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Evaluation of a Chewing Gum Protocol for Postoperative Spinal Patients

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Abstract

Aims and objectives: The purpose of this project was to evaluate if the implementation of a chewing gum protocol improved bowel motility, decreased ileus rate, length of stay, bowel and pain medication use, and hospital costs in post-surgical spinal patients in a suburban hospital.

Background: Postoperative bowel dysfunction is a major source of health problems, including abdominal pain, ileus, increased length of stay, pain medication use, and healthcare costs.

Design: Retrospective cohort study with a focus on program evaluation of the previously implemented chewing gum protocol. An audit of the electronic health record compared outcomes in patients five months before the intervention (n=123) and after the intervention (n=128).

Methods: A retrospective, randomized audit of the electronic health record was conducted to evaluate 1/3rd of the surgical spinal patients before and after the initiation of a chewing gum protocol on a surgical spinal unit in a suburban hospital in the Midwest. Study variables were time to first stool, length of stay, ileus rate, pain and bowel medication use. Statistical analysis conducted using Mann-Whitney U tests.

Results: While no statistically significant difference identified among study variables, there were clinically significant decreases in ileus rate, median time to first stool, length of stay, and pain medication use post-implementation.

Conclusions: The evidence-based chewing gum protocol in this study indicated clinically significant decreases in pain medication use and ileus along with other small decreases in length of stay and time to first stool in post-surgical spinal patients. Despite lack of statistical significance, the protocol was a safe and inexpensive intervention that reduced patient care costs, with a total return on investment of $18,745.16.

Relevance to clinical practice: Chewing gum has potential to positively affect post-operative patient care outcomes as an inexpensive intervention to decrease pain medication use and promote bowel motility.

Keywords: chewing gum, bowel movement, post-surgical patients, ileus

What does this paper contribute to the wider global clinical community?

- The evidence-based chewing gum protocol in this study indicated clinically significant decreases in pain medication use and ileus along with other small decreases in LOS, and time to first stool in post-surgical spinal patients
- While no statistically significant outcomes, this inexpensive protocol decreased pain medication use and ileus, which resulted in a return on investment of $18,745.16.
- The low compliance to the protocol suggests that with an improved compliance and approach, there may also be improved outcome measures. This protocol may be generalizable to other units and surgery types once the approach is improved and re-evaluated.

Evaluation of a Chewing Gum Protocol for Postoperative Spinal Patients

Introduction

Postoperative gastrointestinal dysfunction is a major source of morbidity, including abdominal pain, ileus, increased length of stay, pain medication use, and healthcare costs (Byrne et al., 2018; Ge, Chen, & Ding, 2015). The cause of impaired bowel mobility postoperatively is believed to be a combination of factors which include: the body's stress response to surgery, the surgical trauma and bowel manipulation during surgery, and the number of opioids and analgesics used (Ge, Chen, & Ding, 2015). There is a circular link where delay in bowel motility from surgery, causes pain, which results in increased use of opioid pain medication, which then contributes to continued delay in bowel motility (Byrne et al., 2018).

The cost of decreased bowel motility following spinal surgery is difficult to quantify. However, the cost of severe impaired bowel motility leading to postoperative ileus in the United States is associated with a 29% increase in hospital stay and costs over $1.75 billion (Keller & Stein, 2013). Patients who develop a postoperative ileus have significantly increased overall complications, reduced quality of life, and increased financial burden three months after surgery (Peters et al., 2020). Even patients with impaired bowel function after surgery who do not develop an ileus experience increased costs from prolonged length of hospital stays, increased bowel and pain medication use, and other testing and consultations (Byrne et al., 2018). Therefore, post-operative care generally includes pharmacologic modalities to improve bowel motility after surgery. Pharmacologic options may result in undesired costs and side effects such as nausea, vomiting, diarrhea, and abdominal cramping (Keller & Stein, 2013). Use of chewing gum after surgery may improve bowel motility without the side effects of pharmacologic modalities.

Impaired post-operative bowel motility is generally affected by multiple body systems and stressors. Therefore, the Neuman Systems Model was chosen to guide interventions, as it helps to identify multiple aspects of patients which may contribute to how patients respond to treatment and recovery (Miner, 1995). This model emphasizes holistic care and prevention of disease which is a goal of this project.

Background

Chewing gum is a non-pharmacologic and inexpensive method with the potential to improve multiple outcomes for patients and the health care system. Chewing gum may improve bowel motility by indirect vagal stimulation and increasing levels of hormones associated with this stimulation (Ali et. al., 2017; Park et al., 2018) which is in alignment with a systems approach to this clinical issue.

A rapid integrative literature review on implementing chewing gum postoperatively yielded 10 studies, nine of which demonstrated a statistically significant positive impact on bowel motility. Benefits of chewing gum during the post-operative period may include reduced need for ileus preventive medications such as rectal suppositories, a decreased length of stay (LOS), fewer post-operative consults, less radiographic imaging, in addition to cost savings for the patient and the health care organization (Byrne et al., 2018).

Chewing gum was well tolerated with minimal to no side effects or complications in the literature. Most of the research on the effects of chewing gum was done on colectomy and cesarean section patients; however, there is potential for the gum to be recommended for patients after other types of surgeries. There is a gap in research regarding use of chewing gum to stimulate bowel motility in post-surgical spinal patients.

Purpose

The purpose of this evidence-based project was to evaluate the implementation of a chewing gum protocol to determine its effects on bowel motility, ileus rate, length of stay, as well as bowel and pain medication use in post-surgical spinal patients in a suburban hospital. Objectives of this project included: improving bowel motility postoperatively; decreasing the length of stay of patients, amount of pain medications and bowel medications used postoperatively, and the ileus rate; evaluating time spent chewing gum and participation rate, identifying barriers to chewing gum use.

Methods (design, data collection, analysis)

This study used a retrospective, randomized audit of the electronic health record (EHR) to evaluate 1/3rd of the post-surgical spinal patients for five months before and after initiation of a chewing gum protocol. The protocol was implemented on a surgical spinal unit in a suburban hospital in the Midwest. Inclusion criteria were age 18 or older, having undergone spinal surgery with recovery on the spinal surgery unit, and hospital stay of less than six days. The protocol was based on the most efficacious method in the literature: implementation of gum as soon as tolerated postoperatively, three times a day for 30 minutes, until return of bowel function or discharge (Ajuzieogu, Amucheazi, Ezike, Achi, & Abam, 2014; Byrne et al., 2018). Patients were eligible to receive gum postoperatively after passing a swallow study by a registered nurse. The protocol launched May 4, 2020.

A retrospective randomized EHR audit was conducted on 1/3rd of adult post-surgical spinal patients five months pre-implementation and five months post-implementation of the chewing gum protocol. The audit included: time spent chewing gum (< 30 minutes, > 30 minutes, or refused), bowel motility (time to first stool), LOS (days), amount of bowel

medications used, amount of pain medications used (morphine milligram equivalents), ileus incidence, participation rate, and refusal reasons. No spinal surgeries, unless an emergency, were performed between March 15 and May 1, 2020 because of the COVID-19 pandemic. Therefore, pre-implementation data collection was from surgeries performed between September 15, 2019 and February 15, 2020 (five months of data) to obtain a more representative pre-implementation database. Post-implementation data for the first four weeks of the protocol were not included in the data collection due to ongoing staff education during that time, therefore, post-implementation data was drawn from surgeries performed between June 1 to November 1, 2020 (five months).

Data analysis compared a control group (n=123) to the intervention group (n=128) using quantitative methods in IBM SPSS Statistics 20. Descriptive statistics such as gender, age, and type of spinal surgery, were analyzed. The Shapiro-Wilk normality test determined the data in the two groups were not normally distributed, therefore, a Mann-Whitney U test analyzed time to first stool in hours, LOS in days, pain medication in morphine milligram equivalents, and bowel medication use. A Fisher's Exact test analyzed time spent chewing gum as the data did not fit assumptions for Chi-square testing. Refusal reasons and participation rate were tracked using count data.

Approval for the project was granted by the organization's IRB as human subject expedited review research with a focus on program evaluation in accordance with US Federal Policy for the Protection of Human Subjects. Retrospective analysis used existing data to assess the chewing gum initiative in the site.

Results

General Characteristics of Patients

Patient demographic data is in Table A1. In the pre-implementation group the majority of patients were female, with a median age of 60 years, whereas in the post-implementation group, the majority of patients were male, with a median age of 63 years. In both groups, lumbar fusion was the most common surgery.

Participation

The intervention group consisted of 128 patients and 32 (25%) declined or did not qualify to use chewing gum post-operatively during their hospital stay. Refusal reasons (Table A2) included that the patient was eating, nauseous, in pain, sleepy or sleeping, had thrush, and poorly fitting dentures. The most frequent reasons were being sleepy/sleeping and nauseous. Additional refusal reasons included eating, pain, thrush, and poorly fitting dentures; however, many patient refusal reasons were not charted in the EHR. Disqualifier reasons were decreased level of consciousness (LOC), poor dentition, and an order for head of bed flat. The most frequent disqualifier reason was decreased LOC. It is common for post-surgical patients to be not fully conscious or go in and out of consciousness after surgery due to the lingering effects of anesthesia and pain medications. Decreased LOC is a prominent disqualifier, as chewing gum while not fully alert, could cause choking or aspiration of the gum.

Measures

There were no statistically significant differences in the outcomes between the pre- and post- implementation groups. The following outcome measures can be found in Appendix B. The return of bowel function after surgery, measured in time to first stool (hours), did not improve statistically from pre to post implementation ($p= 0.37$); however, there was a small decrease in

median time to first stool from 2.61 hours to 2.55 hours. Length of stay, measured in days, did not decrease statistically from pre to post implementation (p= 0.28); however, there was a small decrease in median length of stay from 3.16 to 3.06 days. Pain medication use, measured in morphine milligram equivalents, did not decrease statistically from pre to post implementation (p= 0.219); however, there was a small decrease in median Morphine equivalents from 109mg to 88mg. Bowel medication use, including Senna Plus (p= 0.33), MiraLAX (p= 0.52), Milk of Magnesia (p= 0.89), and Dulcolax (p= 0.93), did not decrease statistically from pre to post implementation; however, there was a small decrease in median Dulcolax use from six to five doses.

Time spent chewing gum, measured as < 30 minutes, > 30 minutes, or a combination, did not have a statistically significant correlation between time spent chewing gum and first bowel movement post-surgery. However, patients who chewed gum > 30 minutes, had a median difference in amount of gum used between those with a bowel movement (2.5 times), with a total of 146 times chewed, compared to those without a bowel movement (one time) with a total of 93 times chewed. This may suggest that chewing gum >30 minutes three times versus two times during the hospital stay is more likely to produce a bowel movement.

Documentation on the protocol was missing in several areas including, whether or not patients chewed gum, refused, or did not qualify along with the reason for refusal or disqualification. It was therefore difficult to track if the implementation of the chewing gum followed the evidence-based protocol and the barriers to use.

Return on Investment

Although the difference in outcome measures between the pre and post implementation groups were not statistically significant, there was a notable decrease in ileus and pain

medication use. The estimated average cost of postoperative ileus was estimated using cost data from four diverse hospitals at $10,205 for one ileus (Merkow et al., 2020). There was an estimated cost savings of $10,205 from reducing one ileus post-operatively.

Pain medications were itemized and compared (Table C1). They resulted with a total cost savings of $88.96 per patient, which equates to the total cost savings from pain medication reduction of $ 8,540.16 for the 96 patients who used gum post-operatively. For this project, the cost of chewing gum per patient for the entire hospital stay was approximately $0.40, in other words, the average monthly gum cost for the organization ($30.00) divided by the average number of monthly patients in the last fiscal year (78). The cost estimation of gum may vary depending on the number of times patients use gum and the number of patients undergoing surgery. When multiplied by the number of patients in the intervention group who used gum (96), the total cost of gum was found to be $38.40. A pack of Freedent gum costs roughly $1.30/pack (Amazon.com, 2021). If a patient has a LOS of three days and use gum per the protocol (9 times), the gum will cost a little over $0.70 for their LOS. After subtracting the total cost of the chewing gum from the total project profit (Table C2) a cost savings of $18,706.76 was realized.

Discussion

Use of a chewing gum protocol reduced median time to first stool, length of stay, pain medication use, and ileus rate for patients in this setting. Though not statistically significant, these results are clinically significant. Reduction of use of opioid pain medications aligns with the 2016-2020 goals of the National Institute on Drug Abuse (NIH) to implement strategies to treat severe pain by other means (2020). This approach is also consistent with the Neuman Systems Model as multiple systems may contribute to bowel dysfunction and increased LOS.

Through this holistic lens, chewing gum, as an intervention, combined with the usual standard of care treatment was clinically effective to improve bowel function and decrease the need for symptom relievers such as pain medications or methods to treat the problem such as bowel medications.

In the literature, the most statistically significant results were a decrease in time to first stool and LOS. Pain medication use was only measured in one study and indicated a significant decrease in those who chewed gum. The literature measured cost by reductions in LOS and did not include the cost analysis of reducing pain medication use. This intervention shows promise as a non-pharmacological way to reduce pain and pain medication use post-operatively. It was a cost-effective protocol with no reported side effect or problems and yielded a return on investment of $18,706.76.

Limitations

Patient participation was a limitation of this study; only 75% of patients participated in the protocol by chewing gum a total of one time during their hospital stay. Another limitation was protocol adherence. Of those who participated, gum was only used an average of two times per stay, rather than three times per day as the protocol intends. The average LOS was 3.09 days, therefore, if the protocol was used as intended, the average gum use may have been closer eight to nine times during a patient stay as contrasted to an average of two in this study. This discrepancy could have been due to patient refusal, lack of staff implementation, or lack of documentation.

The protocol of chewing gum three times a day for 30 minutes until the return of bowel function or discharge was rarely followed, which is a limitation. It is suggested that implementation based on best-practices from the literature will produce the best results (The

United States Department of Justice, 2021). In addition, systematic reviews from the literature included large patient samples which may have facilitated significant results, whereas this project was smaller in nature.

Lack of appropriate documentation of the protocol was also a limitation, as gum chewing was not charted an average of 3.5 times during a patient's hospital stay. Furthermore, when patient refusals were documented, they often did not include a reason for the refusal. Nurse fatigue from the Covid-19 pandemic could play a role in this limitation, as the protocol was implemented during this time.

Difficulty tracking first stool was a limitation of this project. Chart review indicated that many patients were discharged home in 24 hours or less. Thus, the first bowel movement after surgery likely occurred at home, which meant it could not be tracked from the provided data. Early discharge may be related to less complex surgical procedures or other unknown reasons.

Conclusion

The Chewing Gum Protocol is a simple, inexpensive, safe, and cost-effective approach to patient care. There were clinically significant decreases in pain medication use and ileus along with small decreases in LOS, and time to first stool in post-surgical spinal patients. Although no statistically significant results, the protocol resulted in a return on investment for the organization of $18,706.76. It is an approach to patient care which deserves further study and may be one that could be implemented in many post-surgical situations.

Relevance/Implications for Practice and Recommendations

To understand the full effect the protocol could have on patient outcomes, the protocol should be implemented as originally designed and in alignment with published protocols in the literature. Recommended revisions in this setting include improved patient and nurse education

to achieve increased adherence to the chewing gum protocol. A revised approach to increase compliance with the chewing gum protocol may result in more significant clinical outcomes. This protocol has the potential to be beneficial on other units and with other types of surgeries in the future.

Literature review indicated chewing gum may reduce postoperative ileus at the average cost of $0.60 per patient (although the cost may vary by institution) which would be a very cost-effective method of reducing the LOS by a mean of approximately two days (Nobel et al., 2009). This could mean a potential cost mitigation of thousands of dollars per day, solely from decreased LOS in addition to the estimated savings from decreased ileus and pain medication use. These are only projections, and the true potential return on investment will not be known until more program development and evaluation is done. This protocol has promise as a widespread post-surgical care option; however, more program development, implementation, and evaluation in other settings is needed to determine the feasibility and effectiveness of the intervention.

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Appendix A

Table A1

Patient Demographics

	Pre-implementation	**Post-implementation**
Number of Patients	**124**	**128**
Gender	50 Female 73 Male 1 Not disclosed	62 Female 66 Male 0 Not disclosed
Age	Median- 60 Range 23- >80 20-39 (3) 40-59 (55) 60-79 **(64)** ≥80 (2)	Median- 63 Range 27- >80 20-39 (6) 40-59 (43) 60-79 **(72)** ≥80 (7)
Surgery Type	Lumbar- 18 **Lumbar fusion- 61** Cervical- 7 Cervical fusion- 38	Lumbar- 16 **Lumbar fusion- 73** Cervical- 8 Cervical fusion- 31

Table A2

Patient Refusal Reasons & Disqualifiers

Refusal Reasons	**Disqualifiers**
Sleep/sleepy (12)	**Decreased LOC (23)**
Nausea (5)	Poor dentition (5)
Eating (3)	Head of bed flat order (2)
Pain (1)	
Thrush (1)	
Poorly fitting dentures (1)	

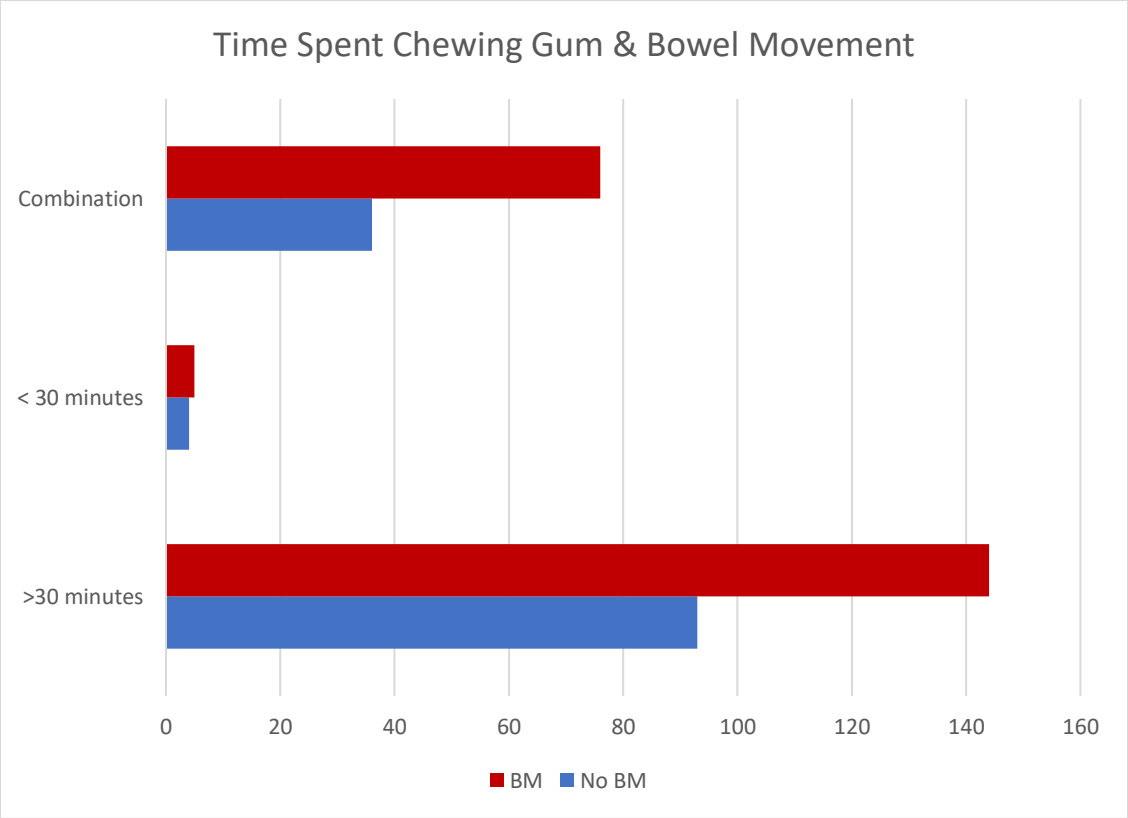
Appendix B

Table B1

Results: Mann-Whitney U Tests

	p Value	Pre-implementation Median	Post-implementation Median
Length of Stay (LOS) in days	p = 0.280	3.16	3.06
Time to First Stool (hours)	p = 0.367	2.61	2.55
Pain Medication Use	p = 0.219	**109**	**88**
Senna Plus 8.6-50 Tablet Doses	p = 0.33	0	0
MiraLAX 17g Doses	p = 0.52	1	1
Milk of Magnesia 400mg/5mL (30mL) Doses	p = 0.89	2	2
Dulcolax 10mg Suppository Doses	p = 0.93	6	5

Figure 1. Results: Fisher's Exact Test P= 1.00



Appendix C

Table C1

Average Pain Medication Doses & Hospital Cost

Itemized Costs:	Pre-implementation:	Post-implementation:
Norco 5-325 tab $0.14	13 **$1.82**	11 **$1.54**
Norco 10-325 tab $0.28	1 $0.28	1 $0.28
Norco 7.5-325 tab $0.27	1 $0.27	1 $0.27
Tramadol 50mg tab $0.05	2 **$0.1**	1 **$0.05**
Oxycodone 10mg CR tab: $3.28	2 $6.56	2 $6.56
Hydromorphone 2ml/mL $2.06	2.44 **$2.50**	1.42 **$2**
Morphine 4mg/mL $1.99	8 **$3.98**	0 **$0**
Fentanyl IV mcg $2.63	174 **$457.62**	142 **$373.46**
Percocet 5-325 tab $0.25	1 $0.25	1 $0.25
Percocet 7.5-325 tab $0.75	1 $0.75	1 $0.75

Table C2

Return on Investment

Ileus cost savings	**$10,205**
Total project pain medication cost savings	**+ $8,540.16 (96 patients)**
Total Project Profit:	**=$18,745.16**
Total Project Gum Cost: $0.40/ patient	**- $38.40 (96 patients)**
Total Project Cost Savings:	**=$18,706.76**

Evaluation of a Chewing Gum Protocol for Postoperative Spinal Patients

Lauren (Rhodes)Vachon

DNP Project Final Defense

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Grand Valley State University
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- Advisor: Joy Turner Washburn, EdD, RN,WHNP-BC
- Committee Members: Marie VanderKooi, DNP, RN; Shelly Mouw (Fezzey), MSN, RN

- Funding: Organization's spinal unit supplies budget
- State Level Spine Surgery Improvement Collaborative

Objectives for Presentation

Review :

1. Clinical problem
2. Organizational assessment and current literature concerning identified problem
3. Project plan
4. Results
5. Sustainability
6. Doctor of Nursing Practice Essentials
7. Summary

Clinical Phenomenon

- Decreased bowel motility is a major source of morbidity (Ge, Chen, & Ding, 2015), including:
    - Abdominal pain, ileus, increased length of stay (LOS), pain medication use, and health care costs (Byrne et al., 2018; Keller & Stein, 2013).
- Ileus complication rate of 2.54%
- Interest of the organization & State Level Spine Surgery Improvement Collaborative
- Associated with a 29% increase in hospital stay and costs over $1.75 billion (Keller & Stein, 2013).
- Circular link between impaired GI motility, pain, pain medication, and exacerbated impaired GI motility (Byrne et al., 20 Leppert, 2012; Ge et al., 2015)
    - National Institute on Drug Abuse (NIH) goal to improve strategies to treat severe pain (NIH, 2020)

NIH
National Institute on Drug Abuse

Organizational Assessment Findings

Figure 1. Universalia. (2020). Institutional and organizational performance assessment. Retrieved from https://www.universalia.com/en/services/institutional-and-organizational-performance-assessment

IOA Model

SWOT Analysis

Strengths	Weaknesses
• Project costs approved within the surgical spinal unit budget at the organization • Low cost initiative (~30$/month) • Support from the unit/ leadership	• Time chewing gum (30min) may not be achieved and vary with patients • Limitation in that many patient outcomes were not tracked prior to starting this intervention
Opportunities	**Threats**
• Spine Surgery partnership • Potential for other surgical units/surgery type • Potential for outpatient settings • Improve quality measures for the larger healthcare system	• Part of the unit budget that may be allocated elsewhere in the future • Clinical Practice Guideline (CPG) Protocol may not align with goals of larger healthcare system

Purpose of Literature Review:

To examine the state of knowledge on chewing gum as an intervention after surgery to improve bowel motility and other associated morbidities.

Clinical Practice Question

What is the impact of chewing gum on the bowel motility and associated factors (ileus, pain and bowel medication use, length of stay (LOS), and cost) of adults over the age of 18 post-spinal surgery?

Literature Review Methods

- Integrative rapid review
- PRISMA
- CINAHL Complete, PubMed
- Limited to RCTs, Systematic Reviews and Meta-analysis from 2009-2020
- Keywords:
  - "Gastrointestinal motility" "chewing gum" and "delayed bowel motility"

PRISMA Figure

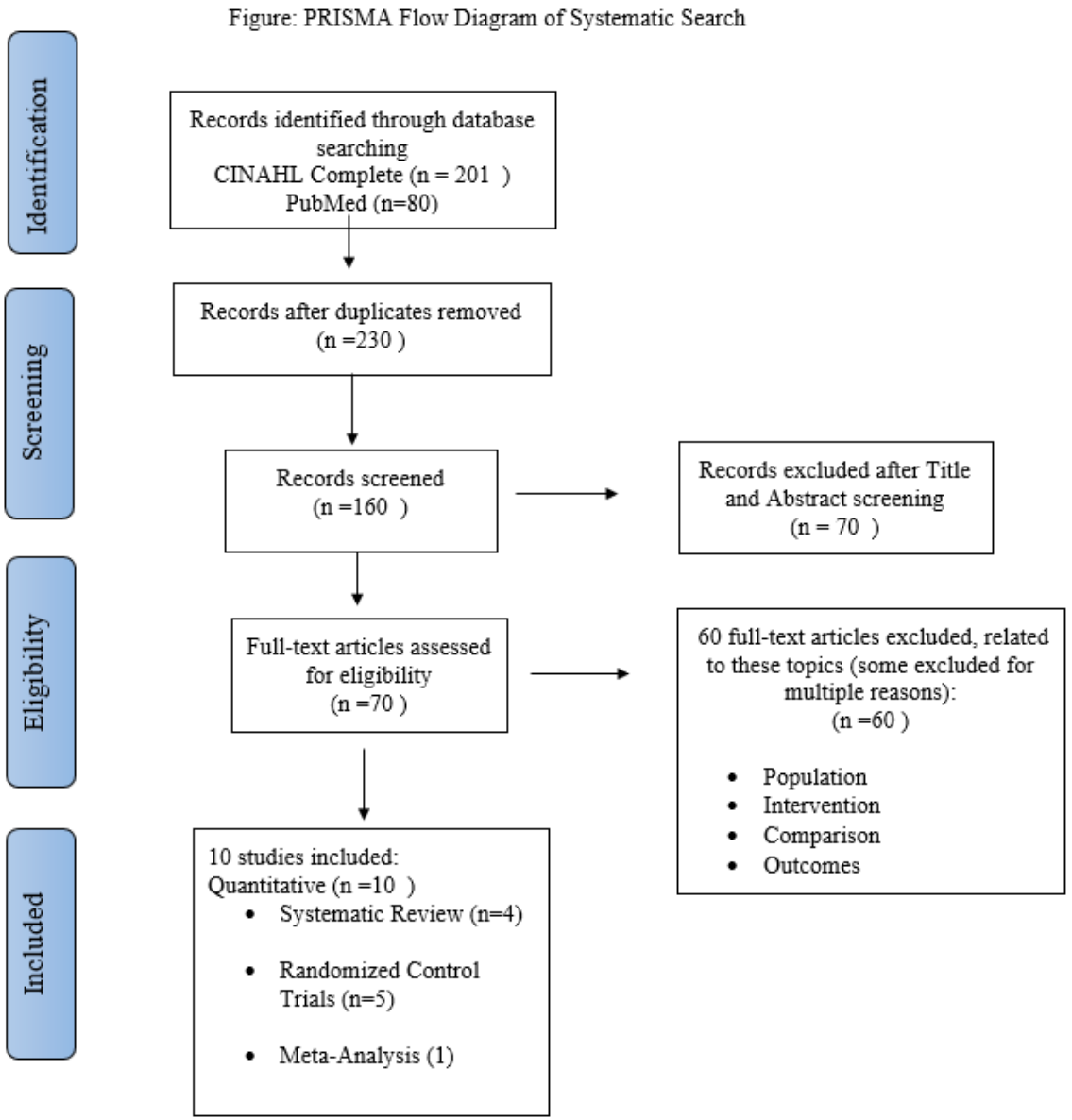


Figure 2. Flow diagram of search selection process. Adapted from "Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement," by D. Moher, A. Liberati, J. Tetzlaff, D. Altman, and PRISMA Group. Copyright 2009 by PLoS Medicine.

Available Knowledge

- Multiple options to improve bowl function (Keller & Stein, 2013; Luckey et al., 2003).
- Chewing gum is a non-pharmacologic and inexpensive method (Park et al., 2018).
- Chewing gum stimulates intestinal motility (Ali et. al., 2017; Byrne et al., 2018; Park et al., 2018).
- Gap in research
- Sugar vs. Sugar-free gum products (Mäkinen, 2016).
- Any known side effects (MARS, 2020; Signature Smiles Dental, 2016).

Search Results

- 10 studies
  - Systematic Reviews (4)
  - Randomized Control Trials (5)
  - Meta-analysis (1)
- All studies: Level 1 Evidence
- All studies included a comparison and an intervention group

Synthesis of Results: Refer to Handout

- Nine out of ten studies indicated chewing gum had a statistically significant impact on bowel motility
- Only one study analyzed pain/ pain medication use; it showed significant reductions in both (Byrne et al., 2018)
- Chewing gum was well tolerated with minimal to no side effects or complications in all studies
- Six studies showed significant reduction in LOS
- Implementation methods
  - Initiation, time spent chewing, duration, frequency,

Critique of Evidence

- Quality of studies included in systematic reviews
- Variability with interventions
  - Frequency
  - Chewing time
  - Duration
  - Type of gum
- Only one study analyzed cost reduction (Nobel et al., 2009)
- Only one study analyzed pain and pain medication reduction (Byrne et al., 2018)
- No studies evaluated concurrent bowel medication use

Gaps in Knowledge

- Chewing gum after spinal surgery
- Gum with sugar versus sugar-free gum
- Best method to implement gum (initiation, chewing time, frequency, duration)

Implemented Chewing Gum Protocol

- **Launched in May 2020 on Spinal Surgery Unit**
- **Type of Gum- Sugar (5 carbs)**
- **Initiation**
  - As soon as safely possible, assessment for disqualifiers
  - Swallow assessment
- **Frequency**
  - 3 times a day
  - At meal-times
- **Chewing time**
  - 30 minutes or greater
  - Less than 30 minutes
- **Duration**
  - Until bowel function is restored (OR)
  - The patient is discharged

(Walmart, 2020)

Program Evaluation Clinical Practice Question (Research)

- **How did the implementation of a chewing gum protocol improve bowel motility, decrease ileus rate, length of stay (LOS), bowel and pain medication use, and hospital costs in post-surgical spinal patients in a suburban hospital?**
  - What is the long-term program sustainability of an implemented evidence-based, chewing gum initiative at a suburban hospital?

Phenomenon Framework: The Neuman Systems Model

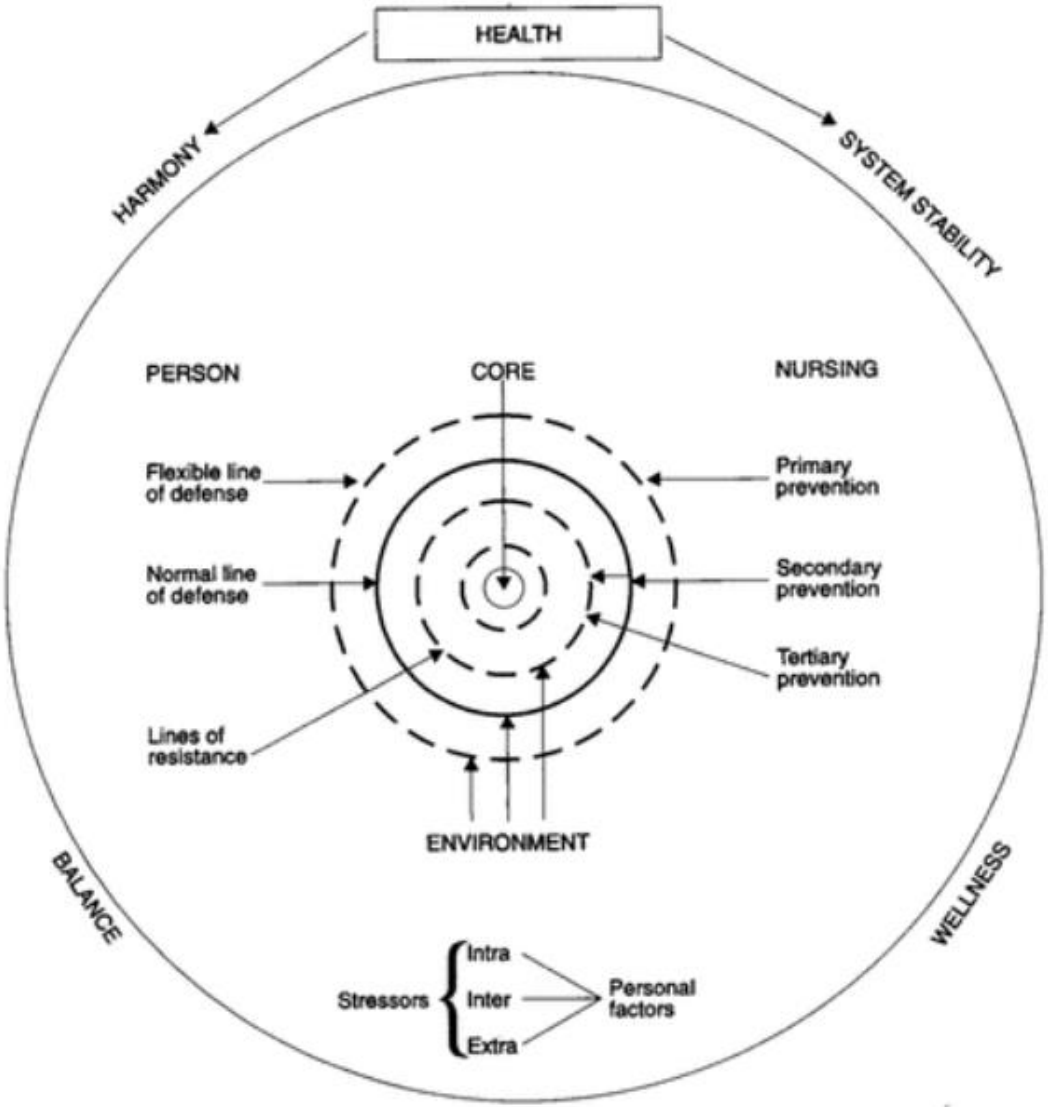


Figure 3. Miner, J. (1995). Incorporating the Betty Neuman systems model into HIV clinical practice. *AIDS Patient Care, 9*(1), 37-39. doi:10.1089/apc.1995.9.37

Project Purpose & Design

Evaluation of a Chewing Gum Protocol for postoperative spinal patients within a Midwest suburban hospital

- Clinical Practice Guideline (CPG) implemented in May 2020 for post-surgical spinal patients
- Guide future expansion of CPG into other post-surgical areas (Moran et al., 2020)

PROJECT PLAN

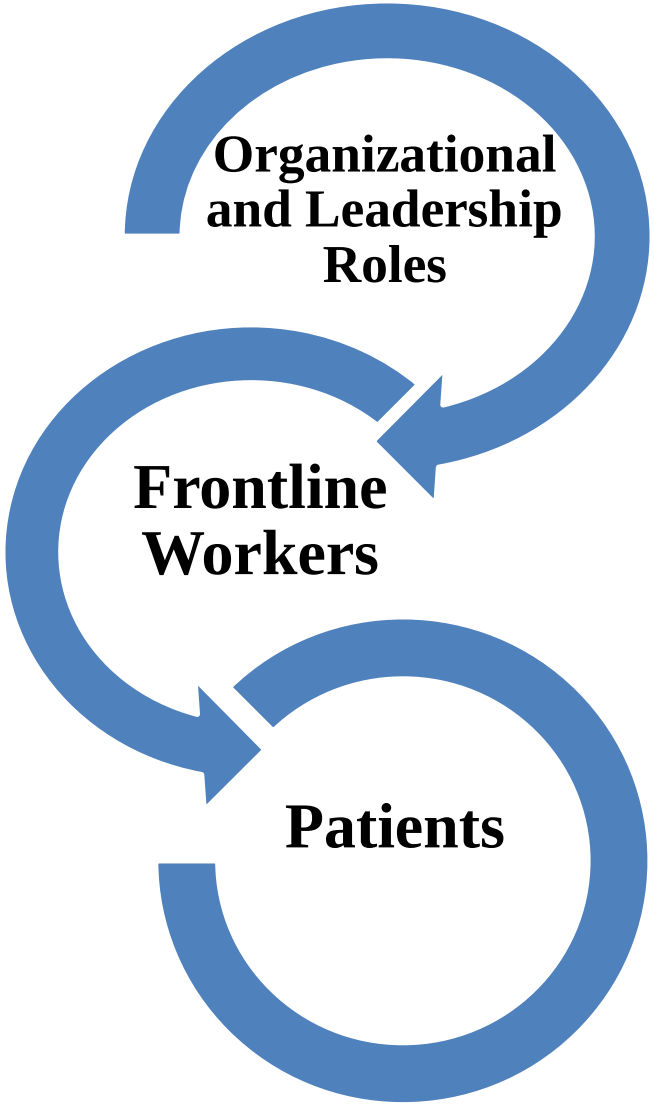
IRB Approval

- Project approved by the organization's IRB as human subjects expedited review research with a focus on program evaluation.
- Project conforms to the U.S. Federal Policy for the Protection of Human Subjects
- Waiver of HIPAA authorization
- Retrospective chart audit
- IRB determination available upon request

Current State of the Organization: Setting and Participants/Stakeholders

- Hospital in a suburban community in the Midwest
  - Surgical Spinal floor (35 bed unit)
  - 40 RNs
- Patients
  - 18-97 years old
  - Those undergoing surgery for degenerative spine disease
  - During fiscal year 2018-2019, there were 931 spinal surgery cases

Key Stakeholders



- Implementation Team
- IT
- Nurse Educator
- MSSIC
- Unit Manager
- Champion Physician
- Pharmacist

- Nurses
- Nurse Aides/Patient Care Techs
- Physicians

- Adult patients 18 years old or older

Program Evaluation Framework: The Logic Model

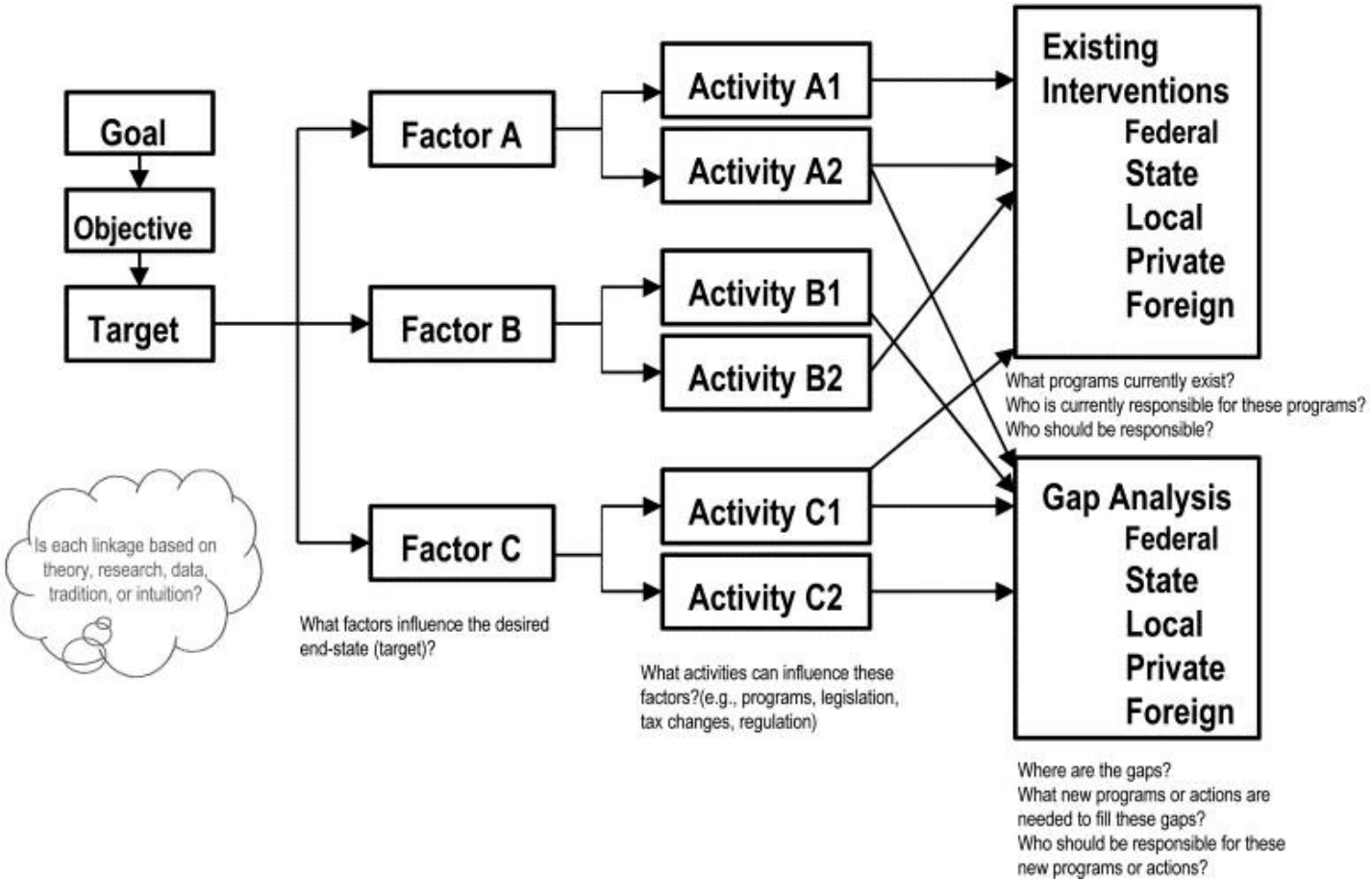


Figure 4. Miller, A. Simeone, R.S. & Carnevale, J.T. (2001). Logic models: A systems tool for performance management. *Evaluation and Program Planning, 24.* 73-81. https://doi.org/10.1016/S0149-7189(00)00048-3

Inputs	Activities	Outputs
Time: • Project Manager • CNS • Quality Coordinator • Pharmacist • Statistician	• Data Collection • Electronic Health Record (EHR) Audit • Data Analysis • Assess for barriers • Develop report • Disseminate results	• Program Evaluation Report • Budget

Short-term Outcomes	Intermediate Outcomes	Long-term Outcomes
• Improved bowel motility • Decreased bowel & pain medication use • Decreased LOS • Decreased ileus rate • Decrease of costs		• Sustainability on unit • Generalizability to other units/types of surgeries • Decrease of costs • Improve organization's quality measures

Project Objectives:

1. Develop a process to evaluate the chewing gum protocol in post-surgical spinal patients
2. Identify the barriers to chewing gum use in post-surgical spinal patients
3. Develop recommendations regarding sustainability of chewing gum protocol in postoperative spinal patients

Evaluation Strategies & Elements

1. **Purposefully Reexamine the Implementation**
2. **Develop and Implement Tools for Quality Monitoring**
3. **Audit EHR for the Purpose of Future Feedback**

- Obtain randomized list of 1/3 of adult spinal surgical patients
  - 5 months prior (September 15, 2019- February 15, 2020)
  - 5 months post (June 1, 2020- November 1, 2020)

  Audit
  - Time spent chewing gum
  - Bowel motility postoperatively
  - Amount of bowel medications used postoperatively
  - Participation rate
  - Amount of pain medications used postoperatively (Morphine equivalents)
  - LOS of patients
  - Ileus incidence

(Powell et al., 2015)

Evaluation Strategies & Elements

4. **Identify barriers to implementation**
   - From audit of patient refusal reasons
   - Time spent chewing gum
5. **Use data experts & data software for statistical analysis**
   - Statistician
   - SPSS
6. **Facilitate relay of clinical data to providers and stakeholders**
   - Outcomes of CPG
   - Rates of Participation
   - Reasons for refusal
   - Reports based on data analysis

(Powell et al., 2015)

Evaluation & Analysis Measures:

See handout

Program Objectives	Indicators	Source of Data	Method	When Measured	Who Measures
Evaluate time spent chewing gum	<30 minutes >30 minutes Refused	Records	EHR Audit	Post implementation	Student
Improve bowel motility postoperatively	Time to first stool (TTFS) measured in hours.	Records	EHR Audit	Post implementation	Student
Reduce the amount of bowel medications used postoperatively	Number of bowel medications used	Records	EHR Audit	Post implementation	Student
Evaluate the participation rate	Number of patients that used the chewing gum postoperatively	Records	EHR Audit	Post implementation	Student

Evaluation & Analysis Measures:

See handout

Program Objectives	Indicators	Source of Data	Method	When Measured	Who Measures
Decrease the amount of pain medications used postoperatively	Number of pain medications used (Morphine equivalents)	Records	EHR Audit	Post implementation	Student
Decrease the LOS of patients	Number of days in the hospital	Records	EHR Audit	Post implementation	Student
Identify barriers to chewing gum use	Refusal reasons	Reasons	EHR Audit	Post implementation	Student
Decrease Ileus incidence	Ileus rate	Records	EHR Audit	Post implementation	Student

Analysis Plan

- Compare control and intervention groups
  - Control group = spinal surgical patients between (September 15, 2019- February 15, 2020) (In order to obtain a more representative pre-implementation database)
  - Intervention group = spinal surgical patients between (June 1, 2020-November 1, 2020) (Due to initial ongoing staff education/reinforcement)
- Quantitative methods
  - Descriptive Statistics
  - Mann-Whitney U Test
  - Fisher's Exact Test

Ethical Considerations

- **HIPPA:**
  - Use of existing data, retrospective analysis
  - No identification of subjects at the aggregate level
  - Identifiers stripped from protected health information (PHI)
- **Privacy requirements**
  - Plan to protect identifiers from improper use and disclosure via use of key and codebook
  - Plan to destroy identifiers at the earliest opportunity
  - PHI will not be re-used or disclosed for another purpose
- **Data**
  - Data deidentified using codebook and key
  - Safe storage (Intranet) using the organization's server and equipment

Timeline: See Handout

- Project Proposal- 10/28/2020
- IRB Approval- 12/2020
- Data Collection- 12/2020-3/2021
- Data Analysis- Completed by 3/15/2021
- Final Defense –4/21/2021
- Final Report Deliverable- No later than 4/24/21

Expenses for Implementation of Project	
Project Manager Time $50/hour, 300 hours (in-kind donation)	($15,000)
Consultation: Statistician Time $38/hour, 3 hours (in-kind donation	($114)
Site Mentor Time $54/hour 20 hours	$1,086
Quality Coordinator Time $43/hour 6 hours	$258
Pharmacist Time $64/hour 3 hours	$192
Total Expenses	$16,650
Revenue for Implementation of Project	
Project Manager Time $50/hour, 300 hours (in-kind donation)	$15,000
Consultation: Statistician Time $38/hour, 4 hours (in-kind donation	$114
Site Mentor Time $54/hour 20 hours	$1,086
Quality Coordinator Time $43/hour 6 hours	$258
Pharmacist Time $64/hour 3 hours	$192
Total Revenue	$16,650

Program Evaluation Proposed Budget & Resources:

See Handout

(Salary.com, 2020)

Results: Participant Characteristics

See Handout

Pre: **124 patients**

- Gender
  - Female: 50
  - Male: 73
  - Not disclosed: 1
- Age in years
    - Median- 60
    - Range 23- >80
    - 20-30 (3)
    - 40-50 (55)
    - 60-70 (64)
    - >80 (2)

Post: **128 patients**

- Gender
  - Female: 62
  - Male: 66
  - Not disclosed: 0
- Age in years
    - Median- 63
    - Range 27- >80
    - 20-30 (6)
    - 40-50 (43)
    - 60-70 (72)
    - >80 (7)

Results: Surgery Type

- Pre:
  - Lumbar-18
  - **Lumbar fusion-61**
  - Cervical-7
  - Cervical fusion-38
- Post:
  - Lumbar-16
  - **Lumbar fusion-73**
  - Cervical-8
  - Cervical fusion-31

Results: Refusals & Disqualifiers

- 32 patients **(25%)** refused or did not qualify for gum

- Refusal Reasons:
  - Eating (3)
  - Nausea (5)
  - Pain (1)
  - **Sleep/sleepy (12)**
  - Thrush (1)
  - Poorly fitting dentures (1)

- Disqualifiers:
  - **Decreased level of consciousness (23)**
  - Poor dentition (5)
  - Head of bed flat order (2)

Results: Chewing Gum

- Number of patients who used gum: 96/128= **75%**
- Ileus incidence during hospital stay and 90 days after hospitalization:
  - **Pre-Implementation: 1**
  - **Post-implementation: 0**

Results: Mann-Whitney U Test: See Handout

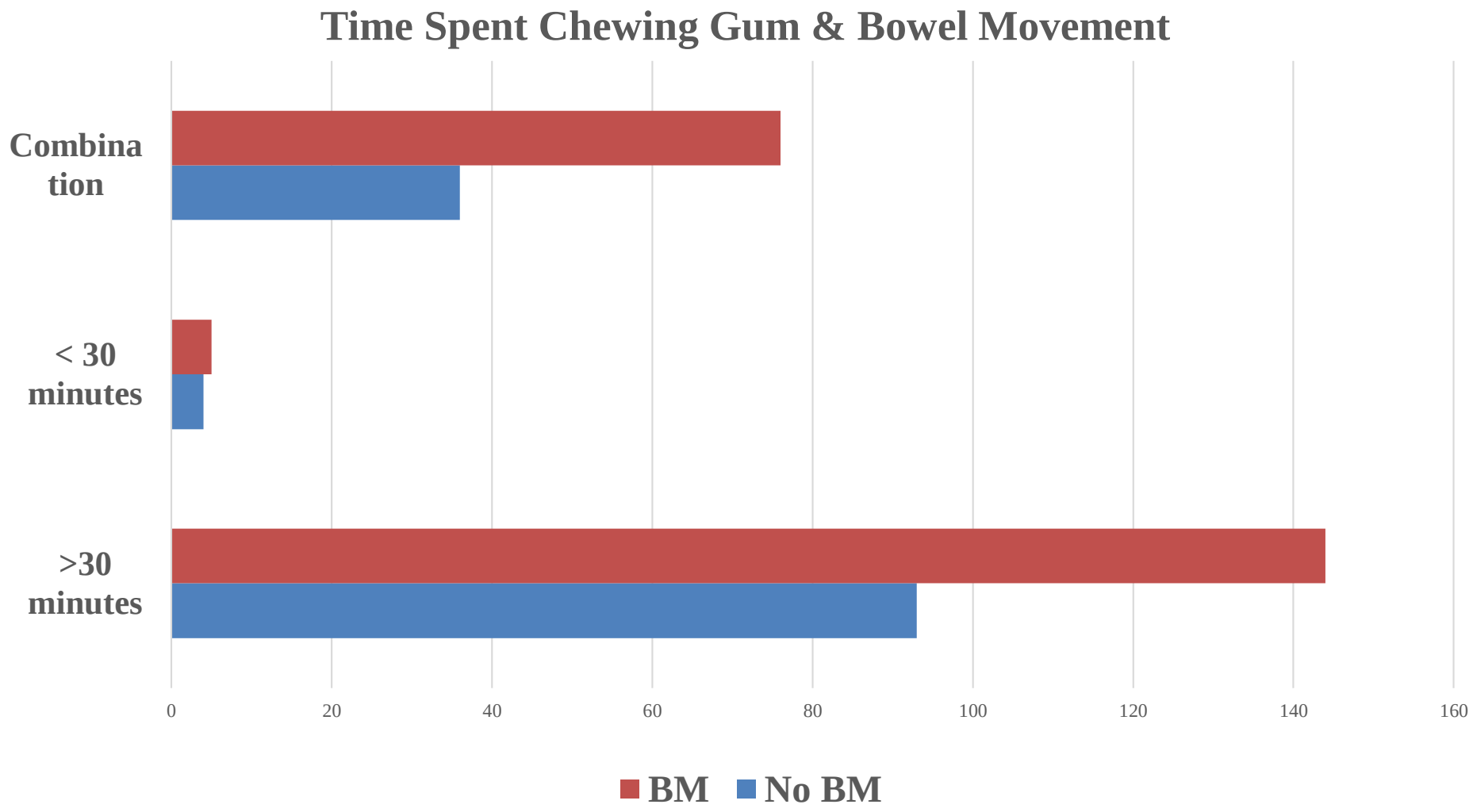
	Length of Stay (LOS) in days **P= .280**	**Time to First Stool (hours)** **P= .367**	**Pain Medications (Morphine Equivalents in mg)** **P= .219**
Pre-Implementation	Median: 3.16	Median: 2.61	**Median: 109**
Post-Implementation	Median: 3.06	Median: 2.55	**Median: 88**

Results: Mann-Whitney U Test

Bowel Medications: See Handout

	Senna Plus 8.6-50 tablet Doses **P= .33**	**MiraLAX 17g Doses** **P= .52**	**Milk of Magnesia 400mg/5ml (30mL) Doses** **P= .89**	**Dulcolax 10mg Suppository Doses** **P= .93**
Pre-Implementation	Median: 0	Median: 1	Median: 2	Median: 6
Post-Implementation	Median: 0	Median: 1	Median: 2	Median: 5

Results: See Handout p=1.00



Ileus Reduction Cost Savings: See Handout

	Pre-implementation Cost	Post-implementation cost
Estimated average cost of 1 ileus: $10,205 (Merkow et al., 2020).	1 Ileus $10,205	0 Ileus $0

Total Cost Savings from Ileus Reduction=

$10,205

Itemized Costs:	Pre-implementation:	Post-implementation:
Norco 5-325 tab $0.14	13 **$1.82**	11 **$1.54**
Norco 10-325 tab $0.28	1 $0.28	1 $0.28
Norco 7.5-325 tab $0.27	1 $0.27	1 $0.27
Tramadol 50mg tab $0.05	2 **$0.1**	1 **$0.05**
Oxycodone 10mg CR tab: $3.28	2 $6.56	2 $6.56
Hydromorphone 2ml/mL $2.06	2.44 **$2.50**	1.42 **$2**
Morphine 4mg/mL $1.99	8 **$3.98**	0 **$0**
Fentanyl IV mcg $2.63	174 **$457.62**	142 **$373.46**
Percocet 5-325 tab $0.25	1 $0.25	1 $0.25
Percocet 7.5-325 tab $0.75	1 $0.75	1 $0.75

Average Pain Medication Doses & Hospital Cost:

See Handout

Impact of Reductions in Pain Medication Use

Itemized Costs:	Pre-implementation	Post-implementation
Total Average Pain Medication Costs Per Patient	$474.12	$385.16
Hospital Cost Savings per Patient		$474.12 - $385.16 _____ = **$88.96**

96 patients in post-implementation group who used gum

x

$88.96 savings per patient

=

$8,540.16

project total cost savings from reducing pain medication use

Return on Investment: See Handout

Ileus cost savings	**$10,205**
Total project pain medication cost savings	**+ $8,540.16 (96 patients)**
Total Project Profit:	**=$18,745.16**
Total Project Gum Cost: $0.40/ patient	**- $38.40 (96 patients)**
Total Project Cost Savings:	**=$18,706.76**

Discussion

- No statistically significant outcome measures
- Clinically significant
- Decreases in pain medication use & ileus
- Greatest benefit chewing >30 minutes
- Cost-effective initiative
- Meets the goals of:
  - National Institute on Drug Abuse (NIH)
  - State Level Spine Surgery Improvement Collaborative

Limitations

- Participation rate 96/128= **75%**
  - Of those, gum was chewed at an average rate of 2 times per person during the hospital stay
  - Following the protocol
    - Chew gum 3x a day for >30 minutes
- Missing documentation
- Difficulty tracking time to first stool
- Conducted during Covid-19

Implications for Practice

Successes:

- Chewing Gum Protocol initiated
- Although not statistically significant- decreases in LOS, & time to first stool (BM)
- Reduction in pain medication use
- Cost-savings

Difficulties:

- Patient participation
- Documentation
- Tracking time to first stool (BM)

Conclusions

- Increased Compliance Required:
  - Additional education for nurses related to the protocol
  - Additional post-operative education combined with initiation of pre-operative education for patients may be helpful
- Potential for success in the future
- Cost-effective intervention
- No reported problems or side effects

Future Potential Return on Investment

Potential Cost Savings:

Average cost of stay in Midwest nonprofit hospital 2019 $2,298 (Becker's Healthcare, 2020)

Based on the literature, may be able to reduce postoperative ileus at the average cost of $0.60 per patient which would be a very cost-effective method of reducing the LOS by a mean of approximately two days (Nobel et al., 2009).

- **Potential cost mitigation of $4,596 per patient from LOS reduction alone**

Sustainability Plan

- Inform key stake holders of project evaluation results
- Continued allocation of unit budget for chewing gum
- The unit manager along with quality improvement specialist are best suited to ensure project sustainability
- Disseminate results to other surgical units, hospitals, and outpatient settings
- Potential for expansion to other units/departments after protocol compliance is improved and re-evaluated

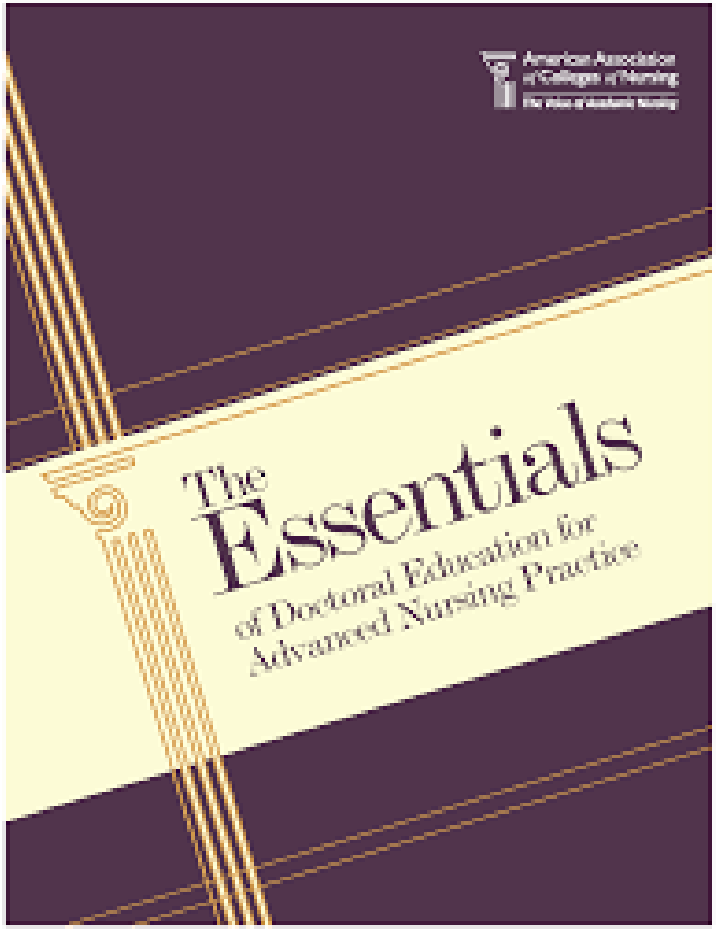
Dissemination

- Project outcomes will be shared with site and stakeholders via email
- Virtual presentation for the site and stake holders 06/2021
- Manuscript shared on ScholarWorks for other professionals and scholars using manuscript guidelines from the Journal of Clinical Nursing

Summary of DNP Project

- Program Evaluation necessary to understand the impact of the protocol
- The chewing gum intervention did not result in statistically significant outcomes, however there were improvements, including reductions in pain medication use, ileus rate, and healthcare costs
- Chewing gum is a simple, cost-effective intervention with potential to improve health outcomes in postoperative patients
- Revised approach to increase compliance with the chewing gum protocol may result in more significant clinical outcomes

DNP Essentials



Discussion of
DNP Essentials
in relation to student
learning and growth
during graduate study

DNP Essentials:

Essential I:

- ***Scientific Underpinnings for Practice***

Essential II:

- ***Organizational and Systems Leadership for Quality Improvement and Systems Thinking***

DNP Essentials:

Essential III :

- ***Clinical Scholarship for Evidence-Based Practice***

Essential IV:

- ***Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care***

DNP Essentials:

Essential V :

- ***Health Care Policy for Advocacy in Health Care***

Essential VI:

- ***Interprofessional Collaboration for Improving Patient and Population Health Outcomes***

DNP Essentials:

Essential VII :

- ***Clinical Prevention and Population Health for Improving the Nation's Health***

Essential VIII:

- ***Advanced Nursing Practice***

Handouts

1. Literature Review Table of Evidence
2. Evaluations and Measures Table
3. Timeline
4. Proposed Budget & Resources
5. Results
6. Return on Investment

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