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Implementation of BSG/ACPGBI/PHE polypectomy surveillance guidelines safely reduces the burden of surveillance in a screening cohort: a virtual model study

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ABSTRACT

Objective To evaluate the impact of British Society of Gastroenterology/Association of Coloproctology of Great Britain and Ireland/Public Health England (BSG/ACPGBI/PHE) 2019 polypectomy surveillance guidelines within a national faecal immunochemical test-based bowel cancer screening (BS) cohort on surveillance activity and detection of pathology by retrospective virtual application.

Design A retrospective review of BS colonoscopies performed in 2015–2016 with 5 years prospective follow-up in single institution. Index colonoscopies were selected. Incomplete colonoscopies were excluded. Histology of all resected polyps was reviewed. Surveillance intervals were calculated according to BSG/ACPGBI/PHE 2019 guidelines and compared with pre-existing 'European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis' (EUQA 2013). Total number of colonoscopies deferred by virtual implementation of BSG/ACPGBI/PHE 2019 guidelines were calculated. Pathology identified on procedures that would have been deferred was reviewed.

Results Total number of index BS colonoscopies performed in 2015–2016 inclusive was 890. 115 were excluded (22 no caecal intubation, 51 inadequate bowel preparation, 56 incomplete polyp clearance). N=509 colonoscopies were scheduled within a 5-year interval following index colonoscopy surveillance rounds based on EUQA guidelines. Overall, volume of surveillance was significantly reduced with retrospective application of BSG/ACPGBI/PHE 2019 guidelines (n=221, p<0.0001). No cancers were detected within the 'potentially deferred' procedures who attended for follow-up (n=330) with high-risk findings found in<10% (n=30) of colonoscopies within the BSG/ACPGBI/PHE cohort.

Conclusion BSG/ACPGBI/PHE 2019 guidelines safely reduce the burden of colonoscopy demand with acceptable pathology findings on deferred colonoscopies.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ We know that demand on endoscopy access is likely to increase in the coming years and the application of new postpolypectomy guidelines will decrease the number of surveillance colonoscopies performed. This will allow endoscopists to focus attention on reducing the incidence of colorectal cancer as oppose to premalignant lesions.

WHAT THIS STUDY ADDS

⇒ This study demonstrates a quantified reduction of surveillance colonoscopies of 56% in a bowel screen cohort with acceptable incidence of pathology on colonoscopies, which would be avoided or deferred with the application of British Society of Gastroenterology/Association of Coloproctology of Great Britain and Ireland/Public Health England (BSG/ACPGBI/PHE) 2019 guidelines.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The findings of this study will provide reassurance both to endoscopists and patients in the safety of the BSG/ACPGBI/PHE 2019 guidelines and allow endoscopy departments to anticipate a significant reduction of surveillance colonoscopies require in the future.

INTRODUCTION

Colorectal cancer (CRC) remains the third most common cancer in the western world with over 1.9 million CRC diagnoses in 2020 and was second only to lung cancer for cancer-related deaths at 9.4%.[1] Projections of global CRC burden over the next 20 years, by the Global Cancer Observatory, are estimated to increase up to 3.1 million diagnoses in the year 2040.[1] However, with the introduction of CRC screening (CRCS), there has been reported reduction in the incidence of late-stage CRC and subsequently, reduction in the overall mortality rate associated with CRC.[2 3] Death rate reduction due to CRCS has been reported as high as 32%.[4] In comparison to

Global Cancer Observatory projections, Cancer Research UK projects a reduction of 11% in cases of CRC in the UK from 2014 to 2035.[5]

Coinciding with the roll-out of national CRCS (NCRCS) programmes comes the increase in demands on endoscopy units. A 2019 endoscopy census among UK JAG-registered services reported a 12%–15% increase in activity across all GI procedures compared with 2017, with the largest increases seen in CRCS.[6] Longer projections predict colonoscopy demand for NCRCS programmes is expected to double in 20 years.[7] In addition to the increased number of index CRCS cases being performed each year, the continued surveillance of patients postpolypectomy, which accounts for up to 15% of total colonoscopies performed, also contributes significantly to pressure on endoscopy capacity.[8] With the benefit of increasing data, there has been a shift in primary objectives of NCRCS programmes from detection and removal of premalignant lesions to reduction of overall CRC incidence and improve early CRC detection.

In 2019, the British Society of Gastroenterology/Association of Coloproctology of Great Britain and Ireland/Public Health England (BSG/ACPGBI/PHE) published new guidelines for postpolypectomy surveillance.[9] These new guidelines focus on 3-year surveillance of patients who have five or more premalignant polyps, a large non-pedunculated colonic polyp (LNPCP), ≥ 2 cm or an advanced polyp. An advanced polyp was considered:

- serrated polyp of at least 10 mm in size or
- serrated polyp containing any grade of dysplasia or
- an adenoma of at least 10 mm in size or
- an adenoma containing high-grade dysplasia.

In the instance of detection of an advanced polyp, the 2019 guidelines require the detection of an additional premalignant polyp to qualify for a 3-year surveillance colonoscopy (e.g. minimum of two premalignant polyps, one of which is an advanced polyp). The detection of an isolated advanced polyp, for example, a single adenoma of 10–19 mm, does not meet the criteria for high-risk surveillance and it is advised that such patients should be discharged from surveillance endoscopy to the NCRCS programme.

At present, the NCRCS programme in Ireland is offered to patient between the ages of 60–69 years. Patients with a positive faecal immunochemical test (FIT) (≥45 µg/g) are offered an NCRCS colonoscopy within 20 working days of eligibility. Until recently, the NCRCS programme followed the 2013 European guidelines for quality assurance in CRCS and diagnosis (EUQA guidelines) for post polypectomy colonoscopy surveillance (see table 1).[10] As of December 2022, the NCRCS programme in Ireland has followed UK NCRCS programmes by implementing the 2019 guidelines.

Significant difference of two guidelines

As outlined in table 1, there are a number of differences in the 2013 and 2019 guidelines. Most noticeably, there is significant increase in polyp burden required to meet the criteria for surveillance in the 2019 guidelines (e. ≥5 premalignant polyp vs 3 premalignant polyps). Also, patients with ≥5 premalignant polyps have a significantly different interval of surveillance depending on the guidelines, with 2013 guidelines offering a 1-year follow-up compared with a 3-year follow-up as per 2019 guidelines. There is also a significant burden of surveillance colonoscopy with application of the 2013 guidelines, whereby a number of patients will qualify for a second surveillance colonoscopy even in the setting of a negative first surveillance colonoscopy. However, the 2019 guidelines apply the same higher threshold criteria for additional surveillance colonoscopy at surveillance rounds as per index colonoscopy criteria. The implementation of 2019 guidelines consequently reduces the overall number of colonoscopies per patient performed in an NCRCS programme. A recent retrospective study by Cross *et al.* reported that by classifying patients' post-index surveillance colonoscopy according to the 2019 guidelines, the risk ratio for detecting CRC at a 3-year surveillance colonoscopy was 1.54 (0.68–3.48).[11]

Aims

Our study aims to review the impact of BSG/ACPGBI/PHE 2019 guidelines in a FIT-based NCRCS programme on surveillance activity. Secondary aim of the study is to assess whether new guidelines impact on the detection of pathology, specifically pathology missed by application of longer surveillance intervals and higher threshold for surveillance criteria, by retrospective virtual application of both guidelines to a single patient cohort.

METHODS

We performed a retrospective review of all index NCRCS colonoscopies performed in our institution between 2015 and 2016 in patients who were referred following a positive FIT (≥45 µg/g) as part of the NCRCS programme. Patients were prospectively followed up for 5 years (or two surveillance rounds). All colonoscopies were performed by a consultant endoscopist with at least 300 colonoscopies performed per year and an adenoma detection rate (ADR) of ≥45% within an FIT-positive index colonoscopy cohort. Colonoscopies which did not achieve caecal or neo-terminal ileum intubation were excluded. Colonoscopies with a bowel preparation classified as 'poor' or with residual premalignant polyps in situ following completion of colonoscopy were also excluded.

Polyps were classified as adenomas and serrated lesions (hyperplastic polyp, sessile serrated lesion, sessile serrated lesion with dysplasia, traditional serrated adenoma, and mixed polyp).[9] Colonic lesions including adenomas, serrated lesions (SLs), and tumours were recorded. Histological classification of all resected polyps was reviewed noting:

1. Size of lesion.
2. Presence of high-grade dysplasia in all premalignant polyps.

Table 1 Comparison of EUQA 2013 and BSG/ACPGBI/PHE 2019 guidelines at index and first surveillance colonoscopies

	EUQA 2013	BSG/ACPGBI/PHE 2019
Index		
6 month+1 year	LNPCP piecemeal resection	LNPCP piecemeal resection without R0 *en bloc* excision
1 year	High risk criteria: ► ≥ 5 premalignant polyps or ► One premalignant polyp ≥20 mm	Colorectal cancer
3 years	Intermediate risk: ► 3–4premalignant polyps or ► One premalignant polyp≥10 mm and<20 mm	High risk criteria: ► ≥ 5 premalignant polyps ► 2 or more premalignant polyps including at least one advanced colorectal polyp
Routine screening by FIT	Low risk criteria: ► 1–2 premalignant polyps (<10 mm each)	Absence of: ► LNPCP ► Cancer or ► High risk criteria
Surveillance round		
6 month+1 year	LNPCP piecemeal resection	LNPCP piecemeal resection without R0 *en bloc* excision
1 year	High risk criteria ► ≥ 5 premalignant polyps or ► One premalignant polyp ≥20 mm	Colorectal cancer
3 years	► Low risk criteria at 3 year surveillance ► Negative or low risk criteria following 1 year surveillance	High risk criteria: ► ≥ 5 premalignant polyps ► 2 or more premalignant polyps including at least one advanced colorectal polyp
5 years	► Negative surveillance following intermediate criteria ► Second negative surveillance following high risk criteria	n/a

BSG/ACPGBI/PHE, British Society of Gastroenterology/Association of Coloproctology of Great Britain and Ireland/Public Health England; EUQA, European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis; LNPCP, large non-pedunculated colonic polyp.

3. Presence of low-grade dysplasia in serrated polyps.
4. Evidence of incomplete resection.

True number of premalignant polyps was calculated by excluding hyperplastic polyps. Colonoscopies with suspicion of incomplete polyp resection were also excluded from the study. All colonoscopies and histology findings were discussed at a histology multidisciplinary meeting (MDT). Interval colonoscopies were then scheduled as per EUQA 2013 guidelines.

Virtual model

Pathology at index colonoscopies was also reviewed in context of the BSG/ACPGBI/PHE 2019 guidelines with alternative surveillance intervals calculated for the same pathology as indicated by new guidelines (see table 1). Patients with diagnoses outside of premalignant polyps (e.g. CRC, inflammatory bowel disease or microscopic colitis) were excluded from surveillance. In the instance patients had an interval colonoscopy, which deviated from EUQA guidelines following histology of MDT discussion (e.g. 3-year interval reduced to a 1-year interval surveillance), the same interval was scheduled for the 'virtual model' surveillance interval. Due to the retrospective nature of the study, patients with isolated advanced polyps were scheduled for a 6-month colonoscopy interval by default as we could not determine *en bloc* removal. If findings did not meet the high-risk criteria, patients were discharged to the NCRCS programme (2 yearly FIT screening).

Interval extension

Within the 'virtual model', patients' colonoscopy interval could be extended (e.g. extended from a 1-year to a 3-year interval) or patients could be 'virtually' discharged to the NCRCS programme.

In the instance of a patient having two real-time colonoscopies within the proposed virtual interval colonoscopy, the pathology from both real-time colonoscopies was combined to reflect anticipated pathology likely to be found at the 'virtual' interval colonoscopy (see figure 1). Interval colonoscopy was calculated according to BSG/ACPGBI/PHE 2019 in addition to EUQA 2013 guidelines.

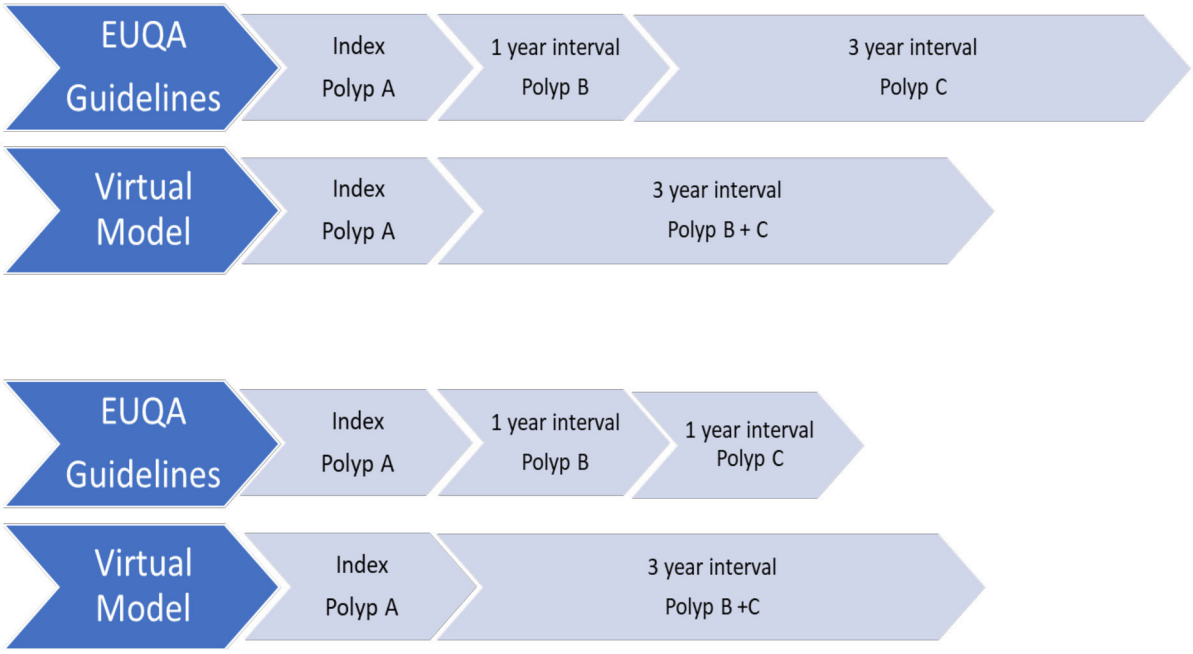

Figure 1 Virtual endoscopy findings at de-escalated interval in virtual model. EUQA, European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis.

Deferred Colonoscopies

Pathology from deferred or cancelled colonoscopies was reviewed. Significant findings were considered as:

- ≥5 premalignant polyps.
- Advanced polyp.
- Large non-pedunculated polyps ≥2 cm.
- Cancer.

RESULTS

Between 2015 and 2016, 890 patients had an index CRCS colonoscopy at our institution. In total, 775/890 were included in the virtual model study with a complete colonoscopy with:

1. Caecal/neoterminal ileum intubation.
2. At least an adequate bowel preparation score.
3. Complete clearance of polyps.

Of 115/890 colonoscopies were excluded from the virtual model:

- Twenty-two colonoscopies were incomplete and did not reach caecum or neo-terminal ileum.
- Fifty-one patients' bowel preparation score was considered 'poor'.
- Fifty-six had residual polyps in situ post-colonoscopy.

Index colonoscopy findings

The patient demographics of the total cohort showed 42% (325/775) were women with a median age of 65 years (range 60–72). Of the 775 index colonoscopies included in the virtual models, 31.6% (n=245) of patients were found to have a normal colonoscopy (absence of premalignant polyps or cancer). Cancer was detected in 4.6% (n=36) patients. The number of index colonoscopies with premalignant polyps in the absence of cancer was 63.6% (493/775). The average number of premalignant polyps detect on index colonoscopy was 2 (range 1–17). High risk criteria, including ≥5 premalignant polyps, advance polyps and LNPCPs, was met in a total 29.4% (228/775). Incidence of≥5 premalignant polyps, advance polyps and LNPCPs were 9% (70/775), 23.0% (178/775) and 7.1% (55/775), respectively. Pre-malignant polyps ≥10 mm in size were the most frequent form of advanced polyps with an incidence of 21.3% (165/775) followed by adenoma with high-grade dysplasia, 3.5% (27/775) and sessile serrated lesion with dysplasia, 0.9% (7/775) (see table 2). Optimal comfort score of 1 or 2 was achieved in 95.7% (742/775). See table 2.

Index colonoscopy surveillance interval

Thirty-one patients were referred for a 6-month 're-look' colonoscopy with one subsequent detection of cancer in both cohorts. EUQA guidelines resulted in 71.0% (22/31) of 6 month 're-look' patients requiring a 1-year colonoscopy and 25.8% (8/31) requiring a 3-year interval colonoscopy. The BSG/ACPGBI/PHE model resulted in a lower number of 1-year surveillance colonoscopies at 41.9% (13/31; p=0.1706) with a subsequent increase in 3-year surveillance follow-up at 54.8% (17/31; p=0.1049), neither of which, however, was statistically significant. There was a significant reduction in overall 1-year interval colonoscopies in the BSG/ACPGBI/PHE virtual model from 11.9% (92/775) in the EUQA group compared with 0.1% (1/775, p<0.0001) in the BSG/ACPGBI/PHE virtual model. The number of three yearly interval colonoscopies scheduled were similar in both guideline groups.

The number of patients discharged from index colonoscopy to NCRCS programme with FIT follow-up was significantly higher in BSG/ACPGBI/PHE group at 68.6% (532/775) compared with the EUQA cohort at

Table 2 Patient demographics and index colonoscopy findings

Patient demographics	Total index cases N=775	%
Sex, female	325	42
Age in years (median) at index colonoscopy	65	(range 60–72)
Findings		
Normal colonoscopy (absence of cancer or premalignant polyps)	245	31.6
Cancer detected	36	4.6
Cases of pre-malignant polyp detected (total cases)	515	66.5
Cases of pre-malignant polyp detected in absence of cancer	493	63.6
Tubular adenoma	448	57.8
Tubular villious adenoma	100	12.9
Villious adenoma	4	0.5
Sessile serrated lesion (SSL)	66	8.6
Median number of premalignant polyps (in positive findings)	2	(range 1–17)
High risk criteria	228	29.4
5 or more premalignant polyps	70	9.0
Advanced polyps	178	23.0
Adenoma/SSL 10 mm or more	165	21.3
Adenoma with high grade dysplasia	27	3.5
SSL with dysplasia	7	0.9
LNPCP	55	7.1
Procedure		
Grade of bowel preparation		
Excellent	567	73.2
Good	208	26.8
Gloucester Comfort score		
1—no discomfort	559	72.1
2—minimal discomfort	183	23.6
3—mild discomfort	28	3.6
4—moderate discomfort	5	0.6
5—severe discomfort	0	0.0
Medication		
Midazolam (mg), median	3	(range 0–10)
Fentanyl (mg), median	50	(range 0–150)
Buscopan (mg), median	0	(range 0–20)

LNPCP, large non-pedunculated colonic polyp.

56.1% (435/775; p<0.0001). Overall, the total number of colonoscopies scheduled from index colonoscopy was also significantly higher in the EUQA group (n=291), compared with the BSG/ACPGBI/PHE virtual model (n=194; p<0.0001). See table 3.

Interval extension at index colonoscopy

Interval extension was achieved by the BSG/ACPGBI/PHE 2019 virtual model in both the 1-year surveillance group and the 3-year surveillance group. The BSG/ACPGBI/PHE 2019 virtual model increased the interval from 1-year to 3-year surveillance in 87.7% (100/114) of patients and resulted in the discharge of 56.8% (96/169) patient from the 3-year surveillance EUQA cohort to the NCRCS programme.

First surveillance colonoscopies

There were 72 patients lost to surveillance colonoscopy indicated by EUQA guidelines following index screening, 43 of which were due a surveillance colonoscopy in the BSG/ACPGBI/PHE cohort. As a result, the cohort for first surveillance colonoscopy was n=219 for the EUQA group and n=152 for the BSG/ACPGBI/PHE group. Following the application of the virtual model based on index colonoscopy, pathology detected at the first surveillance colonoscopy subsequently differed between the cohorts. As a result, cancer was detected in two patients within the BSG/ACPGBI/PHE group with only one cancer detected in the EUQA cohort. The additional second cancer case within the BSG/ACPGBI/PHE cohort was detected in the second surveillance round in the EUQA cohort. As per EUQA guidelines, this patient had 1-year interval colonoscopy followed by a 3-year colonoscopy. The cancer was detected at 3-year interval colonoscopy and, therefore, was not included in the first surveillance pathology in the EUQA group. Due to interval extension from a 1-year interval to a 3-year interval in the virtual model, anticipated pathology for the virtual 3 year colonoscopy incorporated the pathology of the EUQA 1 year and 3 year colonoscopies combined. Subsequently, this resulted in this cancer being reported in the first surveillance pathology in the BSG/ACPGBI/PHE virtual model (see figure 1)

Second surveillance colonoscopies

Similar to the index colonoscopy round, there was a reduction in 1-year colonoscopy surveillance in the BSG/ACPGBI/PHE model 2.0%% (3/152), compared with the EUQA cohort 7.3% (16/219; p=0.0290). There was also a significant reduction in three yearly colonoscopies; EUQA 89.9% (197/219); BSG/ACPGBI/PHE cohort, 15.8% (24/152; p<0.0001).

The BSG/ACPGBI/PHE guidelines successfully discharged 80.3% (122/152) to the NCRCS programme following first round of surveillance compared with 0% in the EUQA cohort (p<0.0001). The BSG/ACPGBI/PHE cohort had a significant reduction in schedule colonoscopies compared with the EUQA cohort with 17.8%

Table 3 Index colonoscopy schedules for EUQA cohort and BSG/ACPGBI/PHE virtual model

	Index colonoscopy			First surveillance colonoscopy		
	EUQA 2013	BSG/ACPGBI/PHE 2019	P value*	EUQA 2013	BSG/ACPGBI/PHE 2019	P value*
Total	775	775		219	152	
Cancer MDT	36	36	1.0000	1	2	0.5702
Symptomatic service	12	12	1.0000	0	0	
6 month	31	31	1.0000	5	1	0.4074
+ 1 year	22	13	0.1706	3	1	0.6473
+ 3 years	8	17	0.1049	2	0	0.5150
+ Surgery	1	1	1.0000	0	0	1.0000
1 year	92	1	**<0.0001**	16	3	**0.0290**
3 year	169	163	0.7569	197	24	**<0.0001**
5 year	n/a	n/a		n/a	n/a	
NCRCS programme	435	532	**<0.0001**	0	122	**<0.0001**
Total colonoscopies scheduled	291	194	**<0.0001**	218	27	**<0.0001**

Boldface used to highlight significant p values.
*Two-tailed p value from Fisher's test.
BSG/ACPGBI/PHE, British Society of Gastroenterology/Association of Coloproctology of Great Britain and Ireland/Public Health England; EUQA, European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis; MDT, multidisciplinary meeting; NCRCS, national colorectal cancer screening .

(27/152) of patient requiring surveillance follow-up after round 1 of surveillance compared with 74.9% (218/291; p<0.0001) in the EUQA model.

Total number of surveillance colonoscopies

The highest number of surveillance colonoscopies, as expected, was from the EUQA cohort with a total of 509 referrals. The BSG/ACPGBI/PHE cohort had a significant reduction in the number of surveillance colonoscopies at 221 compared with the EUQA group over the 5-year follow-up period (p<0.0001). See figure 2.

However, the number of 1-year, 3-year and 5-year interval colonoscopies differs in both groups following the first surveillance colonoscopies. 1-year interval colonoscopies account for 9% of EUQA scheduled colonoscopies and 3% of scheduled colonoscopies in the BSG/ACPGBI/PHE virtual model. The EUQA model also has

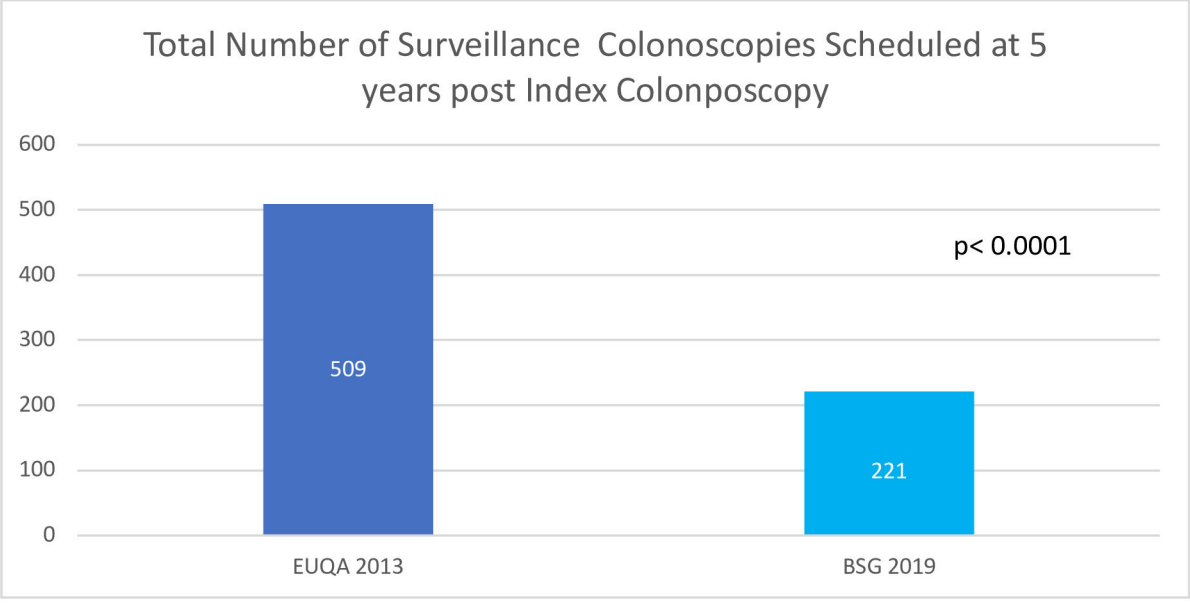

Figure 2 Total colonoscopies scheduled post index surveillance. EUQA, European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis.

a higher burden of 3-year interval colonoscopies at 91% with no 5-year interval colonoscopies or discharges to NCRCS programme. In comparison, 3 year colonoscopies only account for 16% of scheduled colonoscop in the virtual model, which also successfully discharged patients to the NCRCS programme at 81% of first surveillance colonoscopies. No patients in this group were offered a 5-year interval colonoscopy. See online supplemental figure 3.

Pathology on deferred colonoscopies

Pathology on deferred colonoscopies was reviewed for the virtual model. Advanced polyps and five or more premalignant polyps were detected in less than 5% of cases in the BSG/ACPGBI/PHE model (n=15, 4.8% and n=15, 4.8%, respectively). Similarly, LNPCP were detected in less than 1% of deferred cases in the BSG/ACPGBI/PHE model (n=1, 0.6%). Zero interval cancers were detected in the virtual model in colonoscopies that would have been deferred by implementation of the new guidelines.

DISCUSSION

This virtual model study demonstrates significant reductions in endoscopy demands at completion of two rounds of bowel screen surveillance with BSG/ACPGBI/PHE guidelines. We believe that the results offered by this study will provide assurances of patient safety and projections of cost savings following the implementation of these guidelines.

Within our index cohort, ADR was 66.5%, in line with achievable standards of key performance indicators (KPIs) (≥50%).[12] Caecal intubation rate was 97.5%, which was also within achievable standards of KPIs (≥95%), ensuring a high quality of endoscopy, according to international standards. We note that this study was performed in a NCRCS programme cohort, and benefits of a NCRCS cohort from a retrospective analysis perspective include relative standardisation of endoscopists. This may not reflect widespread endoscopist experience, particularly in patients diagnosed with premalignant polyp on symptomatic lists or patients who attend for polyp surveillance outside that of a NCRCS programme. Additionally, all resected premalignant polyps are discussed at a histology MDT facilitating considerations of borderline pathology findings. This prerequisite, however, is not standard practice for all pathology within symptomatic cohorts in some institutions and may have implications in the expansive roll-out of the new polypectomy guidelines.

Certainly, neither old nor new guidelines mitigate the importance of high-quality endoscopy. Both guidelines focus attention on high-quality endoscopy with particular emphasis on clearance of premalignant polyps on index colonoscopy. We noted that 56/890 (6.3%) of index colonoscopies had residual premalignant polyps in situ post-colonoscopy and, thus, were excluded from the virtual model. This may reflect current practice whereupon small residual polyps in situ are deemed acceptable, with the assurance of a short interval colonoscopy scheduled. This may have implications regarding attitudes to colon clearance of premalignant polyps at index colonoscopy in order to implement new guidelines.

The BSG/ACPGBI/PHE guidelines predicted a reduction of approximately 20% in surveillance work load in a polyp surveillance cohort.[9] Following application at index colonoscopy, we have demonstrated a reduction of 33%. Further benefits are to be gained following first round surveillance, where the BSG/ACPGBI/PHE guidelines facilitate the discharge of all patients from colonoscopy surveillance in the absence of high-risk findings. This contributed to a significant reduction in surveillance colonoscopies when compared with the EUQA cohort.

As discussed, the BSG/ACPGBI/PHE cohort successfully discharged 81% of colonoscopies after first the surveillance round. However, it is also important to consider that a proportion of these patients discharged to the NCRCS programme from the BSG/ACPGBI/PHE cohort may be re-referred for a colonoscopy within this time period due to positive FIT screening. Therefore, this model may overestimate the gross reduction over a 5-year period. Following discharge to the NCRCS programme, a patient will be offered an FIT at two yearly intervals. Thus, within a 5-year period, a patient with a persistently positive FIT will be offered two colonoscopies even in the absence of high-risk criteria at previous colonoscopy. In comparison, other European guidelines, such as the European Society of Gastrointestinal Endoscopy, offer a 5-year interval colonoscopy following the absence of high-risk criteria at index colonoscopy. This could potentially result in an overall fewer number of colonoscopies performed by mitigating the need of two FIT screening rounds.

The BSG/ACPGBI/PHE guidelines demonstrate the shift in emphasis in surveillance for detection of metachronous-advanced neoplasia to lowering the risk of morbidity and mortality from CRC. Within the deferred colonoscopy cohort, zero interval CRCs were detected, meeting a primary bowel screen KPI.[12] We detected acceptable incidence of high-risk findings of 10% in the virtual model concluding that only 10% of the 330 colonoscopies deferred would have qualified for further surveillance at 3 years had the original colonoscopy been performed. The remaining 90% would be discharged to the NCRCS programme.

Another limitation of this study is the 'hypothetical pathology' within de-escalated cases in the virtual model cohort. With each round of surveillance, the 'anticipated' pathology findings become more hypothetical and may become less reliable to draw meaningful conclusions. The cohort was followed for 5 years from index (or at least two surveillance colonoscopies), and consequently, the results from many de-escalated cases in first surveillance round have not yet been performed. Therefore, we cannot comment on pathology findings on the most recently deferred cases.

There is also variation internationally for the threshold for a positive FIT. In the Irish NCRCS programme, ≥45 µg/g is the threshold for colonoscopy referral.[12] However, it has been well document that lower FIT thresholds result in higher detection of cancer. Within our national programme, lowering the threshold from ≥45 µg/g to ≥20 µg/g would result in an increase of colonoscopy referral from 5% to 8.6%.[13] Reduction in endoscopy demand, by introduction of new guidelines, can, therefore facilitate:

1. Improved compliance with guidelines intervals with reduction in number of surveillance colonoscopies scheduled.
2. Expansion of screening cohort by expanding age demographics or lowering the FIT-positive threshold with increased endoscopy capacity without significant increase in infrastructure.

In conclusion, this retrospective virtual model demonstrates the BSG/ACPGBI/PHE 2019 guidelines may safely reduce the burden of colonoscopy demand within NCRCS programmes, at least in short term, and application of guidelines resulted in acceptable pathology on deferred colonoscopies.

Contributors RS is the principal investigator of the study. RS, JS, GC, HM, GH, EMcD, MB, MH and GD worked in the design of the study. RS, NO'M, JD and BN contributed to the collection and analysis data for the work. RS, NO'M, JD, BN, JS, GC, HM, GH, EMcD, MB, MH and GD contributed to interpretation of data for the work, drafting and critically revising the manuscript. All authors agreed to be accountable for all aspects of the work and gave approval of the final manuscript. GD is guarantor.

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Patient consent for publication Not applicable.

Ethics approval This study comprises of an audit of colorectal screening colonoscopy in a single centre. Formal ethics approval from the Research and Ethics committee was not required consequently.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Data are available upon reasonable request at email:stack.roisin@gmail.com.

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