SUSQI PROJECT REPORT
BOWEL PREPARATION FOR COLONOSCOPY

Start date of Project: 9/10/2023
Date of Report: 28/12/2023

Team Members:
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Background:

Endoscopy is resource-intensive and a major contributor to the environmental footprint of healthcare and the third highest waste producing department in the NHS. Poor bowel preparation for colonoscopy is the leading cause of failed colonoscopies, seen in up to 25% of procedures: inadequate preparation has a significant impact on procedure outcome, quality and efficiency. Procedures are less comfortable for the patient, there is a reduced ceacal intubation rate, procedure time is prolonged, and there is an increased risk of missing lesions, often leading to abandoned procedures and the need for a repeat endoscopy (1). Repeat colonoscopies carry risks for the patient, and negatively impact endoscopy staff and services (2).

The quality of bowel preparation is crucial because inadequate or incomplete bowel preparation can lower screening effectiveness and increase the health care expenses due to longer or aborted procedures. Poor preparation may be due to a number of procedure or patient related factors. Procedure-related factors may include inadequate indication or delayed start of the colonoscopy after completion of bowel preparation. While patient related factors cannot all be controlled (e.g. increased age, male gender, presence of comorbidities), low residue diet and adherence to bowel prep laxatives is known to improve preparation and success of procedures (3). However, bowel preparation is challenging and is often described by patients as worse than the procedure itself.

Patients' compliance with bowel preparation and dietary instructions may be influenced by patient motivation, education (e.g. language barrier), communication techniques for explanation (e.g. use of video). It may also be influenced by the laxative product offered(3). Our service has historically prescribed Moviprep, requiring a patient to drink 2 litres of a laxative solution that has a poor taste. Patients would be required to drink an additional 2 litres of water, making a total of 4 litres of fluid. It was therefore a concern that some patients attend for colonoscopy and have their procedure abandoned, cancelled on the day and rebooked due to poor bowel prep while some will not attend citing inability to tolerate high volume bowel preparation and poor taste.

A novel low-volume bowel preparation regimen, Plenvu (Norgine) is polyethylene glycol [PEG] laxative designed for oral bowel preparation use before an elective colonoscopy procedure in adults. Plenvu can be

administered in 1 litre, as a 1 day or 2 day regimen has recently emerged. This could offer the potential for enhanced compliance and potentially improved bowel preparation outcomes. A recent (2021) study in London demonstrates that Plenvu is a low volume (1 litre) polyethylene glycol (PEG) plus ascorbate-based bowel preparation which has demonstrated a superior cleansing and equal safety and tolerability profile compared with standard agents (7). Plenvu met the low volume, effective, palatability and convenience criteria on the Boston Bowel Preparation Scale (BBPS) scores.

Northampton General Hospital Endoscopy Unit is a very busy department with three procedure rooms, twelve bedded recovery, one procedure room and four bedded recovery in Daventry Hospital and a decontamination unit offering diagnostic, therapeutic, surveillance and bowel screening endoscopy services to patients in Northamptonshire and the neighbouring counties. In October 2023, 891 patients were seen for various procedures, of which 397 were for colonoscopy. We aim to provide the best possible, flexible, efficient and responsive care to our patients.

With improved compliance, we have the opportunity to improve clinical outcomes for patients while ensuring their procedures are shorter and more comfortable. 11 colonoscopies out of 397 failed due to poor prep in October 2023, this is 2.77% hence not a huge number. However, preventing repeat procedures will save staff time, while reducing environmental and financial waste. Improved prep also reduces risk of short notice cancellations or DNAs if patients don't feel prepared. We aim to inspire our team to embrace sustainability and reduce waste, empower our team to go green and transform by reducing our carbon emission, and service improvement based on feedback.

Specific Aims:

Improve bowel prep pre-endoscopy procedures by changing from routine use of MoviPrep to Plenvu bowel preparation and providing bowel prep to patients earlier.

Methods:

Studying the system:
We completed a process map of our current pathway and highlighted the environmental, social and financial resource use at each step (Appendix 1). This supported us to consider and identify all potential impacts of a switch to Plenvu and confirm our measurement for the project.

Engagement
Pharmacy was on board with the changes. They had already noted requests for Plenvu had started to increase, and they are able to cope with our increased requisition for Plenvu.

Changes were discussed in Endoscopy User Group (EUG) and governance meetings to receive support from senior organisational leaders and clinical leaders. All were supportive of the service improvement.

Proposed changes and advantages discussed with Endoscopy staff team meetings to promote engagement, raise awareness and promote conversation around understanding of the intervention.

Changes implemented
The NGH communications team supported the roll out of a Trust wide screensaver informing staff of the change and benefits for the patient and financial savings.

The same company (Norgine) produces both Moviprep and Plenvu so there is no conflict of interest, and therefore no procurement agreement was required by the endoscopy team. We continue to receive bowel prep supply through direct requisition to pharmacy.

Changes explored

We explored the option to provide bowel prep in the out-patient clinic with consultants compared to posting to patients when the endoscopy is booked. This would reduce emissions associated with postage. However, when we met with outpatient department matrons regarding this option there was several challenges to implementation including

- storage space for bowel prep in the department
- budget: the stock management and payment of bowel prep does not sit within the outpatient department
- it was not clear which staff would be allocated and trained to dispense bowel prep appropriately
- patient feedback suggested that they prefer to receive their prep by post.

Measurement:

Patient outcomes:

We collected data on the

- number of procedures performed by the service
- rates of did not attend (DNAs) and cancellations
- rates of failed/repeat procedures

Environmental sustainability:

The carbon footprint of a colonoscopy has been estimated based on a hybrid methodology. GHG emissions associated with patient travel have been estimated based on an average patient travel carbon footprint per outpatient appointment taken from Greener NHS. Majority of GHG emissions associated with consumables and medical equipment used during the procedure have been estimated on a process-based approach using data from previous Green Team Competitions. GHG emissions associated with the reusable endoscopy were taken from Le NNT et al 2022. Due to time and data unavailability carbon footprints of some consumables as well as the sedatives were estimated based on the top-down approach. GHG emissions associated with the bowel prep and postage were also estimated based on the top-down approach using the conversion factor for pharmaceuticals taken from the UK Government Database (5) (6)

Our CO_2e reduction was translated into miles driven using emission factor 0.3386 $kgCO_2e$/ mile driven in an average car with unknown fuel, from the UK Government Greenhouse gas reporting: conversion factors 2023.

Carbon footprint per colonoscopy: 17.5 $kgCO_2e$, equivalent to driving 51.7 miles in a car.
See below table for a breakdown of emissions.

Colonoscopy pathway element	**$KgCO_2e$**
Pre-assessment (information pack, letter sent to patients, bowel prep, pre-assessment call)	6.96
Procedure (patient travel, consumables, medical instruments, sedative, room energy)	10.51
Total	**17.5**

The emissions associated with bowel prep (based on cost) was included above in the total footprint of a procedure as we are looking at reductions in failed procedures. However, it is not reliable to compare the

carbon footprint of bowel prep options (Moviprep and Plenvu) based on cost. We have assumed the carbon footprint would be similar as both options have similar packaging and are from the same company.

Economic sustainability:
The cost of bowel prep solutions were provided by Pharmacist who working with NetFormulary on costing

- Moviprep - £14.92
- Plenvu - £8.09

The cost of a procedure / DNA / failed procedure information was obtained from the finance department. The income for procedures is received from commissioners (NHS England). If patients do not attend for their procedures then the department does not receive any income. Patients who cancel on the day or during the procedure are classed as abandoned procedures.

Abandoned procedure: £329.47
Successful procedure: £548
DNA - £0

Social sustainability:
We completed a staff survey exploring staff perceptions of whether bowel prep is a problem and why, and opinions on proposed changes to promote staff engagement and stimulate awareness (Questions in Appendix 2).

Patient Feedback.
The service already sends a patient feedback survey to patients following procedures.
Additional questions were added to the survey to capture some feedback on bowel preparation and our changes, which included

If you had a colonoscopy, which bowel prep did you take? Moviprep , Plenvu or Picolax
What was your experience of taking bowel prep?
Would you have preferred to receive your bowel prep in your outpatient appointment rather than in the post or having to come back to collect?

Results:

Patient outcomes:
In October 2023, the service had 11 failed colonoscopy procedures. This is 2.7% failed colonoscopy out of the total 397 performed in October 2023. It is a fact that adequate bowel preparation was achieved in 97.3% of cases, this met and exceeded the UK JAG (United Kingdom Joint Advisory Group on gastrointestinal endoscopy) key performance indicators and quality assurance standards for colonoscopy . However, our endoscopy unit aspires to maintain higher standards and thinking about sustainability and ways to become greener. Therefore assuming a 11 per month, this equals 132 failed procedures per year that will need to be repeated.

5 procedures were cancelled during the pre-op assessment (phone call) the day before the procedure. Projected across a year, this would amount to 60 patients being cancelled. 4 patients did not attend for their colonoscopy appointment in October 2023, which indicates approximately 48 DNAs per year. Cancellations and DNAs may not always be due to bowel preparation, however this may have an impact.

In most cases, these patients will still require a colonoscopy. They will have been posted bowel prep and need a second bowel prep kit sent when rebooked. Another patient requiring colonoscopy could not be booked

into their slot given the short notice and need for bowel prep, wasting a colonoscopy appointment space. For these patients, a delay to treatment may impact on their care, namely delay in diagnosis and/or starting of treatment e.g patients with colitis, diverticulitis or cancer to mention but a few where timely diagnosis and commencement of treatment is of the essence.

We require 12 months to monitor our service data and identify if failed procedures, cancellations and DNA's have reduced, which will indicate improved outcomes for patients. However from previous reports, we have found patients taking Moviprep felt very sick possibly due to the volume of fluid taken. From existing research, Plenvu has met low volume, effectiveness, and convenience criteria on the Boston Bowel Preparation Scale (BBPS) scores, indicating it will be more comfortable and effective for patients.

Environmental sustainability:
We will require 12 months to monitor our service and identify actual savings. We have therefore made an assumption that we can realistically prevent 59% of 132 failed colonoscopies per year with a change to Plenvu bowel prep based on the evidence from a recent UK study (10). This equals 77.9 colonoscopies a year, a saving of 1,361.5kgCO2e, equivalent to driving 4,027.43 miles in an average car.

As stated earlier above, it is not reliable to compare the carbon footprint of bowel prep options (Moviprep and Plenvu) based on cost. We have assumed the carbon footprint would be similar as both options have similar packaging and are from the same company.

We have not included potential CO2e savings from repeated postage of bowel prep required for cancellations and DNA's however if reduced this would also bring additional savings.

Economic sustainability:
We will require 12 months to monitor our service and identify actual savings.

Based on the department being paid £329.47 for an abandoned procedure and £548 for a completed one, assuming 59% of 132 failed colonoscopy prevented and procedures completed- this is 548 x 77.8 = £42,634.4 additional income per year

Plenvu is a saving of £6.83 per patient. Assuming an average of 397 colonoscopies per month/year and 90% of patients having Penvu as their bowel preparation , this is 357.3 x 12 x 6.83 this equals to an additional £29,284.30 saving per year.

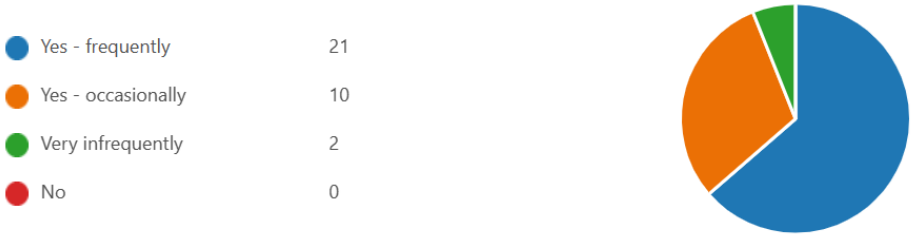
Assuming 50% cancellations which is 24 and DNA's which is 30 could be prevented per year and 54 colonoscopies completed in these slots, this equals 54 completed procedures x £548 . An additional income of £29,592 per year.

Social sustainability:
Patients:
Most patients preferred to receive bowel prep by post this saves the patient making extra trips to the hospital and paying parking to collect bowel preparation, so this process has remained unchanged.

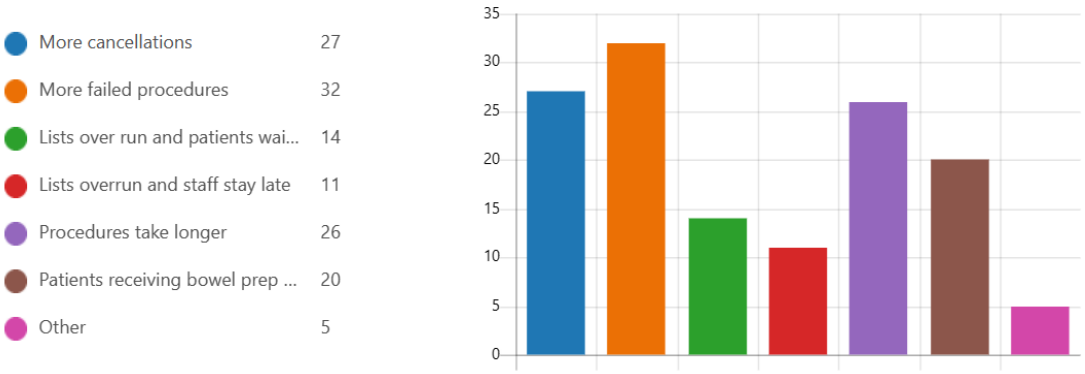
Staff feedback:
33 staff members responded to our survey. Overall, the responses showed a general agreement that bowel prep is a problem impacting staff and patients, and were in favour of our proposed changes.

64% agreed poor bowel prep is a frequent problem (30% occasional problem and 6% an infrequent problem, 0% said it is never a problem). In terms of why this is a problem, staff said poor bowel prep contributed to the following problems:

1. Do you think patients attending procedures with poor bowel prep is a problem?



2. If yes to the above - please select ALL the reasons why you believe it is a problem



50% of staff believed switching to Plenvu (instead of MoviPrep) would improve rates of adequate bowel prep. 36% said they would need more information with 4% believing there will be no change.

Staff comments

"I feel that if the prep works right then there would be less patients being rebooked and less waste"

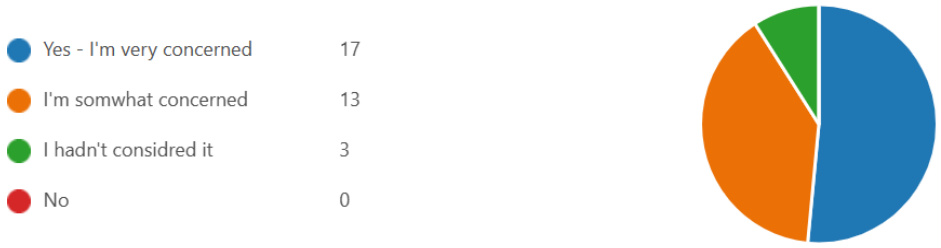
"Elderly patients will benefit from reduced volume bowel prep like Plenvu"

"Other NHS use Plenvu as first line bowel prep and patients are not struggling to drink it and they have good prep."

Staff also highlighted another potential reason for poor bowel prep was patients not receiving prep and/or instructions to follow a 3 day low residue diet in time. Some staff suggested prep be given to the patient when they attend the clinic to have more time and be able to ask consultants questions.

Staff agreed improved bowel prep would have a positive impact on patients and staff.

5. Are you concerned about waste / the environmental impact of the Endoscopy service?



52% said they are very concerned about the environmental impact of the Endoscopy service. 13% said they are somewhat concerned and 9% had not considered this before. No staff member said they were not concerned.

Discussion:

The quality of bowel preparation is crucial for colonoscopy as it affects the detection of polyps and other conditions affecting the colon. Inadequate or incomplete bowel cleansing can lower screening effectiveness and increase associated expenses. The ideal bowel preparation agent pre colonoscopy is the one that is effective, convenient and easier to drink due to its palatability and viewed more favourably by patients so that they are able to completely consume it to achieve optimal bowel preparation and a successful procedure. Choosing a low volume bowel preparation may enhance adherence and compliance while a high volume bowel preparation may be a deterrent and poor compliance.

A limitation to our project is that a single approach to bowel prep may not be generalizable to all patients. Some patients may still require a different bowel prep due to medical conditions. Plenvu contains aspartame, which is a source of phenylalanine which may be harmful for people with phenylketonuria (a genetic disorder affecting metabolism). It also contains ascorbate which may be harmful for people with glucose-6-phosphate dehydrogenase deficiency. People who have phenylketonuria or glucose-6-phosphate dehydrogenase deficiency are advised to speak with their Doctor.

The overall effectiveness of Plenvu would be measured after the switch Plenvu is adopted by embarking on another study in the near future to measure the full impact.

Barriers and challenges encountered during this project include the need for multi departmental data collection which sometimes means that the data might not be received in a timely fashion which was overcome but sending gentle reminders and patience. The NGH sustainability manager also kindly assisted to overcome some of the hurdles.

Another barrier is the reliance on out-patient departments to store and dispense bowel prep which is deemed not achievable due to non- engagement from the out-patient department. However, the majority of patients prefer to receive their bowel preparation by post.

Conclusions:

This study supports the use of Plenvu as an efficacious bowel preparation agent. It remains the lowest volume bowel preparation agent on offer and, given its cost effectiveness, it is an attractive alternative to conventional agents(8).

To ensure the lasting change for the beneficial aspects of the project and to spread learning, the communication team has put up a screen saver on the NGH intranet highlighting the switch to Plenvu as our first line bowel preparation agent pre- colonoscopy to ensure that the initiative have a long lasting effect and to embed the changes in our endoscopy service. This will also be embedded through our procurement.

It is also evident that having a designated pre assessment service with substantial staff would be a significant step to make a positive impact on the patient experience and journey through endoscopy by reducing cancellations and DNA resulting in rescheduling, poor bowel preparation, wasted slots and wasted resources based on a recent quality study carried out by Northampton General Hospital Endoscopy unit staff (9).

We aim to publish the SusQI case study report as a resource in the endoscopy sustainability network and to collect further data from patients post colonoscopy in the near future to endure lasting change, to measure impact and review the initiative for further improvement: also to collect data from our endoscopy staff, members of sustainable endoscopy groups about their experience with Plenvu for wider engagement, cultural change , to spread learning and scale the initiative to outside of our organisation.

The key elements that contributed to the success and learning in this study is the QI training, support, information resources and organisational process support received and links to patients benefit and clinical outcome.

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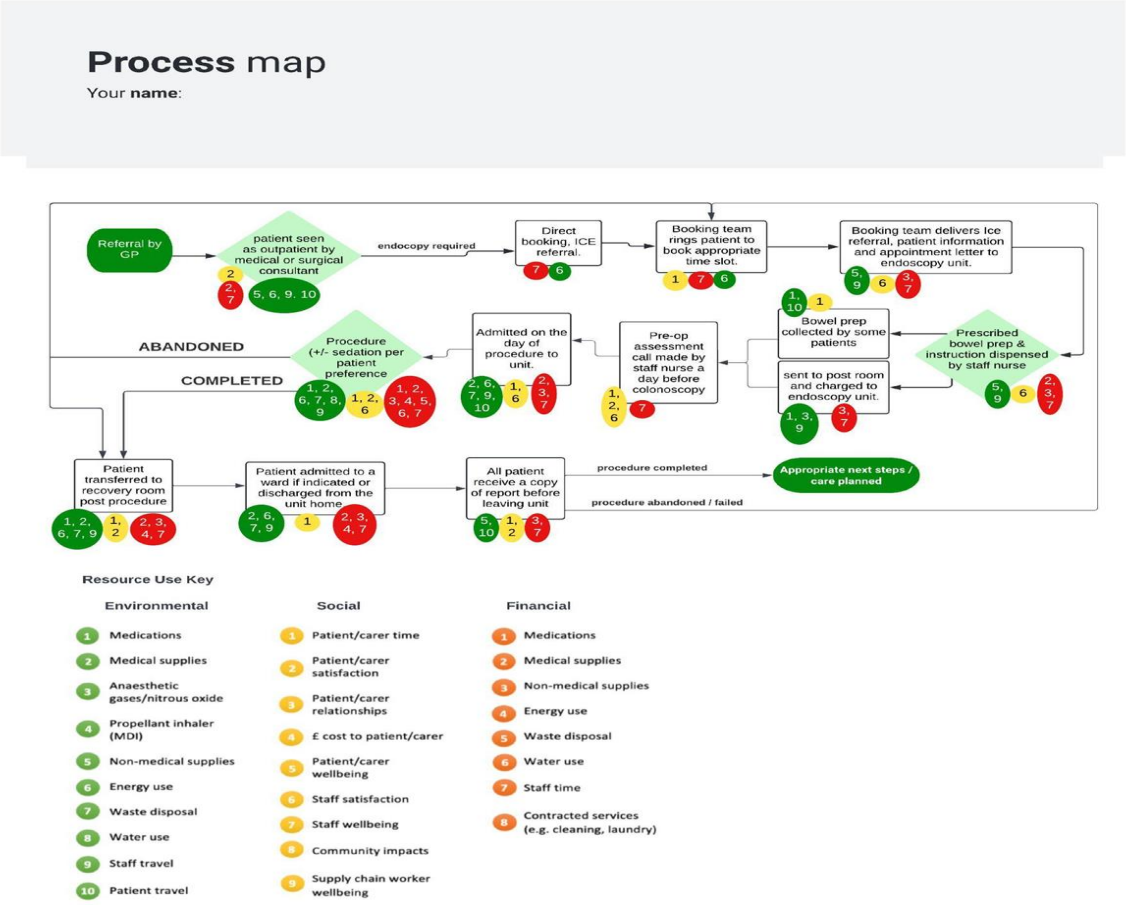
Appendices

Appendix 1: Process map



Appendix 2: Staff survey questions

1. Do you think patients attending procedures with poor bowel prep is a problem? *

- ◯ Yes - frequently
- ◯ Yes - occasionally
- ◯ Very infrequently
- ◯ No

2. If yes to the above - please select ALL the reasons why you believe it is a problem

- ☐ More cancellations
- ☐ More failed procedures
- ☐ Lists over run and patients wait longer
- ☐ Lists overrun and staff stay late
- ☐ Procedures take longer
- ☐ Patients receiving bowel prep late (e.g. if posted)
- ☐ Other

3. Do you think switching to Plenvu (instead of MoviPrep) would improve rates of adequate bowel prep? (as patients required to drink less). *

- ◯ Yes
- ◯ I'm not sure - I need more information
- ◯ No, I don't think it will make a difference

4. What do you think the benefits of improved bowel prep across the patient cohort would be? Please select ALL that apply.

- [ ] Faster procedures
- [ ] Patients more comfortable in procedures
- [ ] Reduce risk and rates of failed procedures
- [ ] Reduce cancellations
- [ ] Improved patient flow / turnaround
- [ ] Staff save time
- [ ] Improve staff wellbeing
- [ ] Reduce waste / carbon footprint of endoscopy service
- [ ] Other

5. Are you concerned about waste / the environmental impact of the Endoscopy service? *

- ( ) Yes - I'm very concerned
- ( ) I'm somwhat concerned
- ( ) I hadn't considred it
- ( ) No

6. Please add any other comments related to bowel prep in the endoscopy service. Thank you!

Enter your answer

Critical success factors

Please select one or two of the below factors that you believe were most essential to ensure the success of your project changes.

People	Process	Resources	Context
☐ Patient involvement and/or appropriate information for patients - to raise awareness and understanding of intervention ☐ Staff engagement ☐ MDT / Cross-department communication ☐ Skills and capability of staff ☐ Team/service agreement that there is a problem and changes are suitable to trial (Knowledge and understanding of the issue) ☐ Support from senior organisational or system leaders	☐ clear guidance / evidence / policy to support the intervention. ☐ Incentivisation of the strategy – e.g., QOF in general practice ☐ systematic and coordinated approach ☐ clear, measurable targets ☐ long-term strategy for sustaining and embedding change developed in planning phase ☐ integrating the intervention into the natural workflow, team functions, technology systems, and incentive structures of the team/service/organisation	☐ Dedicated time X QI training / information resources and organisation process / support ☐ Infrastructure capable of providing teams with information, data and equipment needed ☐ Research / evidence of change successfully implemented elsewhere ☐ Financial investment	☐ aims aligned with wider service, organisational or system goals. X Links to patient benefits / clinical outcomes ☐ Links to staff benefits ☐ 'Permission' given through the organisational context, capacity and positive change culture.