

# The Colonoscopy Cookbook: Analysis of effect of a recipe resource on quality and experience of bowel preparation in colonoscopy



## Authors

Laura Bennett<sup>1,2</sup>, Robert Knox<sup>2</sup>, Georgina Luscombe<sup>3</sup>, Jenny Egan<sup>4</sup>, Lauren Wallace<sup>1</sup>

## Institutions

- 1 The Royal Melbourne Hospital City Campus, General Surgery, Victoria, Australia
- 2 Orange Health Service, General Surgery, New South Wales, Australia
- 3 The University of Sydney, School of Rural Health, Orange, New South Wales, Australia
- 4 Orange Health Service, Bowel Screen, Orange, South Wales, Australia

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Georg Thieme Verlag KG, Rüdigerstraße 14,  
70469 Stuttgart, Germany

## Corresponding author

Laura Bennett, The Royal Melbourne Hospital City Campus,  
General Surgery, 300 Grattan Street, Parkville, Victoria 3050,  
Australia

Fax: +93427802

[laura.j.bennett27@gmail.com](mailto:laura.j.bennett27@gmail.com)

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## ABSTRACT

**Background** High-quality bowel preparation for a colonoscopy improves identification of early lesions in the large bowel, decreases procedure time and increases intervals between colonoscopies. Current recommendations advise a low-residue diet in the days leading up to colonoscopy to improve quality of preparation. This study prepared and provided a recipe resource to patients undergoing colonoscopy and assessed the quality of bowel preparation and patient experience.

**Patients and methods** A “Colonoscopy Cookbook” resource of recipes that comply with the preoperative diet recommendations was created and added to routine preoperative information given to patients undergoing elective colonoscopies at a regional Australian hospital over a 12-month period. Endoscopic reports were reviewed for each case and quality of bowel preparation was classified as “adequate” or “inadequate”. Data collected were compared to a representative local cohort from 2019.

**Results** Procedure reports from 96 patients who were provided with the resource were compared with 96 patients who were not. Adequate bowel preparation was nine times as likely when the resource was available (odds ratio 8.54, 95% confidence interval: 2.85 to 25.60,  $P < 0.001$ ) compared to when it was not. The patient experience was assessed using a post-procedure survey, which demonstrated a positive experience in recipe preparation. Most patients would use the resource prior to future colonoscopies.

**Conclusions** Further randomized controlled trials are required to validate this scoping review. Pre-procedure recipe resources may improve quality of bowel preparation in patients undergoing colonoscopy.

## Introduction

Colonoscopy is a common procedure with approximately one million colonoscopies performed in Australia each year [1]. High-quality bowel preparation for colonoscopy improves iden-

tification of early lesions in the large bowel, decreases procedure time and increases intervals between colonoscopies [2, 3]. The definition of “high-quality” bowel preparation for colonoscopy remains variable and currently standardized criteria and assessment scales are not used in Australia [4]. There are

numerous factors that affect quality of bowel preparation [5]. Increased age, medical comorbidities and previous pelvic and abdominal surgeries have been associated with lower rates of adequate bowel preparation and remain non-modifiable variables [5,6]. A low-residue diet in the days leading up to colonoscopy has been shown to increase compliance with bowel preparation solutions, improve quality of preparation and increase patient willingness for repeat colonoscopy when compared to a clear liquid diet and is a modifiable variable [7]. Success of this diet relies on patient adherence and comprehension of the importance of quality of bowel preparation, offering a potential target for improvement of bowel preparation quality. Both provision of written educational material and split dosing of preparation have been shown to be beneficial in optimizing quality of bowel preparation [8]. The instructions for a low-residue diet provide lists of foods that may be consumed but generally do not offer guidance on preparation or suggested recipes. While some limited recipe resources are available on the internet, this requires the patient to search for such resources themselves. This study aimed to provide an appealing and specific recipe resource that complies with the low-residue diet recommendations in the pre-colonoscopy instructions given to patients prior to their colonoscopy, and in doing so minimize patient effort and confusion around dietary restrictions during colonoscopy preparation. Our hypothesis was that this may increase compliance with current recommendations and may improve quality of bowel preparation. At time of writing, there are no similar papers in the literature examining the effect of a recipe resource on quality of bowel preparation.

## Patients and methods

Ethics approval was obtained from the Greater Western Human Research Ethics Committee, reference code 2020/ETH01626.

This was a non-randomized, historically controlled scoping study. The recipe resource was provided in the pre-colonoscopy information pack for all patients presenting for a colonoscopy to a regional Australian hospital in a 12-month period. If a patient consented to partake in the study, preparation quality of their colonoscopy was reviewed and a post-procedure survey was emailed to the participant.

The recipe resource (Supplementary material, p. 1) was created by the research team using freely available resources from general cookery recipe websites that were modified to comply with the low-residue diet recommendation. Recipes were selected with the following criteria in mind: appealing, easy to prepare and easily modifiable to comply with the low residue diet. The recipe resource was reviewed by a dietitian for safety of recipes and to ensure compliance with the low residue diet recommendations.

Recruitment was undertaken over a 12-month period in 2021. Recruitment was conducted by local endoscopists from their consulting rooms as well as by a clinical nurse consultant who coordinates direct access colonoscopies for the hospital. All patients being seen in preparation for a colonoscopy during that period had the recipe resource included in their pre-colonoscopy information pack. The research protocol was described

at the pre-colonoscopy appointment and if a patient consented to participation, a consent form was signed and collected. All colonoscopies were performed by a range of endoscopists including six general surgeons and two gastroenterologists. The standard bowel preparation solution for the included patients was three sachets of 15.5-g sodium picosulfate powder with each sachet taken 3 hours apart with the final sachet taken approximately 9 hours prior to colonoscopy. Each sachet was prepared as per packet instructions and followed by a glass of water.

Inclusion criteria for this study included all patients seen by the endoscopists in rooms or by the direct access nurse for planning of a colonoscopy in 2021 at a regional public hospital. This included both symptomatic patients and screening patients. Exclusion criteria included any patients with food allergies and any patient who could not sign the consent form for themselves.

De-identified demographic data including age and gender were collected and colonoscopy operation reports were reviewed for all consenting participants. The operation report description of bowel preparation quality was reviewed and compared with historical data on bowel preparation quality obtained from a local audit of direct access colonoscopies in 2019 who were not directed to a recipe resource. The control cases were selected consecutively from the results for the year when sorted by date of procedure to minimize selection bias and matched for age and gender against the intervention group. Other characteristics or key morbidities of the patient groups, such as diabetes, diverticular disease or previous gynecologic procedures, were not available for adjustment or comparison. The control cases followed the same bowel preparation as the intervention group and were given a list of low-residue foods that were and were not allowed to be consumed prior to their colonoscopy. The descriptors used by endoscopists in the operation reports to describe the quality of bowel preparation included “poor,” “fair,” “inadequate,” “unsatisfactory,” “adequate,” “good,” “excellent,” “reasonably good”. “Poor,” “fair,” “inadequate” and “unsatisfactory” were classified as “inadequate” bowel preparation. “Adequate,” “good,” “excellent” and “reasonably good” were classified as “adequate” bowel preparation. These descriptors were used as the quality scale for this project as they were the terms most commonly used by the endoscopists who performed the colonoscopies included in this study. Data on outcomes such as cecal intubation and pathology detection rate were not available for the control group so these were not assessed in the intervention group. Statistical analysis was performed using the statistical analysis program jamovi (version 1.6) with results reviewed by an experienced statistician [9]. Odds ratio and chi-squared values were calculated for quality of bowel preparation in the participants compared with the quality of bowel preparation of the controls.

An online survey assessing satisfaction (Supplementary material, p. 1) was emailed to the patients 7 to 14 days after the procedure. A reminder email to complete the survey was then sent at the conclusion of the study at the end of 2021. The survey questions gathered information on age, gender, if the resource was used, ease of use of the resource and if they would

use the resource again. This survey was developed to assess the patient experience of utilizing the cookbook prior to undergoing the colonoscopy. Validated questionnaire tools were not used in the development of this questionnaire. The survey was analyzed by tabulating the frequency of each survey question answer.

# Results

A total of 149 patients consented to participate in this study. For these 149 patients, 96 (64%) colonoscopy operation reports were able to be accessed and reviewed. The other reports were unable to be accessed due to limited access to reports at a day procedure facility where some of the colonoscopies were performed or the patient did not have their colonoscopy as planned.

The colonoscopy results from the 96 study patients were then compared with the colonoscopy results from 96 control patients from the local direct access colonoscopy program during 2019. There was no significant difference between the study and control groups when compared by gender (Pearson chi-squared=0.524, df=1,  $P=0.469$ ) or by age group (Pearson chi-square=0.116, df=2,  $P=0.944$ ) due to gender and age group matching in control case selection (► **Table 1**).

Regardless of exposure to the recipe resource, adequate bowel preparation was twice as likely if a patient was female compared with male (odds ratio [OR] 1.98, 95% confidence interval [CI]: 0.83 to 4.7,  $P=0.119$ ) which was not statistically significant. Regardless of exposure to the recipe resource, there was no significant association between age groups and adequate bowel preparation (Pearson chi-squared=4.30, df=1,  $P=0.116$ ). Adequate bowel preparation was nine times as likely when the recipe resource was provided (OR 8.54, 95% CI: 2.85 to 25.60,  $P<0.001$ ) compared to when it was not provided (► **Table 2**).

The patient experience of utilizing the recipe resource was assessed by completion of a survey following the colonoscopy. There were 67 survey responses from the 149 participants for a response rate of 45%. Because the survey results were anonymous, they could not be matched with participants who had their colonoscopy reports accessed. Of the respondents, 69% were female and 31% were male. Of the respondents, 63% were ages 50 to 75, 9% were older than 75 and 28% were younger than 50. The provided recipes were generally found to be easy to prepare (54% said the recipes were easy to prepare, 33% very easy and 13% were neutral). Of the patients, 42% stated the recipe resource improved their experience of having a colonoscopy, 42% responded with “maybe” and 17% responded with “no”. Of the respondents, 65% stated they would use the recipe resource again for their next colonoscopy (► **Table 3**).

# Discussion

High-quality bowel preparation in colonoscopy is important for identification of lesions, decreasing frequency of colonoscopy and decreased procedure times. There are many variables that

► **Table 1** Demographics.

		Intervention group No. patients (%)	Control group (%) No. patients
Overall		96	96
Gender	Male	42 (44)	47 (49)
	Female	54 (56)	49 (51)
Age	<50	24 (25)	22 (23)
	50–75	69 (72)	71 (74)
	>75	3 (3)	3 (3)

► **Table 2** Bowel preparation results.

		Intervention No. patients (%)	Control No. patients (%)
Overall		96	96
Bowel prep	Adequate	92 (96)	70 (73)
	Inadequate	4 (4)	26 (27)

contribute to adequate bowel preparation and some are not modifiable (such as age and comorbid diseases). One modifiable factor is compliance with a low-residue diet prior to undertaking bowel preparation.

This study found that there may be an increase in the likelihood of adequate bowel preparation when a recipe resource complying with low-residue recommendations is provided to patients prior to bowel preparation for a colonoscopy. Adequate bowel preparation was nine times as likely when the recipe resource was provided (OR 8.54, 95% CI: 2.85 to 25.60,  $P<0.001$ ) compared to when it was not provided.

The rate of inadequate bowel preparation in the control group was 28%, which is slightly higher than the 25% previously seen in large systematic reviews [10]. This may have been due to confounding factors and sources of biases as discussed below.

Significant sources of bias were present in this study, including selection bias. The patients who consented to participate in the study may have been more likely to comply with the bowel preparation recommendations and, therefore, may have been more likely to have high-quality preparation [11]. Patients who declined to participate in the study may have been likely to have been less compliant and less likely to have adequate bowel preparation. The historical controls encompassed direct access colonoscopy patients from 2019 who did not “elect” to participate in the study. This introduces a key difference between the two groups.

The control patients for this trial were taken from a direct access database. Traditionally a direct access patient is referred for a colonoscopy for a positive Fecal Occult Blood Test (FOBT). This key difference in patients taken exclusively from direct access colonoscopy where the most common indication

► **Table 3** Survey response results.

		No. respondents (%)
Overall		67 (100)
Gender	Male	21 (31)
	Female	46 (69)
	Other	0 (0)
	Prefer not to say	0 (0)
Age	<50	19 (28)
	50–75	42 (63)
	>75	6 (9)
Prepared and ate recipes from resource	Yes	43 (69)
	No	19 (31)
Ease of preparation of recipes	Very easy	16 (33)
	Easy	26 (54)
	Neutral	6 (13)
	Difficult	0 (0)
Improvement in colonoscopy experience	Very difficult	0 (0)
	Yes	22 (42)
	No	9 (17)
	Maybe	22 (42)
Would use resource again	Yes	39 (65)
	No	9 (15)
	Maybe	12 (20)

for colonoscopy is positive FOBT compared with the intervention patients where there was a combination of symptomatic and screening patients has likely introduced a key confounding factor in the comparison groups in this study. The most obvious difference between direct access colonoscopy patients and other patients is that direct access patients generally are not seen in the endoscopist rooms prior to their scope. They usually receive bowel preparation instructions via email or over the telephone, which may reduce the effectiveness of education about how to undertake bowel preparation when compared to face-to-face explanations [12].

A further source of bias is the subjectivity of the endoscopist reports and the simplistic analysis terms used. The inter-reporter validity between endoscopists was not tested and the descriptors used that were classified as “adequate” versus “inadequate” may vary between clinicians. To add further validity to the findings of “adequate” versus “inadequate,” other characteristics such as cecal intubation rates and pathology detection rates should be measured.

Double blinding and randomization were not performed in this study. As such, only a potential association between use of the recipe resource and higher rates of adequate preparation can be assumed, not causation.

The majority of patients who accessed the resource and completed the post-procedure survey found the recipe resource useful and would use it again prior to another colonoscopy. The design of the questionnaire used in this study was not a validated questionnaire tool and did not ask questions that provided granularity of the patient experience of colonoscopy in relation to the cookbook; therefore, conclusions relating to the experience of using the cookbook in relation to the colonoscopy cannot be inferred. Because the survey results were anonymous, they could not be linked to the participants whose colonoscopy reports were able to be accessed. Having access to paired data (survey result plus the colonoscopy result) would have allowed comparison of the experience of utilizing the resource with the quality of bowel preparation. This would be an important methodological improvement to apply in future work on this topic.

## Conclusions

This study demonstrated that the provision of a recipe resource in the pre-colonoscopy information packet may improve the quality of bowel preparation; however, the significant sources of bias and confounding factors in this study does not allow causation to be assumed. Further research, such as randomized controlled trials, is required to validate the initial associations observed in this study. Given the low risk of providing the resource and the potential benefits to the quality of bowel preparation, endoscopists could consider including a recipe resource in pre-colonoscopy information.

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## Competing interests

The authors declare that they have no conflict of interest.

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