

Standardizing inpatient colonoscopy preparations improves quality and provider satisfaction

Quality
improvement
of bowel
preparation

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Abstract

Purpose – Inpatient colonoscopy bowel preparation quality is frequently suboptimal. This quality improvement (QI) intervention is focused on regimenting this process to impact important outcomes.

Design/methodology/approach – Define, Measure, Analyze, Improve and Control (DMAIC) methodology was employed, including generating a root-cause analysis to identify factors associated with inpatient bowel quality. These findings motivated the creation of a standardized electronic health record (EHR)-based order set with consistent instructions and anticipatory guidance for administering providers.

Findings – There were 264 inpatient colonoscopies evaluated, including 198 procedures pre-intervention and 66 post-intervention. The intervention significantly improved the adequacy of right colon bowel preparations (75.0 percent vs 86.9 percent, $p = 0.04$) but not overall preparation quality (73.7 percent vs 80.3 percent, $p = 0.22$). The intervention led to numerical improvement in the proportion of procedures in which the preparation quality interfered with making a diagnosis (10 percent–6 percent, $p = 0.29$) or resulted in an aborted procedure (3.5 percent–1.5 percent, $p = 0.39$). After the intervention, provider satisfaction with the ordering process significantly increased (23.3 percent vs 61.1 percent, $p < 0.001$).

Practical implications – The QI intervention significantly reduced the number of inpatient colonoscopies with inadequate preparation in the right colon, while also modestly improving the diagnostic yield and proportion of aborted procedures. Importantly, the standardized EHR order set substantially improved provider satisfaction, which should justify broader use of such tools.

Originality/value – Novel clinical outcomes such as ability to answer diagnostic questions were improved using this intervention. The results align with strategic goals to enhance provider experience and continuously improve quality of patient care.

Keywords Inpatient bowel preparation, Quality improvement, Standardized order set, Electronic health record

Paper type Case study

Introduction

The quality of inpatient colonoscopy bowel preparation is frequently inadequate and estimated to occur in 50–80 percent of cases (Chambers *et al.*, 2016; Ergen *et al.*, 2016; Garber *et al.*, 2019; Lee *et al.*, 2015; Ness *et al.*, 2001; Reilly and Walker, 2004; Shah-Khan *et al.*, 2017; Yadlapati *et al.*, 2018; Hendry *et al.*, 2007; Mahmood *et al.*, 2018). Inadequate bowel preparation can preclude satisfactory visualization of the colon and result in diagnostic uncertainty requiring repeated or alternative testing (Yadlapati *et al.*, 2018; Hendry *et al.*, 2007). As a result, hospital length of stay can be extended up to 25 percent and associated costs may increase by as much as 22 percent (Hendry *et al.*, 2007; Enns and Krygier, 2008). Improvement in the quality of inpatient bowel preparations should enhance initial endoscopic mucosal visualization and reduce incomplete or non-diagnostic procedures. As a result, patients and providers may experience less frustration, shorter hospital stays and reduced resource utilization (Lee *et al.*, 2015; Enns and Krygier, 2008; Strate and Syngal, 2003).



Suboptimal inpatient bowel preparation are often a result of institutional practices such as poorly structured patient education, lack of standardized preparation methods and administration instructions or inappropriate timing of preparation administration (Garber *et al.*, 2019; Reilly and Walker, 2004; Hillyer *et al.*, 2012), whereas outpatient programs are increasingly instituting formal standardized processes to mitigate the consequences associated with poor bowel preparation (Rex *et al.*, 2002; Kurlander *et al.*, 2016; Andrealli *et al.*, 2018), these programs are rare for hospitalized patients, who are particularly vulnerable to incomplete preparation. Poor recognition of this problem may be due to a lack of readily available – and clinically relevant – means to measure and track this problem.

Admittedly, characterizing the problem of inadequate bowel preparations is different between the inpatient and outpatient settings. “Inadequacy” of outpatient and inpatient preparations is typically defined based on standard outpatient measures such as the Boston Bowel Preparation Score (BBPS). But bowel cleanliness has a more significant impact on outpatient screening procedures, as potential goal is to prevent colorectal cancer (CRC) by identifying and removing polyps which can be even diminutive in size. On the other hand, inpatient colonoscopies are diagnostic in nature, and they are typically performed to identify larger phenomena such as masses, sources of bleeding or inflammatory changes seen on imaging. Thus, the actual clinical relevance of “inadequate” (as measured by standard outpatient measures such as the BBPS) *inpatient* bowel preparations at different institutions remains unclear. Novel outcome measures pertinent to inpatient procedures are needed to better characterize the problem of inadequate inpatient bowel preparations and measure the clinical relevance of improving these preparations across institutions.

Prior inpatient colonoscopy quality improvement (QI) initiatives aimed at reducing variability in the preparation process have shown small benefits with fewer aborted, delayed or repeated procedures, which resulted in reduced hospital costs, length of stay and improved patient satisfaction (Chambers *et al.*, 2016; Ergen *et al.*, 2016; Lee *et al.*, 2015; Shah-Khan *et al.*, 2017; Yadlapati *et al.*, 2018; Rosenfeld *et al.*, 2010). However, limitations of these interventions have restricted general applicability, including small sample sizes, unusually high pre-intervention inadequate preparation rates and variable definitions of preparation quality or other outcomes (Chambers *et al.*, 2016; Ergen *et al.*, 2016; Garber *et al.*, 2019; Lee *et al.*, 2015; Reilly and Walker, 2004; Yadlapati *et al.*, 2018; Rosenfeld *et al.*, 2010). Therefore, strong justifications for widespread implementation of these QI interventions remain uncertain.

The objective of this QI study was to expand on prior experiences and quantify the magnitude of problems related to inadequate inpatient bowel preparation through measuring relevant traditional clinical outcomes as well as novel measures related specifically to inpatient bowel preparation processes and colonoscopy outcomes. While quality of bowel preparation is a complex issue, we aimed to evaluate and address factors directly related to preparation administration, nursing instructions and physician. To address the observed problems, we sought to create an electronic health record (EHR) intervention based on causative factors identified on root-cause analysis of inadequate inpatient bowel preparations. Finally, we studied the impact of this intervention on our traditional and novel outcome measures, as well as whether it affected provider satisfaction with preparing patients for inpatient colonoscopy.

Methods

Formal data-driven Define, Measure, Analyze, Improve and Control (DMAIC) QI methodology was employed for this investigation to identify, analyze and improve current inpatient bowel preparation processes at our tertiary care academic medical center (Ettinger, 2001). All patients aged 18 years or older admitted to Duke University Hospital (Durham, North Carolina,) who underwent inpatient colonoscopy with bowel preparation were

included. Patients in the ICU, as well as those with severe medical comorbidities precluding procedural safety or understanding and compliance with bowel preparation, were excluded. This study was exempted from institutional review board (IRB) approval.

To evaluate the impact of inpatient bowel preparations on relevant clinical outcomes, we utilized outcomes derived from both currently accepted *outpatient* standards and novel *inpatient* measures tailored specifically for this QI project. Specifically, we evaluated preparation adequacy using the BBPS (Lai et al., 2009), which is validated for outpatient CRC screening and composed of ranking prep quality 0–3 in three sections (right, transverse and left colon) for a maximum score of 9; adequacy is defined by a score of ≥ 6 and no segment < 2 . We also assessed whether the preparation interfered with diagnostic capabilities, led to aborted or delayed and repeated procedures, or it was adequate for simultaneous CRC screening (to prevent redundant outpatient procedures). Finally, we investigated the impact of ordering and administering inpatient bowel preparations on provider satisfaction.

Physicians performing inpatient colonoscopies prospectively recorded procedure outcomes. The frequency of abandoned, postponed or repeated colonoscopies due to inadequate inpatient bowel preparations was also recorded, as determined by the performing endoscopist. In addition, the physicians were also asked whether they felt the preparation interfered with diagnostic yield or the ability to simultaneously perform CRC screening. Trained endoscopy nurses present before and during inpatient colonoscopies were provided a questionnaire to also record patient demographics, procedure indication, timing to colonoscopy from hospital admission, preparation methods and patient tolerability (defined as > 80 percent consumed). Finally, to evaluate the attitudes and ease of preparing patients for colonoscopy, Internal Medicine (IM) residents on any inpatient hospital service were surveyed using an online poll before and after the intervention. For simplicity, only two questions were included: (1) “How frustrating do you find the bowel prep process?” and (2) “If a colonoscopy order set with troubleshooting instructions for nurses existed, would you use it?” Only IM residents were included, because they order the majority of inpatient colonoscopies at our institution by virtue of running most inpatient specialty and non-specialty services.

A process map was then created to characterize factors leading to inadequate inpatient bowel preparations through stakeholder interviews and process observation. Problems at the level of the physician, nurse, patient and electronic preparation order were all identified as significant contributors. A summary of these factors is shown in Figure 1, which supported a root-cause analysis to identify factors most contributing to poor inpatient bowel preps.

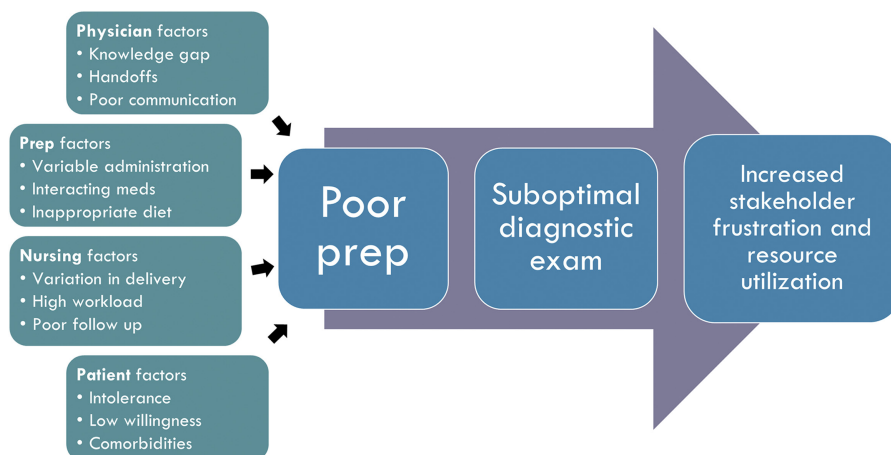


Figure 1.
Inpatient bowel
preparation “usual
care” root-cause
analysis

The most significant factors were related to the lack of standardized provider administration instructions. These findings then motivated the creation of an evidence-based standardized EHR-based order set (Saltzman *et al.*, 2015). The intervention consisted of a comprehensive electronic checklist with instructions for ordering, administering, troubleshooting and monitoring a patient for an inpatient colonoscopy (Figure 2). Instructions for split-dose GOLYTELY preparation and anticipatory guidance were included. This order set was created and launched within the EPIC (Epic, Verona, WI) EHR.

Baseline and post-intervention inpatient bowel preparation data were collected from February 1, 2017 to June 30, 2018. Prior to the bowel preparation intervention, patients received either GOLYTELY or MiraLAX bowel preparations after gastroenterology (GI) consultation according to usual care. Following a prolonged run-in period during which the problem of inadequate bowel preparations was confirmed and potential etiologies identified, our intervention was then incorporated into the EHR and publicized to ordering providers on February 2, 2018. Despite a larger collection of data pre-intervention, we stopped collecting data five months after intervention deployment due to the transition of (IM) trainees on July 1.

Descriptive statistics were calculated using means and proportions. The *t*-test was used to compare mean BBPS before and after the intervention. Univariate logistic regression was used to calculate *p*-values for preparation characteristics, as well as resident survey outcomes, before and after the intervention. A multivariate logistic regression model adjusted for age, sex and bleeding indication (given presumed association with inadequate bowel preparation) was used to obtain *p*-values for colonoscopy outcomes before and after the intervention. Missing data were excluded. The datasets generated and analyzed during the current study are available from the corresponding author in de-identified form on reasonable request. All calculations were performed using R statistical software version 3.6.1.

Results

A total of 264 inpatient colonoscopies were evaluated at Duke University Hospital (Durham, North Carolina) during the observation period from February 1, 2017 to June 30, 2018, including 198 pre-intervention and 66 post-intervention procedures. Throughout the observation period, most patients were male (53 percent) with a mean age of 63.1 (SD, 14.4) (Table I). The mean number of days from admission to inpatient colonoscopy was 4.9 (SD, 3.4) and 56.3 percent of procedures were for GI bleeding. Overall, the mean BBPS was 6.9, comprised 2.2 on the right colon, 2.4 for the transverse and 2.4 for the left.

After the intervention, use of GOLYTELY increased (87.8 percent vs 97.0 percent, $p < 0.05$), as did the proportion of patients who completed the preparation (91.4 percent vs 94.6 percent, $p = 0.46$) and received a clear liquid day on the day prior to colonoscopy (87.3 percent vs 95.9 percent, $p = 0.11$). The proportion of patients who received a one-day preparation decreased (84.5 percent vs 77.4 percent, $p = 0.20$), perhaps related to increased attention to optimizing preparation quality and increasing to a two-day preparation if necessary. All of these factors were expected and related to the design of the inpatient EHR bowel preparation order set.

During the study follow-up period (Table II and Figure 3), the intervention significantly improved the adequacy of right colon bowel preparations (75.0 percent vs 86.9 percent, $p = 0.04$) but not overall preparation adequacy (73.7 percent vs 80.3 percent, $p = 0.22$). The proportion of procedures in which the preparation quality interfered with making a diagnosis decreased (9.9 percent–6.1 percent, $p = 0.29$), as did the number of cases aborted due to prep quality (3.5 percent–1.5 percent, $p = 0.39$), but neither achieved statistical significance. There was no significant effect on the ability to perform CRC screening (64.4 percent vs 67.7 percent, $p = 0.58$) or the number of delayed or repeated procedures (14.1 percent vs 16.7 percent, $p = 0.68$). Overall, inadequate bowel prep led to a procedural delay in 14.8 percent of cases.

Orders	Dose	Administration	Timing	Additional Instructions
Diet Order	Clear Liquid Diet		Effective Now	No red fluids
Diet Order	NPO		Effective Midnight	Except for: Sips, Ice chips, Meds
Medication	Peg-electrolyte (GOLYTELY) solution	Oral	1 Dose, Now	Please have patient drink 8oz. every 15 minutes. Give 2L the day prior to procedure at 1700. Given final 2L on day of procedure at 0400.
Misc Nursing Order	Instructions for nausea and vomiting associated with Colonoscopy preparation administration	See instructions	Effective now	1) Make sure prep is chilled (place in refrigerator and serve on ice) 2) Ask patient to drink through a straw 3) Slow down to 8oz. consumed every 30 minutes 4) Take a 1 hour break and try again
Misc Nursing Order	Please page house officer if the patient is written to receive any of these medications (these should be HELD prior to Colonoscopy)	See instructions	Effective now	1) Blood thinners (eg, Warfarin, Apixaban, Dabigatran, Rivaroxaban) 2) IV Heparin (held 4 hours prior to procedure) 3) Antiplatelet agents (eg, clopidogrel, ticagrelor) 4) Iron supplementation (eg, Ferrous Sulfate)
Misc Nursing Order	Please check on bowel preparation at 1900 the day prior to the colonoscopy	See instructions	Effective now	Please page house officer if patient refuses bowel preparation. Please see nursing instructions regarding intolerances as needed.
Misc Nursing Order	Please check on bowel preparation at 0600 the day of the colonoscopy	See instructions	Effective now	If stool is not clear/yellow liquid, please administer extra 2L GOLYTELY, as ordered PRN
Medication	Ondansetron (ZOFRAN), injection (IV)	Intravenous (IV)	1 Dose, PRN	For nausea/vomiting associated with colonoscopy bowel preparation

Quality improvement of bowel preparation

Figure 2. Inpatient bowel preparation order set

	Overall [#] (n = 264)	Pre-intervention (n = 198)	Intervention Post-intervention (n = 66)	p-value
Age in years, mean	63	63	64	
Male sex	141	108	33	
Hospital day of procedure, mean	4.93	4.73	5.52	
Initial consultation on weekend (%)	59 (22.35%)	42 (21.21%)	17 (25.76%)	
Bleeding indication for procedure (%)	148 (56.27%)	109 (55.33%)	39 (59.09%)	
<i>Preparation characteristics</i>				
Received Golytely (%)	236 (90.08%)	172 (87.76%)	64 (96.97%)	0.05
One Day-Prep (%)	212 (82.81%)	164 (84.54%)	48 (77.42%)	0.20
Clear liquid diet one-day prior (%)	143 (89.94%)	96 (87.27%)	47 (95.92%)	0.11
Patient completed preparation (%)	190 (92.23%)	138 (91.39%)	52 (94.55%)	0.46
BBPS, mean (sd)	6.88 (2.12)	6.81 (2.20)	7.08 (1.89)	0.35
Right BBPS (sd)	2.18 (0.82)	2.13 (0.85)	2.34 (0.70)	0.05
Transverse BBPS (sd)	2.36 (0.76)	2.33 (0.78)	2.43 (0.69)	0.38
Left BBPS (sd)	2.36 (0.72)	2.39 (0.72)	2.28 (0.70)	0.28

Table I. Baseline demographics and characteristics of study population

Note(s): [#] Missing data excluded

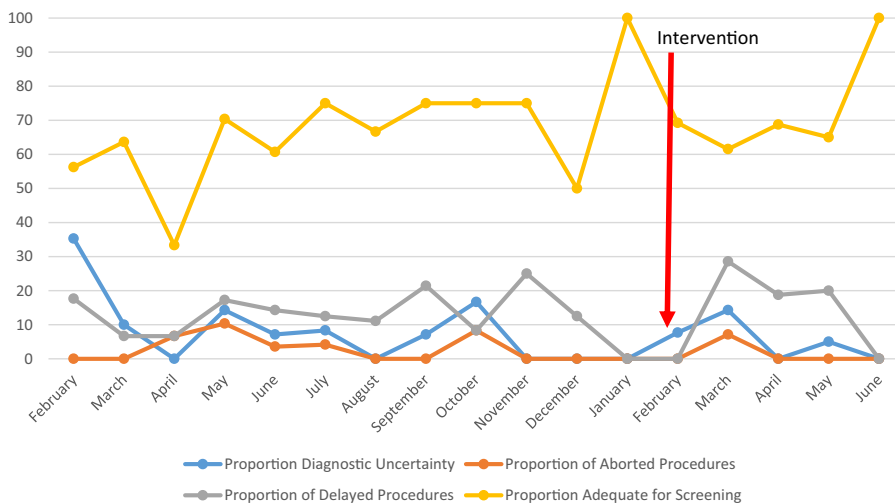
	Overall [#] (n = 264)	Pre-intervention (n = 198)	Intervention Post-intervention (n = 66)	p-value
<i>Preparation outcomes, no. (%)</i>				
Total BBPS adequate*	186 (75.3%)	137 (73.66%)	39 (80.33%)	0.22
Right Side BBPS adequate ⁺	191 (77.96%)	138 (75.00%)	53 (86.89%)	0.04
Transverse BBPS adequate ⁺	211 (85.08%)	157 (83.96%)	54 (88.52%)	0.31
Left Side BBPS adequate ⁺	217 (86.8%)	162 (87.1%)	55 (85.94%)	0.95
Interfered with diagnosis	23 (8.92%)	19 (9.90%)	4 (6.06%)	0.29
Adequate for CRC screening	167 (65.23%)	123 (64.4%)	44 (67.69%)	0.58
<i>Procedure Outcomes, No. (%)</i>				
Delayed or repeated	39 (14.77%)	28 (14.14%)	11 (16.67%)	0.68
Aborted	8 (3.03%)	7 (3.54%)	1 (1.52%)	0.39

Table II. Impact of QI intervention on inpatient colonoscopy outcomes

Note(s): [#] Missing data excluded, * Defined as total score ≥ 6 and no segment < 2 , ⁺ Defined as ≥ 2 , [^] Adjusted for age, sex and bleeding indication

Interestingly, in contrast to preparation quality, 22.3 percent of cases were delayed due to the weekend given that routine endoscopic procedures are not performed at our institution on the weekends (Table I).

We had 60 individual IM residents respond to the survey prior to our intervention and 37 responded after the intervention. Prior to the intervention, only 14 (23.3 percent) IM residents reported complete satisfaction with the current process and 59 (98.3 percent) were supportive of introducing a comprehensive order set. After the intervention, 22 (61.1 percent) IM residents reported complete satisfaction with the ordering process, for an increase in provider satisfaction of 37.8 percent ($p < 0.001$, Figure 3).



Quality improvement of bowel preparation

Figure 3. Inpatient colonoscopy run-chart before/after intervention

Discussion

Using DMAIC methodology, we identified peri-procedural instructions as a critical factor in determining inpatient bowel preparation quality and provider satisfaction at our institution. The resulting change utilizing a standardized, evidence-based EHR order set significantly improved provider satisfaction (23.3 percent–61.1 percent, $p < 0.001$) and right sided colon preparations (75.0 percent vs 86.9 percent, $p = 0.04$). Compared to prior studies, only modest improvements were seen in overall preparation quality using our intervention. However, our intervention nearly doubled the diagnostic yield and substantially improved provider satisfaction. These results suggest inpatient colonoscopy quality may be best assessed by different metrics, in this case diagnostic yield, rather than preparation quality scales intended primarily for screening exams.

Inadequate bowel preparations are a potential source of frustration not only for patients but also healthcare team members. Processes which simultaneously seek improvement not only in clinical outcomes but also provider satisfaction, are highly relevant to larger goals of reducing physician burnout and decreasing non-clinical responsibilities that burden inpatient teams (Chaiyachati *et al.*, 2019; Drybye *et al.*, 2018; Rotenstein *et al.*, 2018). Our low cost, standardized colonoscopy preparation EHR order set provides easy and comprehensive guidance that significantly improved provider satisfaction more than five-fold ($p < 0.001$). This finding alone should provide justification for the use of similar EHR order sets across institutions in a variety of clinical settings. Additionally, this finding complements prior studies which have shown similar efforts to be effective in improving patient satisfaction (Lee *et al.*, 2015), which is important for hospital feedback and reimbursement. Among the benefits of this intervention is its applicability across regional and international institutions with varying EHR platforms. The order set provides anticipatory guidance and uses structured, standardized language that could be reproduced and/or adapted for uptake elsewhere.

Inpatient bowel preparation quality also impacts both patient safety and tolerability as well as procedural success. While we acknowledge that patient-level factors such as comorbid conditions and intolerance are important contributors to prep quality, these are less sensitive to QI intervention. As a result, we focused on potentially modifiable factors such as anticipatory guidance and standardization. We found that after the introduction of

our intervention, rates of adequate bowel preparations improved to 80.3 percent, which is comparable to other investigations. A study by Yaldapadi *et al.* utilized a similar electronic inpatient bowel preparation order set at their institution and found post-intervention rates of adequate inpatient bowel preparations of 85.7 percent (Yadlapati *et al.*, 2018). Studies by Ergen *et al.* and Lee *et al.* also found similar rates of adequate inpatient bowel preparations after patient and nursing education, respectively (Ergen *et al.*, 2016; Lee *et al.*, 2015). Importantly, the most significant impact of our intervention was in the right colon ($p = 0.04$), which is frequently the site of inadequate prep and the source of missed lesions (Brenner *et al.*, 2011). Although our pre-intervention adequacy rates of inpatient bowel preparations were high compared to other studies, our adequacy rates still improved to levels consistent with the literature, suggesting that simple EHR interventions could have an even more significant impact at institutions with high rates of inadequate inpatient preparations at baseline. These results should encourage institutions to routinely track inpatient bowel cleanliness, as our study adds to the body of literature which has consistently shown that simple EHR interventions can improve inpatient preparation adequacy rates to a threshold of 80 percent or greater.

Increased hospital stays and costs have been associated with inadequate inpatient colonoscopy preparations when compared to inpatients with adequate preparations (Chambers *et al.*, 2016; Ergen *et al.*, 2016; Garber *et al.*, 2019; Yadlapati *et al.*, 2018). Understanding the frequency of inadequate inpatient preparations should thus be an important initiative across health care institutions as part of larger QI efforts to improve effectiveness and efficiency of care by leveraging our HER. However, only the studies by Chambers *et al.* and Yaldapadi *et al.* reported a possible mechanism of their intervention by showing a significant reduction in repeated procedures (Chambers *et al.*, 2016; Yadlapati *et al.*, 2018). Therefore, we did not formally calculate our intervention's impact on length of stay given the inability to detect a meaningful reduction in the number of delayed or repeated procedures, which could be due to a higher baseline rate of adequate inpatient preparations (73.7 percent) compared to prior studies (<50 percent) (Chambers *et al.*, 2016; Ergen *et al.*, 2016; Garber *et al.*, 2019; Lee *et al.*, 2015; Yadlapati *et al.*, 2018). Furthermore, the proportion of our baseline cases in which the preparation actually interfered with a diagnosis was even lower at 9.9 percent. Perhaps as a result, our intervention could not add substantial improvements to overall preparation adequacy or significant reductions in delayed, repeated or aborted procedures. These baseline findings are likely due to the strong existing communication framework within our institution, which includes multiple inpatient rounds by medicine teams and closed-loop communication between endoscopy and floor nurses. This culture mirrors efforts found to be helpful in improving inpatient bowel preparations in prior studies (Ness *et al.*, 2001; Reilly and Walker, 2004), and it is likely a crucial piece to any QI intervention aimed at improving inpatient bowel preparations at different institutions.

Our study has important limitations. While the use of formal QI methodology for iterative planning and implementation was important to the success of our work, we did not collect data regarding patient-level factors that may be associated with inadequate colonoscopy bowel preparation, such as concurrent medical illnesses, health literacy, functional status or relevant medication use. The impact of these mostly non-modifiable factors on our results remains unclear. Furthermore, no data were collected regarding patient satisfaction. We also cannot confirm overall uptake or usage patterns, including whether this intervention was used by providers outside of the IM training program. Additionally, we cannot ascertain the proportion of respondents to our survey and whether the same trainees responded before and after the intervention roll-out, given that IM residents likely answered on behalf of their large hospital teams. But, the general support of these ordering residents likely extends to the other providers on their teams, which includes

attending physicians, residents and interns and potentially to other multi-disciplinary teams as well. Finally, our outcome definitions are novel and should be validated in the future. Additional and prolonged efforts are needed for more widespread implementation and to ensure stability in usage over time. Further studies have the potential to detect more significant improvements than those measured statistically in our current work. It is possible that outcomes could continue to improve as more providers became motivated to sustain changes to current practice. This is consistent with a prior study that found significant improvements in inpatient bowel preparation after similar intervention only after 3–6 months (Shah-Khan *et al.*, 2017).

Conclusion

In summary, our QI intervention significantly reduced the number of inpatient colonoscopies with inadequate preparation in the right colon, while also modestly improving the diagnostic yield and decreasing the number of aborted procedures. We did not achieve significant reduction in procedural delays, likely due to the low incidence of this outcome at baseline, which contrasts with prior studies and may reflect increased attention to ensuring a quality preparation prior to an inpatient procedure at our institution. Nonetheless, our low cost and standardized colonoscopy preparation EHR order set provides guidance that dramatically improved provider satisfaction, which should justify broader use of such simply tools across health care institutions and inpatient settings.

Implications of research

Practical measures of bowel preparation adequacy for *inpatient* diagnostic colonoscopies have yet to be appropriately defined or thoroughly investigated. Given that adequacy of bowel preparation as determined by the BBPS may be less relevant to inpatient procedures, we designed novel outcomes to assess whether inpatient bowel preparations impacted practical outcomes such as interference with diagnosis or a reduction in redundant outpatient screening colonoscopies, whereas prior studies demonstrated improvements in inpatient colonoscopy preparation quality using a scale developed for screening exams, we found that important clinical outcomes such as ability to answer a diagnostic question were improved using this intervention. Identifying novel metrics to enhance QI efforts targeting inpatient colonoscopy preparations aligns with the health system's strategic goals to enhance the provider experience and continuously improve the quality of patient care. Future investigations should include these novel inpatient colonoscopy outcomes in EHR QI implementation efforts to improve cost effectiveness calculations, particularly at other institutions without standardized interventions and higher baseline inadequacy rates. Even minor improvements could demonstrate substantial cost-savings at the population level when applied throughout the health care community (Garber *et al.*, 2019).

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Further reading

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