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ARAM V. CHOBANIAN & EDWARD AVEDISIAN SCHOOL OF MEDICINE

Thesis

COLONOSCOPY EDUCATION AND OUTCOME OPTIMIZATION

by

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B.S., Kennesaw State University, 2022

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COLONOSCOPY EDUCATION AND OUTCOME OPTIMIZATION

ANNA C. AKINS

ABSTRACT

In endoscopic procedures, there is a gold standard for helping diagnose patients with intestinal inflammatory, allergic, or infectious processes. The success of these procedures depends on the success of completing a clean-out preparation (CoP), which helps clean out the intestinal contents that otherwise would obscure the visualization of the intestine during the procedure. A poor CoP could result in a physician missing the clinical findings during the procedure. A poor CoP could also result in a longer procedure and greater exposure to anesthesia.

This study is designed to understand the patient experience with a CoP to understand better the education the patients receive to complete the CoP. This study also assesses the access to medication and information. This study will assess the quality of the CoP rates across diagnoses, ages, gender, race, preferred language, and ethnicity. By taking in all these factors, this study will help improve the quality of the CoP and create a better outcome for the endoscopic procedures and better patient care.

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LIST OF ABBREVIATIONS

BBPS.....	Boston Bowel Preparation Scale
CoP.....	Clean-Out Preparations
CRC.....	Colorectal Cancer
EDG	Esophagogastroduodenoscopy
ERCP.....	Endoscopic Retrograde Cholangiopancreatography
GPU.....	Gastroenterology Procedure Unit
HCS.....	Harefield Cleansing Scale
MRN	Medical Record Number
PDSA	Plan Do Study Act
PEG.....	Polyethylene Glycerol
PREMS	Patient-Reported Experience Measures
PRO-STEP	Patient-Reported Scale for Tolerability of Endoscopic Procedures
OBPS.....	Ottawa Bowel Preparation Scale
OSS.....	Oral Sulfate Solution
QI	Quality Improvement

INTRODUCTION

Endoscopic procedures represent the gold standard for diagnosing pediatric patients with known or suspected gastrointestinal diseases. Preceding the initiation of endoscopic procedures, patients are administered clean-out preparations (CoP) designed to facilitate the thorough cleansing of their gastrointestinal tract. In the case of upper endoscopic evaluation, an overnight fast is all that is typically necessary. However, preparation for lower endoscopic evaluation (colonoscopy) is considerably more complicated, as extant fecal matter in the large intestine must first be removed to ensure sufficient visualization to assess underlying pathology, including mucosal inflammation, diverticular disease, or polyps. The success of colonoscopy prep (CoP) directly impacts the quality of the subsequent study and the ability of the clinician to provide accurate diagnostic and therapeutic decisions. Patients and their families must be appropriately educated on bowel preparation to ensure the highest quality evaluation (Scotto et al., 2009). The more patients understand about the CoP, the better they should be able to follow the directions. Existing data have demonstrated a positive correlation between patient education and the success of a colonoscopy (Scotto et al., 2009). This is based on comparing patient-facing data while collecting nurse- and physician-reported data. By conducting surveys developed to optimize patient-centered satisfaction and throughput by limiting the need for repeat or canceled studies, utilization of limited healthcare resources (anesthesia and operating room space), and clinical outcomes. By determining which factors impact patient education, including preferred language, diagnosis, age, gender, race, and ethnicity, we can better understand how patients should be educated to

complete scheduled CoP. This should improve patient and provider satisfaction and throughput by limiting the need for repeat or canceled studies, utilization of limited healthcare resources (anesthesia and operating room space), and clinical outcomes.

TOLERABILITY

The ability to tolerate a prescribed CoP is also a big factor, particularly in younger patients. Most CoP include the administration of a cathartic solution, including (PEG) and (OSS). These requisite volumes and taste contribute to the frequency of inadequate preparations. The availability of more patient-facing data can contribute to improvements in CoP administration. Different cathartic solutions are available for use in patients preparing for colonoscopy, and investigators have identified patient satisfaction and compliance factors driving the success of CoP in primarily adult populations (Lawrance et al., 2013). However, it is inherently more difficult for pediatric patients to tolerate the taste and volume of fluid prescribed. Data from one study suggested that an oral sulfate solution (OSS) is better tolerated over polyethylene glycerol (PEG) (Socha et al., 2023). PEG is commonly used in CoP in both adults and children. However, the volume required makes this particularly difficult for younger patients (Socha et al., 2023).

Endoscopic procedures are invasive and require parental consent after explaining the anticipated risks and benefits. The need for excessive endoscopic maneuvering (due to increased stool burden) and the length of the study increase the risk of a complication and the cost of the procedure. Longer procedures also entail greater anesthesia exposure for the patient. Ultimately, the procedure's success largely depends upon the quality of the mucosal inspection. If the imaging is distorted, this can affect the patient's diagnosis and the procedure time.

BOWEL PREPARATION

An inadequate bowel preparation can impact the diagnosis of GI diseases. A patient may require additional colonoscopic evaluations if an unsuccessful prep obscures affected mucosa. This increases the risk of procedural complications, additional time under anesthesia, and increased cost. It can be difficult to rate the quality of bowel preparation in adult or pediatric patients. While several metrics exist, no consensus approach exists, particularly in pediatric patients (Kastenberg et al., 2018). The lack of CoP outcome standards results in inconsistencies in reported studies (Kastenberg et al., 2018). Moving forward, there is a great need to develop both standards for bowel preparations and outcome measurement. Some of the qualities inherent in a standardized bowel prep would be validity and inter-rater reliability (Kastenberg et al., 2018).

There are currently no consensus standards for CoP in children and adolescents. There are different metrics used to assess the success of a CoP, and these include the

Aronchick Scale, the Boston Bowel Preparation Scale, and the Ottawa Bowel Preparation Scale (OBPS). Less commonly used scales include the Chicago Bowel Preparation and the Harefield Cleansing Scale (HCS) (Kastenberget al., 2018). The Aronchick Scale is one of the CoP metrics used in clinical practice and trials to assess outcomes (Kastenberget al., 2018). The Ottawa Bowel Preparation Scale focuses on fluid quantity (Kastenberget al., 2018). The Boston Bowel Preparation Scale (BBPS) has been validated in multiple studies (Kastenberget al., 2018). The BBPS was used for bowel preparation in this study. BBPS was the least complicated and presented visual metrics to improve inter-rater reliability.

Below is the visual metric accompanying the BBPS (Figure 1). Physicians used these visual cues to assess CoP quality.

Figure 1: Below is the visual metric accompanying the BBPS (Figure 1). Physicians used these visual cues to assess CoP quality (Gunay & Abuoglu, 2018).

The Boston Bowel Preparation Scale (BBPS) is a scale used by a physician who is performing your colonoscopy to judge the quality of bowel cleanliness. It replaces subjective terms such as "excellent", "good" and "fair". Three segments of the colon are looked at for this. The highest rating for a segment is 3 so a perfect overall score is 9 = 3 x 3.

Segments:

1. Left Colon Quality
2. Transverse Colon Quality
3. Right Colon Quality

Each segment is scored as follows:

- 0 = Unprepared colon segment with mucosa not seen due to solid stool that cannot be cleared.
- 1 = Portion of mucosa of the colon segment seen, but other areas of the colon segment not well seen due to staining, residual stool and/or opaque liquid.
- 2 = Minor amount of residual staining, small fragments of stool and/or opaque liquid, but mucosa of colon segment seen well.
- 3 = Entire mucosa of colon segment seen well with no residual staining, small fragments of stool or opaque liquid.

The physician adds up your scores to arrive at the total BBPS.

BBPS		3	2	1	0
3=Excellent					
1=Poor					
					0=Inadequate
LC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
TC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
BBPS=		<input type="checkbox"/>			

Fig. 3. Boston bowel preparation scale (BBPS). LC: Left colon. TC: Transverse colon. RC: Right colon.

There is a lack of evidence-based findings from patient-facing studies evaluating the experience and success of CoP (Lawrance et al., 2013). This knowledge gap needs to be addressed (Lawrance et al., 2013). There are similarly no validated measurements available for use in pediatric studies. Insufficient sample size also limits conclusions from previous patient-facing studies (Lawrance et al., 2013). As such, future studies should be adequately powered to derive data that can move forward the process of colonoscopy procedures in children and young adults.

Figure 2:

The parameters used in an adult metric are included in Figure 2 (Lawrance et al., 2013).

The questionnaire was admitted to patients prior to the procedure and then prior to discharge (Lawrance et al., 2013).

**Colonoscopy Preparation
Patient Tolerability Questionnaire**

	None	Very Mild	Mild	Moderate	Severe
Unpleasant Taste					
Excessive Thirst					
Nausea					
Vomiting					
Bloating					
Abdo Pain / or Cramp					
Headache					
Dizziness					
Sleep disturbance					

Did you miss work because of the preparation? **YES / NO**

If you required a future colonoscopy would you be willing to use the same bowel preparation again? **YES / NO**

Please indicate on the line below the overall tolerability of the bowel preparation medication used.

Not Tolerated At All

Totally Tolerated

Patient Name.....

Patient Number..... **Date**.....

Creating a validated questionnaire provides a framework for future studies evaluating tolerability, compliance, and outcomes related to different endoscopic procedures.

Table 1:

The table below shows the demographic used in this study. There were over 600 participants in this study (Lawrance et al., 2013).

From: A Validated Bowel-Preparation Tolerability Questionnaire and Assessment of Three Commonly Used Bowel-Cleansing Agents

	Total	PEG	NaP	Pico
Patients, n (%)	634 (100)	284 (45)	179 (28)	171 (27)
Age (mean \pm SD)	53.6 \pm 12.6	53.2 \pm 13.1	52.7 \pm 12.1	55.3 \pm 12.6
<40 years, n (%)	81 (13)	41 (14)	22 (12)	18 (11)
40–49 years, n (%)	137 (22)	58 (20)	43 (24)	36 (21)
50–59 years, n (%)	191 (30)	85 (30)	56 (31)	50 (29)
60–69 years, n (%)	168 (27)	76 (27)	48 (27)	44 (26)
70–74 years, n (%)	57 (9)	24 (9)	10 (6)	23 (14)
Gender: male, n (%)	292 (46)	127 (45)	83 (46)	82 (48)
Primary indication, n (%)				
Abdominal pain	56 (9)	23 (8)	15 (8)	18 (11)
Altered bowel habits	124 (20)	66 (23)	34 (19)	24 (14)
Bleeding/anemia	266 (42)	124 (44)	71 (40)	71 (42)
Screening	170 (27)	60 (21)	56 (31)	54 (32)
Weight loss/miscellaneous	18 (3)	11 (4)	3 (2)	4 (2)

Sex, age, and primary indication for colonoscopy distributed by bowel preparation

Table 2:

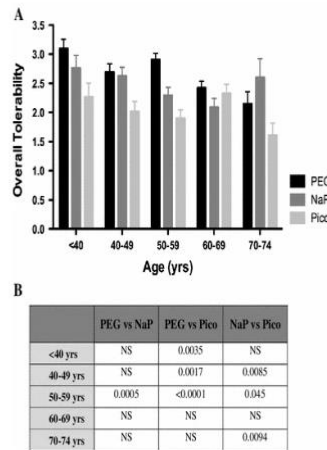
The data in Table 2 outlines the findings from this study. A Bland-Altman plot assessed the individual scores, and a retest was performed to assess the significance of the data collected (Lawrance et al., 2013).

	Kappa/ICC	Interpretation
Unpleasant taste	0.53	Moderate
Excessive thirst	0.59	Moderate
Nausea	0.60	Moderate
Vomiting	0.64	Good
Bloating	0.60	Moderate
Abdominal/cramps	0.54	Moderate
Headache	0.63	Good
Dizziness	0.69	Good
Sleep disturbance	0.57	Moderate
Aggregate	0.71	Good
Visual analogue	0.97	Excellent

Bland-Altman plots assessing the kappa and ICC scores for the nine individual components of the questionnaire along with the aggregate of these nine components and the visual analogue score. Kappa and ICC values; ≤ 0.20 poor, 0.21-0.40 fair, 0.41-0.60 moderate, 0.61-0.80 good, and > 0.81 excellent

Figure 3:

Below are different bar graphs of the tolerability among the patients categorized based on age (Lawrance et al., 2013).



Overall bowel-preparation tolerability. **a** Average overall tolerability scores for each bowel preparation used (\pm SEM). **b** Statistical significance identified by age group between the preparations used (p value). Using square-root transformed data tolerability scores, a significant interaction between age and bowel preparation ($p = 0.006$) was observed when all nine tolerability aspects were combined with the patient age group, with older patients tolerating all the bowel preparations better than younger patients. PEG was significantly less well tolerated than Pico in patients aged <60 years but no statistical differences were detected between PEG and either NaP or Pico in patients older than 60 years. NS not significant

The results of these data suggest some consensus about colonoscopies being manageable for patients and tolerable. There is insufficient data to develop a standard measurement that can be used across pediatric centers to evaluate the quality of colonoscopy clean-outs reliably. The CoP project aims to learn about how well the existing communication about the education of the procedure is between the patient and the endoscopy center. The study's second aim is to assess how well patients understand the process involved in completing a successful colonoscopy clean-out. Existing data primarily addresses adult patients to gauge where patients stand on the tolerability and willingness to go through with the procedure again. There is insufficient patient-facing data in the pediatric literature.

Serial colonoscopic evaluations are essential for colorectal cancer (CRC) screening in adults. When caught early, patients have much higher survival rates (Kastenberg et al., 2018). For this reason, colonoscopies are more commonly used in adults, and there is more research concerning adult colonoscopies than in pediatrics (Rosvall et al., 2022). More quality improvement research in pediatrics is necessary. There are standard validated measurements for studying endoscopic procedures in adults, including the Aronchick Scale, Boston Bowel Preparation Scale (BBPS), and Ottawa Bowel Preparation Scale (OBPS) (Walsh et al., 2022).

The PRO-STEP study included outpatients over the age of 18 to report tolerability of endoscopic procedures. The questionnaire used in this study allowed patients to report their experience and pain tolerance concerning Esophagogastroduodenoscopy (EGD) and Endoscopic Retrograde Cholangiopancreatography (ERCP) procedures (Forbes et al.,

2021). This study introduced the PRO-STEP and Patient-reported experience measures (PREMs). The scale that was handed out to patients is included in Table 4 (Forbes et al., 2021). This study emphasized the need to include PREMs in any effort to create a more positive outcome with these procedures.

Table 3:

The table below highlights the characteristics of the patients who participated in the PREMs study (Forbes et al., 2021).

Patient and procedural characteristics of the patient-reported scale for tolerability of endoscopic procedures cohort

	Colonoscopy (n = 91)	EGD (n = 73)	ERCP (n = 91)	P value
Sex, male, %	53.8 (49)	47.9 (35)	47.3 (43)	.63
Mean age, y	54.4 (15.3)	53.6 (13.2)	56.3 (18.5)	.54
Current or former heavy ethyl alcohol use, %	8.8 (8)	13.7 (10)	6.6 (6)	.08
Any baseline benzodiazepine use, %	5.5 (5)	4.1 (3)	2.2 (2)	.52
Any baseline opiate use, %	2.2 (2)	5.5 (4)	4.4 (4)	.54
Mean midazolam dose, mg	3.89 (1.30)	4.42 (1.22)	5.33 (1.93)	<.001
Mean fentanyl dose, µg	65.93 (21.58)	73.97 (22.61)	100.27 (39.53)	<.001
Mean diphenhydramine dose, mg	4.40 (14.24)	5.48 (15.73)	45.60 (13.23)	<.001
Mean overall procedure time, min	27.13 (9.95)	14.93 (6.21)	17.46 (10.42)	<.001

Values are % (n) or mean (standard deviation).

Table 4: Below is the scale that was handed out to patients (Forbes et al., 2021).

Intraprocedural domain (domain 1)
1) What was your level of awareness <i>during</i> the procedure
<i>(if 0 is not aware at all and 10 is fully aware)</i>
0 1 2 3 4 5 6 7 8 9 10
2) What was your level of discomfort or pain <i>during</i> the procedure?
<i>(if 0 is none at all, and 10 is the worst possible)</i>
0 1 2 3 4 5 6 7 8 9 10
Postprocedural domain (domain 2)
1) What is your level of NEW abdominal pain <i>after</i> the procedure?
<i>(if 0 is none at all, and 10 is the worst possible)</i>
0 1 2 3 4 5 6 7 8 9 10
2) What is your level of NEW nausea <i>after</i> the procedure?
<i>(if 0 is none at all, and 10 is the worst possible)</i>
0 1 2 3 4 5 6 7 8 9 10

Table 4 (Continued)

3) What is your level of NEW bloating or distention *after* the procedure?

(if 0 is none at all, and 10 is the worst possible)

0 1 2 3 4 5 6 7 8 9 10

4a) What is your level of NEW mouth or throat pain *after* the procedure?*

(if 0 is none at all, and 10 is the worst possible)

0 1 2 3 4 5 6 7 8 9 10

4b) What is your level of NEW bottom pain *after* the procedure?*

(if 0 is none at all, and 10 is the worst possible)

0 1 2 3 4 5 6 7 8 9 10


*Depending on whether the endoscopic procedure was performed via the mouth or anus, only 1 of questions 4a or 4b were asked.

Intraprocedural and postprocedural domains were included to understand patient tolerability (Forbes et al., 2021). Patients recorded their answers to survey questions on a scale from 1-10. The results of this study show that patients generally tolerated their colonoscopies while under conscious sedation (Forbes et al., 2021). The data from the PRO-STEP survey can be used in future initiatives to help improve the quality of colonoscopy.

QUALITY IMPROVEMENT

Table 5:

The data presented in Table 5 outlines the terms and definitions related to quality improvement (Walsh et al., 2022).

	Term	Definition
	Domain	<ul style="list-style-type: none"> • Broad area of pediatric endoscopic care.
	Quality standard	<ul style="list-style-type: none"> • Recommendation on high-quality practice for a specific aspect of pediatric endoscopic care. • Quality standards may reflect priority areas for quality improvement and may be related to quality indicators.
	Quality indicator	<ul style="list-style-type: none"> • A measure of the process, performance, or outcome of pediatric endoscopic service delivery used in determining the quality of care. • Can highlight potential targets for quality improvement. • Other terms for a quality indicator include performance measure, quality measure, key performance indicator, clinical quality measure, etc.

The PEnQuIN study is a quality improvement(QI) study addressing parameters relating to pediatric endoscopic studies (Walsh et al., 2022). The PEnQuIN addresses some key factors and highlights some performance areas that require more investigation, including rates of cecal intubation rate and terminal ileal intubation, as well as overall bowel preparation quality (Walsh et al., 2022). Based on the study, this research paper aims to help improve bowel preparation.

Table 6: The table below shows the different strategies that can be used when completing a PDSA cycle (Reed et al., 2016).

Exploration of two different strategies for the implementation of a care bundle

Lesson	Strategy 1	Strategy 2
1 Find opportunities to learn about and practise PDSA	<p>The team have limited opportunity to learn and practise their approach to implementation of the care bundle – everything rests on the ‘big launch’.</p> <p>During the launch event, colleagues raise a lot of valuable questions and issues that could improve the care bundle – but the team, having not run an event like this previously, have no means of capturing these issues and can only recall some of these issues after the meeting. They are disappointed the idea wasn’t better received after all of the work they had put in.</p>	<p>The team have opportunities to apply the PDSA approach in simulations and on a small scale tests. This supports learning and builds competence and confidence prior to more complex and larger tests of change.</p> <p>After one of the initial small scale tests, the study phase reveals only 2/10 forms have been filled in. Only by asking the people doing the test did they understand the reason why: it was difficult to obtain the information to complete the forms. The team learnt the importance of getting feedback from staff and of building good relationships with them. They also realised the test had been too large, and the same conclusion could have been reached from one or two patients rather than 10.</p>
2 Stop doing what isn’t working and start spending more time on PDSA	<p>A significant portion of work undertaken by the team prior to the launch may be wasted if it turns out that the care bundle is not fit for purpose.</p> <p>Following the launch event they realised that they need to redesign the form and have to recall the hundreds of forms they had printed. The project has already been running for 6 months and only 2 months remain, staff morale is low and no new people have volunteered to get involved.</p>	<p>By devoting time to developing the intervention through PDSA cycles, the team are able to avoid extensive rework of the care bundles later on, and can build engagement with more staff as they go.</p> <p>In an early PDSA cycle, the team realise that junior doctors will play a bigger role than they had thought at the start. At this point, they engage a junior doctor as a project champion and plan PDSA cycles testing out the care bundle with them.</p>
3 Encourage clinicians to learn safely from failure	<p>By undertaking the ‘do’ stage as one big launch, the team deprive themselves of the potential to incorporate related learning into the design of the care bundle (‘study’ and ‘act’). This means the first point of failure in practice is the launch itself, resulting in a high profile, high cost failure.</p> <p>They discover after the launch that the clinical information needed is not available in A&E at the time it is required, and have limited time and resource left to remedy it.</p>	<p>Being involved in the testing and development of the care bundle increases buy-in and allows failure of the care bundle to occur on a small scale in a safe and contained manner. This enables rapid learning without using up physical and emotional resources of other staff unnecessarily.</p> <p>The team test the care bundle with one patient and realise that the clinical information that they need is not available in A&E at the time it is required. They are then able to modify the information flow through several more tests of the bundle to eliminate this problem.</p>

A&E = accident and emergency department; PDSA = plan-do-study-act

In the ongoing investigation, the focus pertains predominantly to the first instructional session and the second strategic approach. Employing the Plan-Do-Study-Act (PDSA) methodology, an initial implementation was conducted on a limited scale. The distribution of the survey spanned a brief duration of a few weeks, followed by a subsequent evaluation to gauge its efficacy and the extent of participation from patients or their guardians in providing feedback concerning the clean-out process.

MATERIAL AND METHODS

STUDY DESIGN

Surveys will be handed out to pediatric and young adult patients. The broad inclusion criteria will permit a stratified analysis relating to how the choice of CoP impacts younger children and older children. Parents will complete surveys given to patients under 18 (with patient input). Patients over the age of 18 will be filling out the forms themselves. Having patients fill out the surveys independently will provide an added dimension for data analysis.

Patient data will be abstracted from the electronic medical record at Boston Children's Hospital. Data for the CoP study is being collected in the Gastroenterology Procedure Unit (GPU). The survey used in this study was developed by a consensus in a diverse committee that included physicians, fellows, Research Study Coordinators, and Nursing staff in the GPU. Surveys are handed out to patients or parents while waiting to complete a procedure. A standardized survey script was created to ensure that all patients would be presented with similar information concerning the risks and benefits of participation in the study. GPU nursing staff were not required to assist in survey completion. The study was primarily directed to patients undergoing standard diagnostic studies. We did not include patients receiving subspecialty evaluations, including motility studies. This avoided the need to include patients who may be provided with different condition-specific CoP guidelines. Inpatients were excluded as their clean-out was managed by hospital staff. Patients are typically approached in the waiting or pre-operative room after consent has been obtained by procedural staff. A survey was

presented to the parent or patient, taking about five to ten minutes for the patients or parents to complete. The three dimensions of interest in the survey included questions related to the general background of the procedure, questions related to instructions, and questions related to the outcome. The pilot phase of survey collection began in January 2024.

Procedural physicians were asked to complete the BPPS scale to assess the success of the clean-out. Visual metrics were provided to assist in grading.

STUDY AIMS/HYPOTHESIS

This study hypothesizes that the instructions provided to patients are impacted by their preferred language, portal and internet access, and access to medications. The data collected from the survey will permit an assessment of patient-preferred language and help target initiatives to address any inequities. We hope to use this data to provide more effective information that will preclude the need for patients to call GPU or on-call medical staff to clarify any confusion related to the CoP.

The most popular languages encountered in the pilot study were Spanish, Portuguese, and Arabic. Any language outside of those choices was written in and specified by the patient. Questions concerning communication addressed how patients would prefer we communicated with them moving forward (phone, email, text, portal message). The final set of questions related to access to the medications necessary to complete the CoP and any previous experience(s) they have had with colonoscopies.

The questions concerning instruction addressed how well the patient felt the provider had educated them. Patient access to the prep instructions was next addressed in the survey. Questions were asked about the need to make phone calls or portal requests addressing questions or clarifications related to the prep. This should help to identify areas in the education process that are most in need of remedy.

The last set of questions is related to the outcome of the procedure. These questions addressed any difficulties with the prep, including if the child experienced GI distress or the instructions were unclear. We also elicited how successful the patient/parents thought the prep had been. A feedback portion at the end of the survey

enables patients to provide input and feedback concerning their experiences with the CoP at Boston Children's Hospital.

Research Study Coordinators requested completion of the Boston Bowel Preparation Scale from endoscopists completing studies on consented patients. We hope to compare input from both patients and physicians about the success of the prep.

The survey was translated into three other languages (Arabic, Portuguese, and Spanish). Patients were offered a preferred language interpreter if indicated.

SURVEY

Figure 4 includes the survey questions that were created for data collection. The material assessed in the survey was developed from a series of consensus meetings that included physicians, procedural nursing staff, administrative staff, and quality improvement experts. This survey was reviewed by Boston Children's Hospital Family Advisory Council members before being handed out to patients.

Figure 4**CoLonoscopy EducatioN and Outcome OpTimization (CLEAN-Out)****Background Questions:**

1. What language do you prefer to use when discussing your/your child's care?
 - a. English
 - b. Spanish
 - c. Portuguese (European or Brazilian)
 - d. Arabic
 - e. Other(please specify): _____

2. Can you access the Boston Children's Hospital MyChildrens Patient Portal?
 - a. No
 - b. Yes

3. How do you prefer to receive prep information from your medical team?
 - a. Portal message
 - b. Email message
 - c. Phone call with emailed or portal hard copy of instructions
 - d. In person with a paper copy of instructions
 - e. Other

4. Did you have any difficulty getting the medications necessary to complete the prep recommended in the instructions (Miralax, Senna, Bisacodyl)?
 - a. No
 - b. Yes, I had difficulty finding it in the pharmacy.
 - c. Yes, the expense was an issue.
 - d. Yes, other please describe the barrier: _____

5. Did you have any difficulty getting a sports drink necessary to complete the prep recommended in the instructions (Gatorade®, Powerade®, or Pedialyte®)?
 - a. No
 - b. Yes, I had difficulty finding it in the pharmacy.
 - c. Yes, the expense was an issue.

6. Is this the first time you or your child has had a colonoscopy?
 - a. Yes
 - b. No |

Figure 4 (Continued)**CoLonoscopy EducatioN and Outcome OpTimization (CLEAN-OuT)****Questions Related to Instructions:**

7. Did your GI Provider review with you/ your child that a prep was necessary before a Colonoscopy?
 - a. Yes
 - b. No
 - c. Unsure
 - d.
8. When you received the prep instructions, was it what you expected based on your prior communication with the GI provider?
 - a. Yes
 - b. Yes, although it was different than expected
 - c. No
9. How did you receive your prep instructions?
 - a. Email
 - b. Portal
 - c. Phone
 - d. I didn't receive instructions and had to call the call provider
10. Were the instructions for your prep provided to you in your preferred language?
 - a. Yes
 - b. No
11. Did you/ your child have any questions after reading the written prep instructions?
 - a. Yes
 - b. No
12. If yes, please let us know your questions:
13. Did you receive a pre-op phone call from one of the nurses to see if you had any questions before the procedure?
 - a. Yes
 - b. No
14. Was the pre-op phone call to answer questions provided to you with the help of an interpreter?
 - a. Yes
 - b. No
15. Did you find the pre-op phone call helpful, and were all of your questions answered?
 - a. Yes
 - b. No

Figure 4 (Continued)**CoLonoscopy Education and Outcome OpTimization (CLEAN-OuT)****Questions Related to the Outcome:**

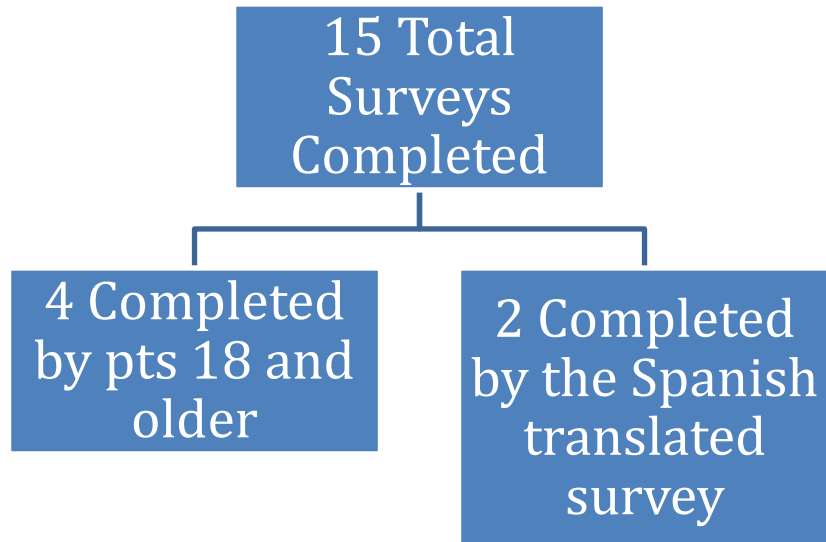
16. Did you have any difficulties completing the prep as instructed?
 - a. No
 - b. Yes
17. If yes, please describe your difficulties:
 - a. Yes – I/my child faced difficulties from not eating for a whole day before the procedure.
 - b. Yes – it was difficult for me/my child to take all the Miralax/Gatorade as instructed.
 - c. Yes – I/my child had a difficult time with the taste of the Miralax/Gatorade
 - d. Yes – I/my child experienced significant symptoms (nausea, vomiting, or cramping) that made completing the prep difficult.
 - e. Yes – I didn't understand the prep instructions
 - f. Other (please specify)
18. Did you have to call the GI Team or on-call medical staff to ask any questions within the three days before the procedure?
 - a. No
 - b. Yes- related to prep
 - c. Yes- illness
 - d. Yes- other: _____
19. Do you feel your/your child's prep was successful?
 - a. Yes
 - b. No
 - c. Unsure
20. Do you have other comments about you or your child's experience receiving a colonoscopy?
 - a. No
 - b. Yes (open text)
21. Is there other input you would like to share about how patients are prepared for their procedure?

RESULTS

This preliminary survey data was collected during a pilot 3-week period. This survey data was subsequently presented to the team for review and discussion to see if any changes to the questions or the process of handing out the survey were indicated.

Parents or patients were apprised of this QI study and our intention to use their responses to improve the process of bowel preparations moving forward. Most patients and parents were willing to complete the survey and provide feedback.

Figure 5: The figure below shows the number of surveys handed out.



The study team reviewed the primary findings to determine if there were any systematic difficulties in understanding and responding to the survey questions.

Figure 6: The bar graph below shows how many patients or parents were handed a survey and which language they spoke.

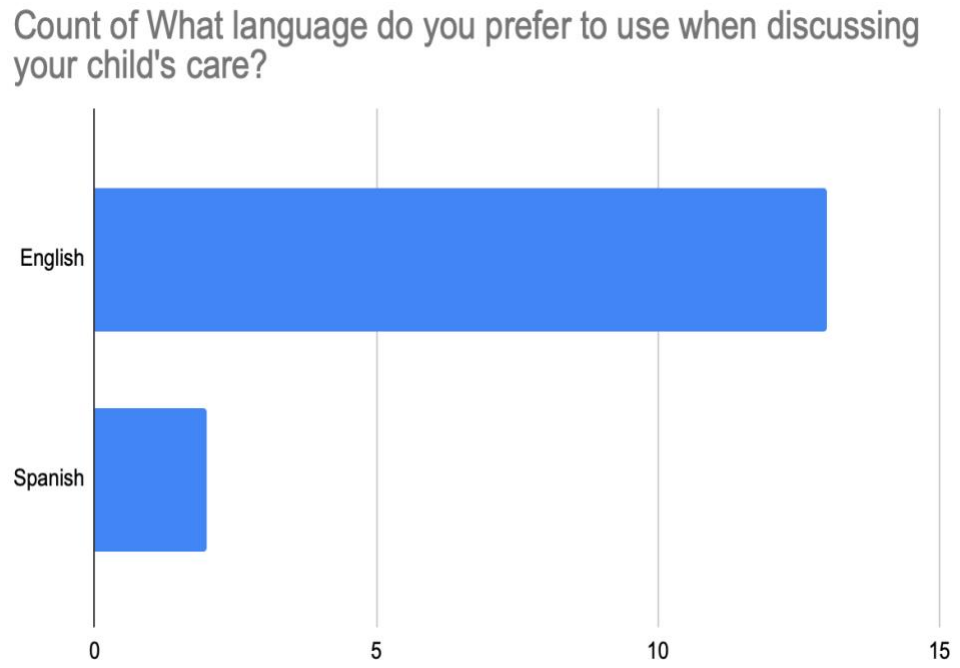
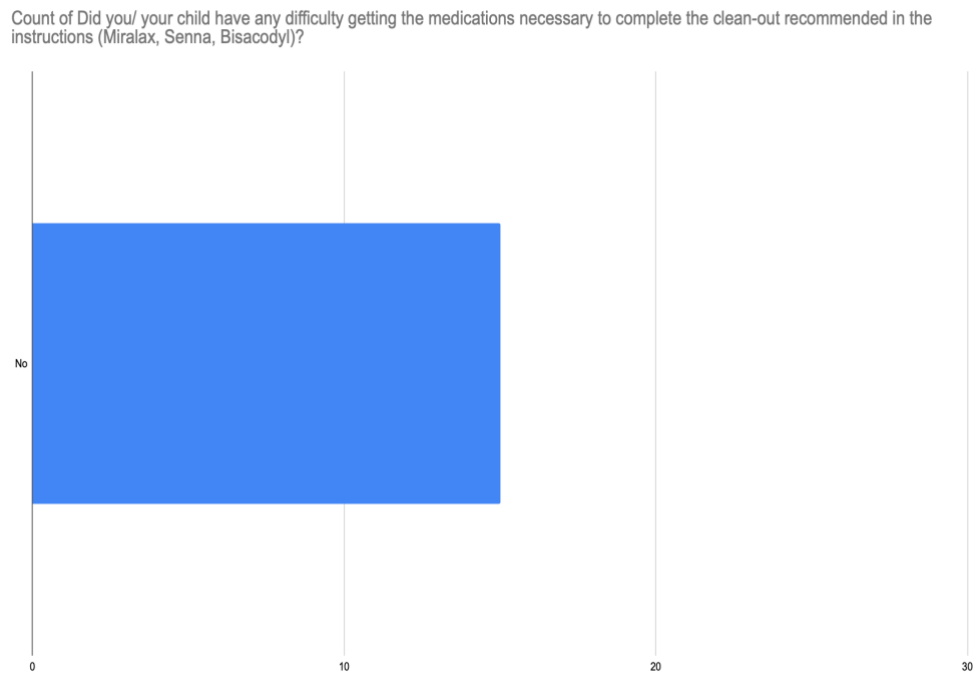


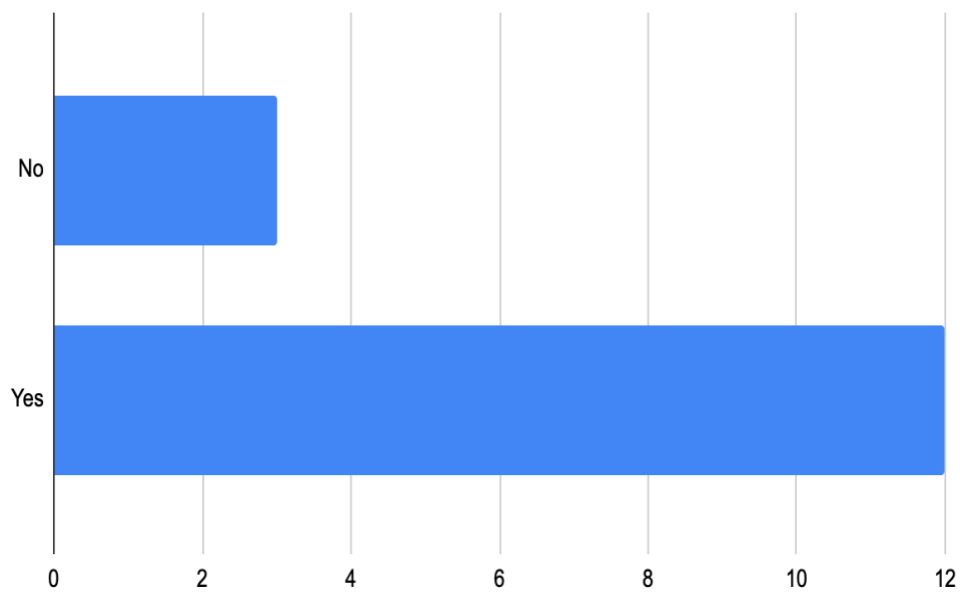
Figure 7: The bar graph shows how accessible the medication was for the parents or patient.



None of the patients completing the survey experienced any difficulties getting the prescribed medications (Figure 7). As such, access to medication did not appear to be a limiting step in completing the clean-out in the responding sample.

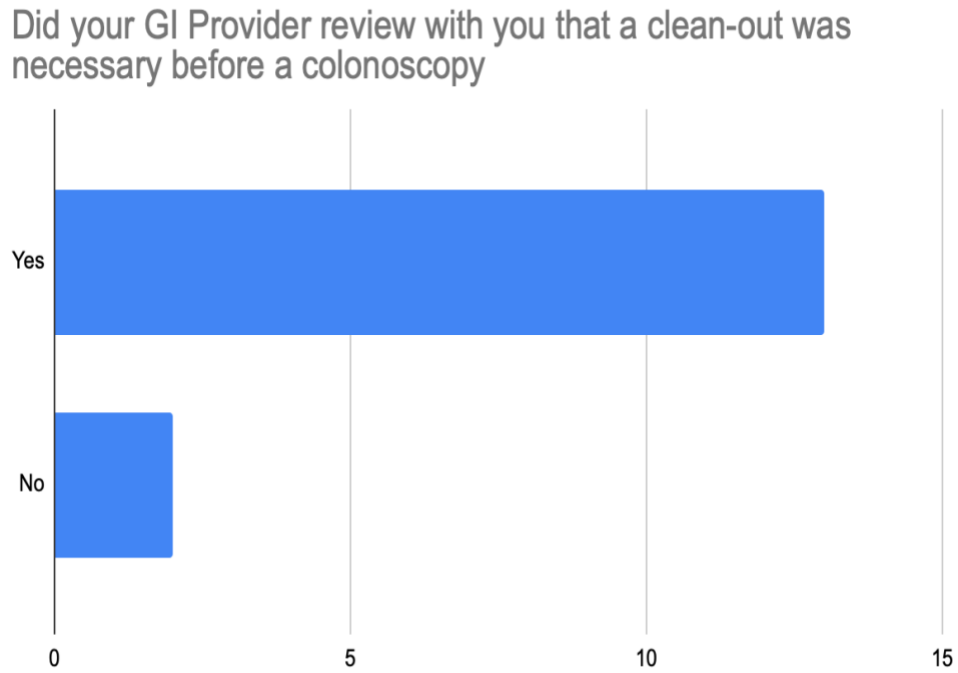
Figure 8: This bar graph shows the prior experiences parents or patients had with colonoscopies prior to completing the survey.

Have you/your child had prior experience in dealing with clean-outs for colonoscopies?



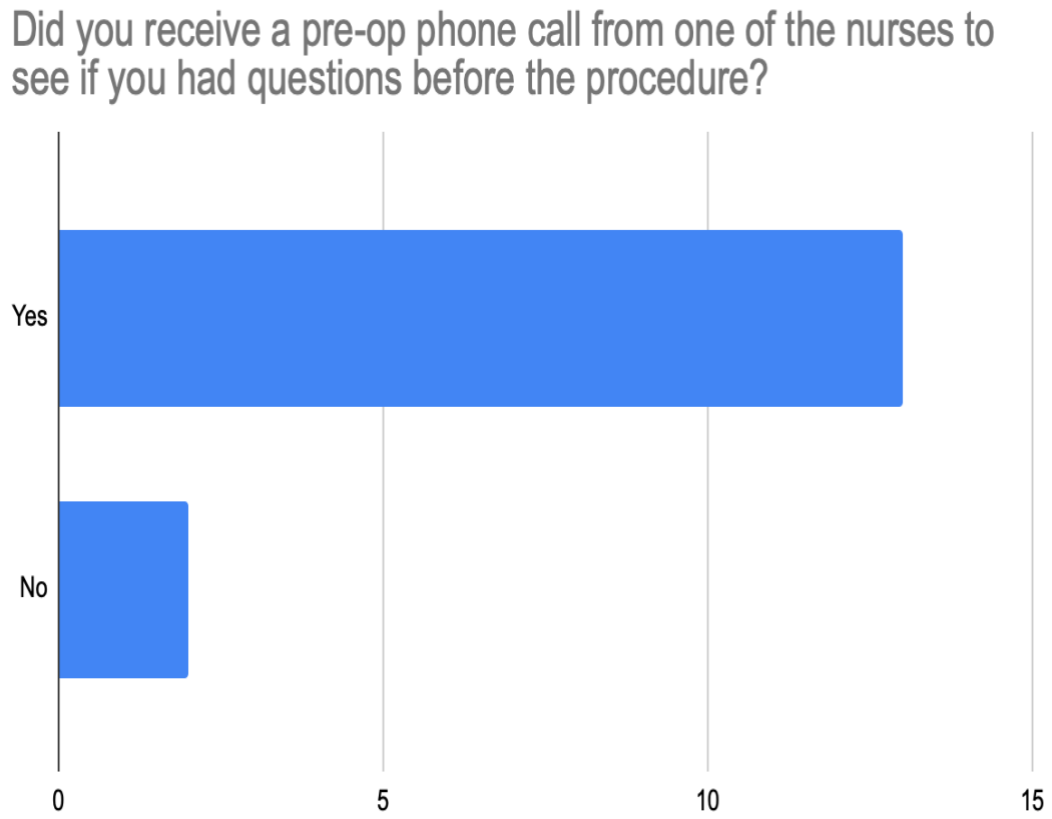
The data in Figure 8 demonstrated that most patients and or parents participating in the study have had experiences with following a clean-out procedure in the past experiences following a clean-out procedure.

Figure 9: The bar graph shows how many parents were aware of the importance of a clean-out by the GI provider.



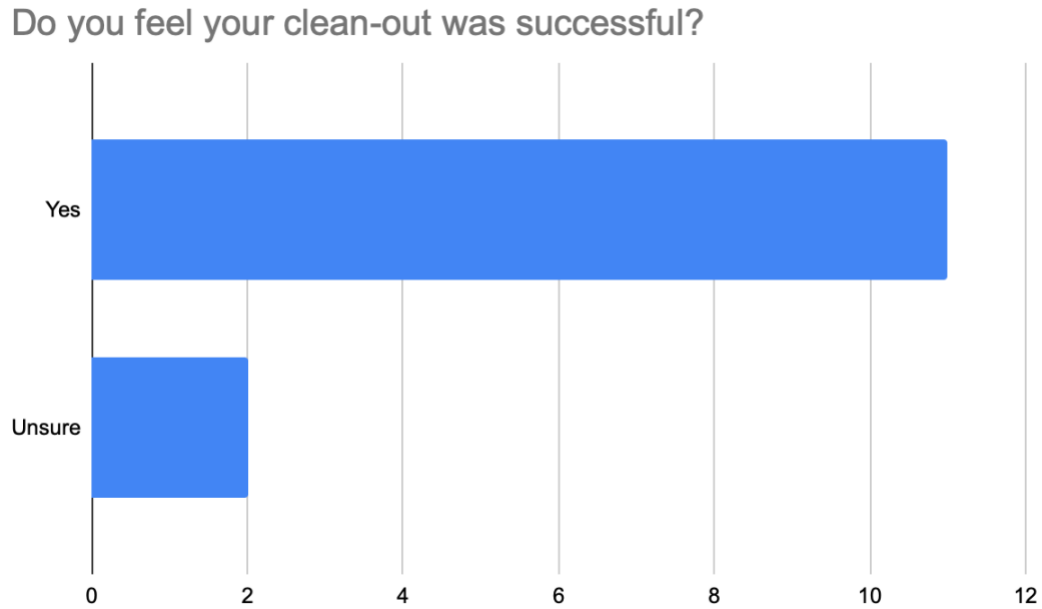
Patients must recognize the importance of completing the clean-out and why it is necessary for the colonoscopy. The data presented in Figure 9 suggest that most patients were apprised of the importance of the clean-out by their primary GI providers.

Figure 10: This bar graph shows how many patients and or parents received a phone call from the pre-op nurse.



Per protocol, all patients receive a phone call to determine if there are any outstanding questions prior to initiating the clean-out. However, some survey responses indicated that not all patients received a phone call. The parent had to answer the phone and confirm the appointment and prep to be considered “contacted”. The survey question was changed, and an extra answer option was added.

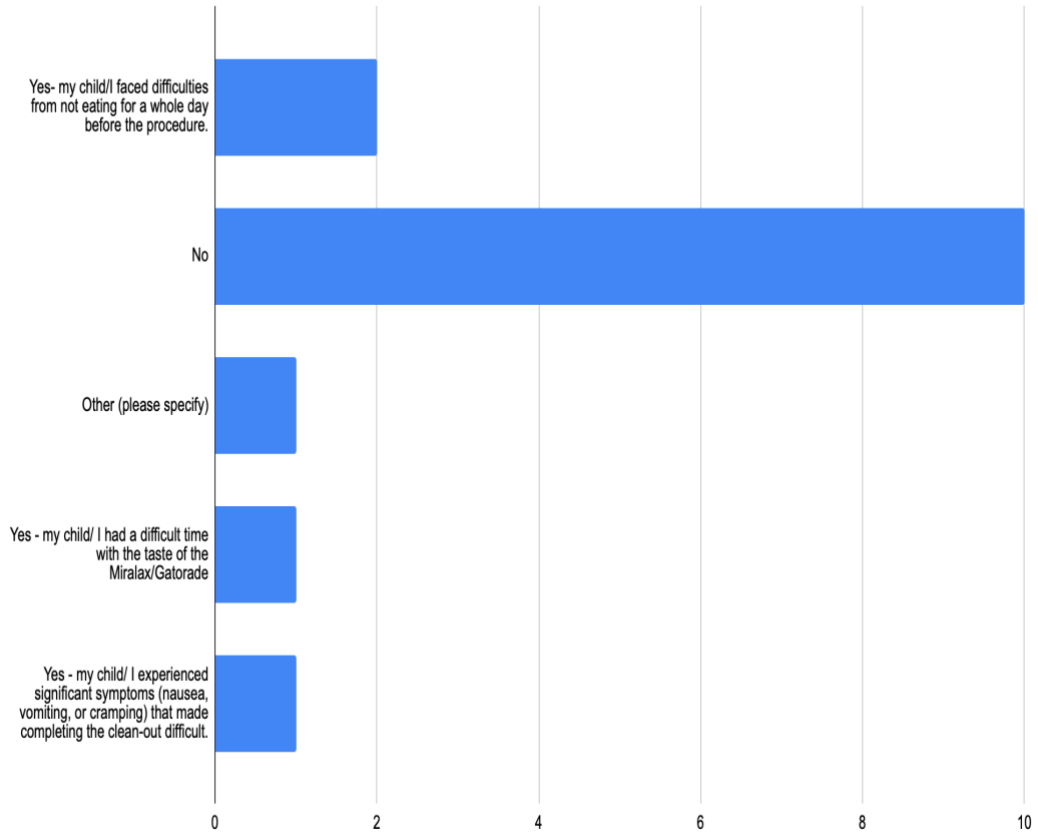
Figure 11: The bar graph shows if there were any difficulties the parent or patient faced when completing the prep.



The results collected to date suggest that many patients complained about the prep. Most patients who completed the survey did not face too many physical symptoms.

Figure 12: The bar graph shows that in the parent’s or patients’ opinions if they thought the clean-out was successful.

Did you have any difficulties completing the clean-out as instructed (choose one)?



Most parents or patients completing the survey reported a successful cleanout. This question was also posed to the endoscopist to assess how well the clean-out went from their perspective.

An algorithm has been established in the BCH procedure unit (GPU) for scheduling colonoscopies and providing clean-out prep instructions. This QI study was designed first to assess how well the existing process in the GPU was working. We limited our study population to patients undergoing elective diagnostic procedures and excluded those undergoing procedures for subspecialty evaluations, including motility studies. Completed surveys were scanned on-site and archived in a password-protected server behind the Boston Children's Hospital digital firewall. After scanning, data from written surveys was abstracted to a RedCap database.

Endoscopists were polled about the BBPS grading of the clean-out either in real-time or by an email sent later that day. There have been some problems collecting the BBPS clean-out data from physicians, and this was discussed in the meeting. Physicians initially provided composite "neutral, excellent, poor, or good" grades for the clean-out. Moving forward, physicians will be instructed to score each segment (right colon, transverse colon, and left colon) as outlined in the BBPS.

Overall, the study data collection is going as expected based on the GPU nurses and physicians understanding the process of colonoscopies at Boston Children's Hospital. The team will reassess the process when closer to 40-50 surveys have been completed.

DISCUSSION

Pilot survey data was collected for this study over about a month. The majority of the first year of this project was dedicated to setting up the survey questions and study infrastructure, building a study team, and securing necessary administrative approvals. Once the team edited and finalized the survey, the language was reviewed by Family Liaison staff at Boston Children's Hospital. The survey was ready for piloting in February 2024. Most parents or patients were not confused by the process and understood the directions well. The most adverse event reported by study participants was nausea and vomiting resulting from the prescribed cathartic medication.

Spanish was the most common language used by English non-preferred speakers. The interpreter was asked to explain the study to the parent in the pre-operative room. If they agreed to participate, the survey was handed to them in their preferred language whenever possible. Most patients polled during this pilot phase of the study were English-speaking. The survey was translated into three different languages (Spanish, Portuguese, or Arabic.) to ensure the questions were being understood.

One of the edits made after completing the initial survey pilot related to Question 12 concerned the pre-op phone call. Several patients responded “No” to this question. However, we learned patients could only be scheduled for a procedure after speaking with the preprocedural nursing staff. Question 12 was edited to include “Unsure” as a response choice. Data input required recording the patient’s medical record. However, most parents were unsure what their child’s medical record number (MRN) was or how to access it. The MRN is now included on the back of the survey to ensure correct survey data assignments. Other information added to the survey included which prep the patient was assigned to receive. Clean-out preps are selected based on weight, previous experiences, and concomitant medications. Clean-out preps ranged from three to four days.

We have adjusted the study protocol to ensure BPPS clean-out assessments are completed after the procedure. Preliminary data suggests that most physicians reported “neutral” or “excellent” concerning prep quality. We are presently educating endoscopy staff to rate each segment of the colon before irrigation to standardize prep assessments across providers. One of the study endoscopists commented that “every physician scores differently and may not remember the BBPS system”. A different scale has been used at Boston Children’s Hospital for some time, so including the BPPS metric is a learning point for most clinicians.

One logistical difficulty encountered was the timing. After patients were brought back into the operating room, it could be difficult to find the parents, who may be getting

food or coffee while they waited. Colonoscopy often takes longer than other procedures in the GPU. Approaching parents in the Recovery Room was not optimal. Their focus was challenged as they answered survey questions, monitored their children closely while they woke up from anesthesia, and spoke with physicians about the procedure's results. The nurse also had to provide parents in the Recovery Room with instructions for

PROSPECTS OF THE STUDY

The data collection infrastructure to complete this study could be leveraged to answer questions outside of the procedure unit. The studies can initiate further changes to improve the care patients and young adults receive in the procedure unit and outpatient setting. For example, we plan to apply this same survey approach to assess patients' experiences being studied endoscopically outside our procedure unit and in the main operating room or a satellite site. The algorithm to provide clean-out instructions to patients in the operating room differs from that of patients studied in the procedure unit. The primary focus on scheduled ambulatory procedures was directed toward outpatients. This is due to medication access and administration difficulties, which differs from how nursing staff might coordinate a clean-out for a hospitalized patient. This study focuses on an important topic not well-recognized in the literature. Expanding on this study would help bring more data to the topic and help with future studies.

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CURRICULUM VITAE

