination regionally and beyond, an abstract submission to the Paralyzed Veterans Association regional conference for poster presentation to disseminate to larger audience of clinical providers, patients, and caregivers showcasing improvement in success at first attempt for screening and therapeutic colonoscopy when protocol is in use. Manuscript submission to SOAR@USA for dissemination through open access provided content sharing to global audience.

Conclusion

Developing and implementing a guideline for care for patients with SCI/D presented consistent application of preparation process steps to help with the decreased colonic motility experienced in this population resulting in successful completion of screening for colorectal cancer. Continued utilization of this guideline ensures the SCI/D patient will receive the appropriate prep and enjoy success by completing the colonoscopy process the first time. With colorectal cancer being a leading cause of death in patients with SCI/D, having a screening that is successful with the prep is crucial. This process also allows for patients to decrease their length of stay in the hospital. Most importantly, the patient will be more satisfied with the process and their stay in the hospital.

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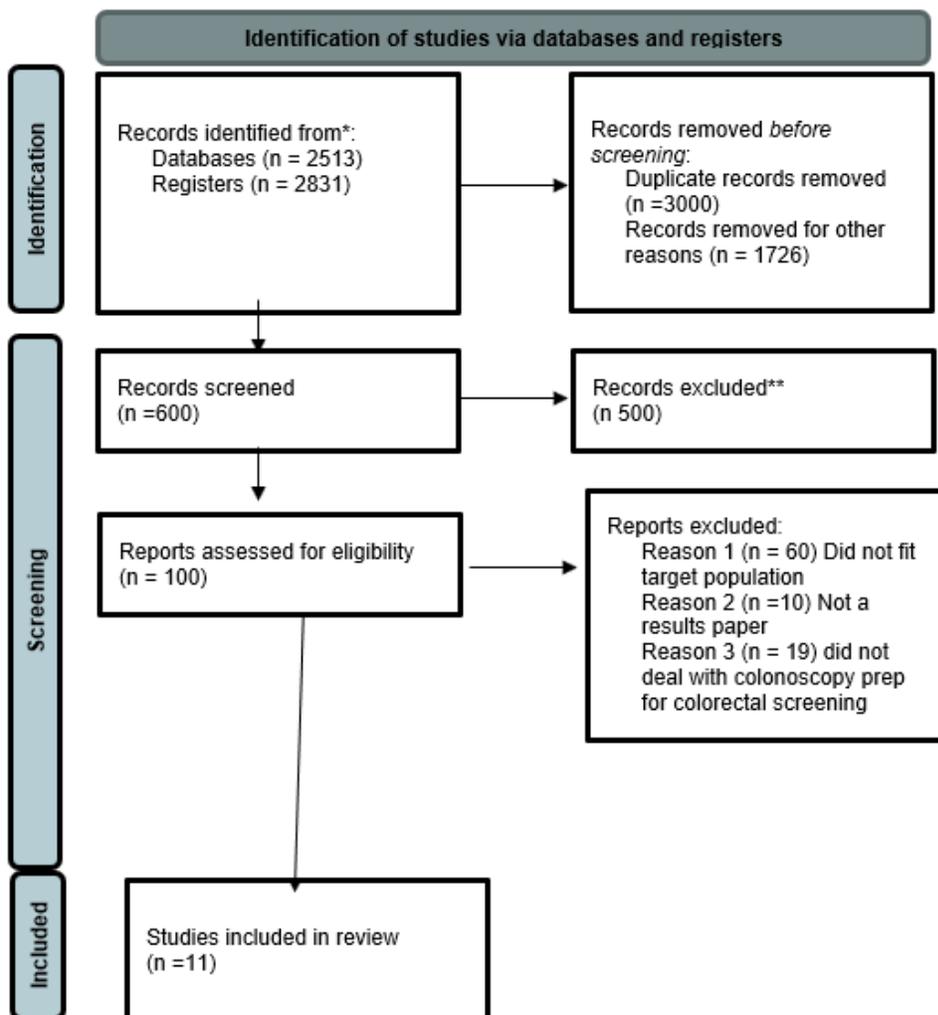
https://www.augusta.va.gov/services/Spinal_Cord_Injury.asp

Table 1*Project Budget and Revenue Description*

Budget	
<hr/>	
Expenses	
Prep Supply per colonoscopy	
GoLytely	\$306
MoviPrep	\$286
Revenue	
Projected Savings per colonoscopy	
Repeat prep avoidance	\$596
Reduced length of stay	\$2000/day

Figure 1

PRISMA Diagram



Note. Adapted from: “The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews,” by M.J. Page, J.E. McKenzie, P.M. Bossuyt, I. Boutron, T.C. Hoffmann, C. D. Mulrow, L. Shamseer, J. M. Tetzlaff, E. A. Akl, S. E. Brennan, R. Chou, J. Glanville, J. M. Grimshaw, A. Hróbjartsson, M. M. Lalu, T. Li, E. W. Loder, E. Mayo-Wilson, S. McDonald...& D. Moher. *PLoS Medicine* 18(3): e1003583 (doi:10.1371/journal.pmed1000097). Copyright 2021 by The PRISMA Group.

Figure 2*Level and Grade of Evidence*

Level I	Level II	Level III	Level V
5 articles	3 articles	1 article	2 articles
Grade A	Grade B	Grade C	
3 articles	5 articles	3 articles	

Figure 3

Strengths, Weakness, Opportunities, and Threats

<p>Strengths</p> <ul style="list-style-type: none"> a. Significant support by the hospital chief and the unit chiefs b. Motivation to screen all SCI patients for colorectal cancer 	<p>Weakness</p> <ul style="list-style-type: none"> a. Multiple ways of providers prepping the patient for a colonoscopy
<p>Opportunities</p> <ul style="list-style-type: none"> a. improve the care for the patient population b. decrease the length of stay 	<p>Threats</p> <ul style="list-style-type: none"> a. sustaining the guideline when a patient cannot tolerate the prep

Appendix A
Evidence Table

Citation	Design, Level Quality Grade	Sample Sample size	Intervention Comparison	Outcome Definition	Usefulness Results Key Findings
Hayman, et al. (2013).	Design: Retrospective observation Level: II Grade: B	440 colonoscopies comprising of 148 SCI patients and 292 age-and gender-matched controls	Several Limitations: Although our sample size is large, we did not have a control group. Study was conducted at two of the largest VA SCI centers it is possible that practices at these centers do not generalize to other VA SCI centers	Outcome measures included quality of bowel preparation, completion rates, procedural duration, and benign and malignant disease detection.	Incomplete colonoscopy most commonly due to poor preparation and looping in both groups The polyp detection rate was lower in the SCI group but there was no difference in malignancy

<p>Kao, et al. (2016).</p>	<p>Design: Retrospective cohort study Level: II Grade: A</p>	<p>A total of 41,900 patients diagnosed with SCI between 2000 and 2011 were identified from the National Health Insurance Research Database Each of the SCI patients was randomly matched with 4 people from the general population</p>	<p>The X2 test and student t test were used to evaluate the allocation of categorical and continuous variables respectively, between the SCI and non-SCI cohorts.</p>	<p>Each subject was monitored from the index date until a new diagnosis of cancer or until the subject was censored because of loss to follow-up, death, withdrawal from insurance, or the end of follow-up on December 31, 2011</p>	<p>No significant difference in overall non-GU cancer risk was observed between the SCI and control groups The diverse patterns of cancer risk among the patients with SCI may be related to the complications of chronic SCI.</p>
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		without SCI according to age, sex, comorbidities and index year			
Korsten, et al. (2015).	Design: Randomized study Level: I Grade: B	27 SCI subjects	Comparing whether the addition of neostigmine to MoviPrep before elective colonoscopy produced a higher percentage of acceptable bowel preparations in patients with SCI to not adding the neostigmine	Receiving an acceptable Ottawa Score (OS) which is <3 means the quality of the cleansing preparation for colonoscopy was good.	Administration of MoviPrep alone resulted in suboptimal bowel cleansing When the neostigmine added to the MoviPrep it markedly improved the quality of the bowel preparation, with 85% of its patents then having a acceptable Ottawa score

<p>Korsten, et al. (2018).</p>	<p>Design: Phase I clinical trial</p> <p>Level: I</p> <p>Grade: C</p>	<p>25 participants of which 4 was excluded</p>	<p>The power of our study is too low to designate the 24% difference in BM between TD and IV route as statistically significant</p> <p>Sample size of this and our other studies are small</p> <p>Further diminished application of stringent exclusion criteria for safety reasons</p>	<p>All groups reported the anticipated cholinergic side effects. However, individuals who received IV NEO/GLY experience a greater number of side effects. All individuals who responded to the IV NEO/GLY received TD low dose NEO/GLY and 5 responded with a BM within 60 min</p>	<p>Individuals receiving IV NEO/GLY demonstrated significantly greater change in MAP when compared to combined TD groups at the 5 min interval</p>
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<p>Lyons, et al. (2015).</p>	<p>Design: observational, single-blinded study Level: I Grade: C</p>	<p>24 subjects with SCI</p>	<p>Variables are reported as mean +/- SD. A contingency table and Chi-square analysis was used to determine the significance of the percentage of acceptable preparation. The level of significance was set at 0.05 for all analyses</p>	<p>Patients with SCI who received PIEE tended to have lower Ottawa scores and a higher percentage of acceptable preparations than did those who received PEG</p>	<p>In subjects with SCI neither PEE nor PEG produced acceptable bowel preparation for elective colonoscopies.</p>
<p>Martin, et al. (2016).</p>	<p>Design: retrospective, observational study Level: II</p>	<p>28,368 colonoscopies half were male and the average age was 61 +/- 9 years</p>	<p>Variables were reported as mean, standard deviation, median, and range for continuous variables, and percentage for categorical variables. A two-tailed p-value was calculated for all test and p<0.05 was</p>	<p>Compared with PEG, magnesium sulfate had a poorer quality of bowel preparations (OR0.6, 95% CI 0.40.9; pB0.05), whereas the quality</p>	<p>When possible, sodium sulfate-based preparations should be recommended in the community setting for colonoscopy because of their high quality of bowel preparation.</p>

	Grade: A		considered as being of statistical significance.	of bowel preparation was significantly improved by using sodium sulfate (OR5.7, 95% CI 5.46.1; pB0.001) and sodium phosphate (OR2.1, 95% CI 1.82.5; pB0.001)	
Song, et al. (2018).	Design: retrospective, case series Level: V	53 SCI patients. All patients were male with a mean age of 64.1	Several limitations Small number of patients who had inadequate quality bowel preparation, Limited statistical power to identify factors associated	Patient characteristics, tolerance of full bowel preparation, pre- and post-bowel preparation electrolyte values,	Sixty-eight percent of patients had a cervical level of injury and the majority were either American Spinal Injury Association

	Grade: A		with poor quality bowel preparation	adverse events, and adequacy of bowel cleansing were abstracted.	Impairment Scale A (41%) or D (43%)
Teng, et al. (2018).	Design: Retrospective Chart Audit Level: V Grade: B	255 patients were included in the study. 85 patients with SCI	Data are expressed as mean +/-standard deviation. The fishers exact test or Chi Square. All statistical analyses were performed with SPSS for windows	Average risk screening was a more common colonoscopy indication in patients with SCI vs the control population. No difference in adequacy of bowel preparation or adenoma detection rate.	The study demonstrated that an extended bowel preparation for patients with SCI produces similar bowel preparation results and diagnostic yield when compared to patients without undergoing colonoscopy

<p>Solenberg , et al. (2020).</p>	<p>Design: Qualitative Study Level: III Grade: B</p>	<p>Interviews with 30 individuals with SCI/D were conducted using a semi-structured interview guide, audio recorded, and transcribed.</p>	<p>Data were analyzed using the six-step thematic analysis outlined by Braun & Clark. Data familiarization occurred by reading and listening to the interviews before the coding process</p>	<p>Themes identified included barriers to CRC screening, such as socioeconomic, health systems, transportation, psychological, and environmental or accessibility barriers.</p>	<p>Specific evidence-based guidelines on the use of stool specimens first with follow up direct visualization, if needed, should be developed for this population.</p>
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Appendix B

Summary of Systematic Reviews (SR)

Citation	Quality Grade	Question	Search Strategy	Inclusion/ Exclusion Criteria	Data Extraction and Analysis	Key Findings	Usefulness/ Recommendation/ Implications
Gkolfakis, et al. (2019).	Quality: Level I Grade: C	What type of interventions are used to substantially improve inpatient's bowel preparation?	A systematic literature review	Eligibility criteria were a priori delineated using the PICO statement. Any type of trial published as full text in English language was included, while pediatric studies, meta-analyses or systematic reviews, editorials, case reports, narrative reviews, and conference abstracts	Extracted data were analyzed using the statistical software Review Manager To assess the quality and the risk of bias of the included randomized	The analysis did not find solid evidence to support that specific types of cathartics or alterations in timing of their administration could result in better mucosa visualization.	The evidence to strongly support a similar conclusion regarding inpatients is quite low deriving only from 1 RCT and 5 non-randomized studies.

				Studies that did not detail patient information and duplicate publications were excluded	and nonrandomized study, we used the Cochrane collaboration tool and the 38 Newcastle-Ottawa scale	Acknowledge a series of limitations in the study. The principal limitation lies in the heterogeneity encountered calling for careful interpretation of our results.	
Kurlander, et al. (2016).	Quality: Level I Grade: B	How efficacious are patient education interventions to improve bowel	A systematic literature review	Inclusion criteria were: a patient education intervention; a primary aim of improving bowel preparation; a validated bowel preparation scale; a prospective design; a concurrent control group, and adult participants	A structured form was used to extract data on a patient sample (size and inclusion/exclusion criteria,	1080 abstracts were screened. Bowel preparation significantly improved with the intervention in all but one study. All but one study was	Patient education interventions appear efficacious in improving the quality of bowel preparation.

		preparation for colonoscopy?			study design, study setting, content and format of both intervention and control preparation used and outcomes	done in a single center. Validity scores ranged from 13 to 24.	
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Appendix C

Evidence-Based Guideline for Practice: Colonoscopy Preparation for Patients with SCI/D

Purpose

The evidence-based guideline to care will provide help with preparing the patient with a spinal cord injury/disorder in preparation for a colonoscopy. This preparation guidance provides an adequate preparation for colonoscopy procedure and to decrease the number of repeat procedures.

- A. Preparing the patient for hospital admission
 - a. One week prior to colonoscopy counsel the patient to abstain from recreational drugs.
 - b. Advise to hold the following medications: iron supplements (including preparations containing added iron), aspirin or aspirin-containing medications to include antacids/antidiarrheals that contain salicylate (such as bismuth subsalicylate including Pepto-Bismol, Maalox Total Relief, Kaopectate) or, anticoagulants, which may include warfarin (Coumadin), enoxaparin (Lovenox), clopidogrel (Plavix).
 - c. Advise diet change day prior to admission: abstain from red meat, high residue foods such as seeds, nuts, vegetables, and salads.
 - d. Advise to bring all medications lists and dosages.
- B. Preparing the patient for the colonoscopy preparation (in addition to normal admission orders and patient-specific medication regimen).
 - a. Day 4 (96 hours) before the procedure
 - i. Admission to facility, inpatient, greater than 2 midnights.
 - ii. Diet: regular diet all meals until dinner/evening meal; convert diet to colonoscopy clear liquid diet with Jell-O
 - iii. Pre-procedure lab draw x 1: CBC, CMP, magnesium, PT-INR, PTT
 - b. Day 3 (72 hours) before the procedure
 - i. Diet: colonoscopy clear liquid diet with Jell-O all meals
 - ii. MoviPrep (peg-3350, sodium sulfate, sodium chloride, potassium chloride, sodium ascorbate) 2 liters PO in begin at 1200hrs (noon).
 - iii. If movie Prep is on unavailable then use Magnesium citrate 1.745g in 10-ounce bottle x 1 bottle PO at 1200hrs (noon).
 - iv. Bisacodyl 40mg PO once at 1300.
 - c. Day 2 (48 hours) before the procedure
 - i. Diet: colonoscopy clear liquid diet with Jell-O
 - ii. Electrolyte peg-3350 4 liters PO begin at 1200hrs (noon). Instruction comment: Drink one 8-ounce glass every 10 minutes as tolerated until 4 liters are consumed.
 - iii. Tap water enema x1 in PM
 - d. Day 1 (24 hours) before the procedure
 - i. Diet: colonoscopy clear liquid diet with Jell-O
 - ii. Electrolyte peg-3350 4 liters PO begin at 1200hrs (noon). Instruction comment: Drink one 8-ounce glass every 10 minutes as tolerated until 4 liters are consumed.
 - iii. Tap water enema x1 in PM
 - iv. NPO at midnight
 - e. Day of procedure
 - i. Insert peripheral IV catheter.

- ii. IV Fluids: normal saline 1000ml at rate 50ml/hr.
- iii. Electrolyte peg-3350 4 liters PO begin at 0400. Instruction comment: Drink one 8-ounce glass every 10 minutes as tolerated x 2 hours. At end of 2 hours may stop administration.
- iv. Tap water enema x1 at 0700.
- v. Procedure scheduled at 1000

For patients who cannot tolerate Electrolyte peg-3350 (GoLyteLy) solution

- A. Preparing the patient for hospital admission
 - a. One week prior to colonoscopy counsel the patient to abstain from recreational drugs.
 - b. Advise to hold the following medications: iron supplements (including preparations containing added iron), aspirin or aspirin-containing medications to include antacids/antidiarrheals that contain salicylate (such as bismuth subsalicylate including Pepto-Bismol, Maalox Total Relief, Kaopectate) or, anticoagulants, which may include warfarin (Coumadin), enoxaparin (Lovenox), clopidogrel (Plavix).
 - c. Advise diet change day prior to admission: abstain from red meat, high residue foods such as seeds, nuts, vegetables, and salads.
 - d. Advise to bring all medications lists and dosages.
- B. Preparing the patient for the colonoscopy preparation
 - a. Day 4 (96 hours) before the procedure
 - i. Admission to facility, inpatient, greater than 2 midnights.
 - 1. Diet: regular diet all meals until dinner/evening meal; convert diet to colonoscopy clear liquid diet with Jell-O
 - ii. Pre-procedure lab draw x 1: CBC, CMP, magnesium, PT-INR, PTT
 - b. Day 3 (72 hours) before the procedure
 - i. Diet: colonoscopy clear liquid diet with Jell-O all meals
 - ii. Magnesium citrate 1.745g in 10-ounce bottle x 1 bottle PO at 1200hrs (noon).
 - iii. Bisacodyl 40mg PO once at 1300.
 - c. Day 2 before the procedure
 - i. Colonoscopy clear liquid diet with Jell-O
 - ii. Magnesium citrate 1.745g in 10-ounce bottle x 1 bottle PO at 0800hrs.
 - iii. MoviPrep (peg-3350, sodium sulfate, sodium chloride, potassium chloride, sodium ascorbate) 2 liters PO in begin at 1400hrs.
 - iv. Tap water enema x1 in PM
 - d. Day 1 before the procedure
 - i. Colonoscopy clear liquid diet with Jell-O
 - ii. Magnesium citrate 1.745g in 10-ounce bottle x 1 bottle PO at 0800hrs.
 - iii. MoviPrep (peg-3350, sodium sulfate, sodium chloride, potassium chloride, sodium ascorbate) 2 liters PO in begin at 1400hrs.
 - iv. Tap water enema x1 at
 - v. NPO at midnight
 - e. Day of procedure
 - i. Insert peripheral IV catheter.
 - ii. IV Fluids: normal saline 1000ml at rate 50ml/hr.
 - iii. Magnesium citrate 1.745g in 10-ounce bottle x 1 bottle PO at 0500hrs.
 - iv. Tap water enema x1 at 0700hrs.
 - v. Procedure scheduled at 1000hrs.

	NUR7801								NUR7802								NUR7803								
Activity	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15	
Refine guideline												x													
Begin implementation														x											
Round with stakeholders															x										
Ask for feedback																	x								
Adjust guideline														x	x	x	x	x	x	x	x				
Data collection																			x	x					
Project Evaluation																				x	x	x	x		

Appendix E

Outcome/Process Measure

Measure	Benchmark	Goal	Data Type
Outcome measure: Rate of successful colonoscopies on first attempt	No benchmark yet for facility but would like to see 75%	≥ 95 %	Continuous Data
Outcome measure: Increased staff knowledge on colonoscopy prep	100%	≥ 95 %	Correlational Data
Process Measure Percent of providers completing the survey	100%	≥ 95 %	Continuous Data
Balance Measure Length of hospital stay	An estimated length of stay of 5 days	≤ 4.8 days	Continuous Data
Financial Measure Cost of materials	Supplies GoLytely \$102 per container (\$306. Per colonoscopy) MoviPrep \$143 per container (\$286 per colonoscopy)	≤ \$596 per colonoscopy	Continuous Data
Financial Measure Additional Length of stay	596 for additional prep and 2000 for additional days in hospital	≤ \$2596 per patients	Continuous Data
Sustainability Measure Compliance with the use of the standard of approach	100 %	≥ 95 %	Continuous Data

Appendix F

Data Evaluation Form

Patient Letter	Date Time Last Colonoscopy
Colonoscopy prep with Electrolyte PEG	Yes No
Colonoscopy prep with Magnesium Citrate	Yes No
Ottawa Score	
Patient needs to be prepped again	Yes No
Patient passed the colonoscopy	Yes No