

Weekend and evening planned colonoscopy activity: a safe and effective way to meet demands



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Bibliography

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ABSTRACT

Background and study aims Colonoscopy is the “gold standard” investigation for assessment of the large bowel

that detects and prevents colorectal cancer, as well as non-neoplastic conditions. The Joint Advisory Group (JAG) on Gastrointestinal Endoscopy recommends monitoring key performance indicators such as cecal intubation rate (CIR) and adenoma detection rate (ADR). We aimed to investigate the quality of colonoscopies carried out during evening and Saturday lists in our unit and compare them against JAG standards of quality for colonoscopies.

Patients and methods We retrospectively collected and analyzed demographical and procedure-related data for non-screening colonoscopies performed between January 2016 and November 2018. Evenings and Saturdays were defined as the out-of-hour (OOH) period. We compared the outcomes of the procedures done in these against the working hours of the weekdays. We also wanted to explore whether the outcomes were different among certain endoscopists. Other factors that could affect the KPIs, such as endoscopist experience and bowel preparation, were also analyzed.

Results There were a total of 17634 colonoscopies carried out; 56.9% of the patients (n=10041) <70 years old. Key Performance Indicators (KPIs) of weekday, evening, and Saturday colonoscopies regarding the CIR and ADR met the JAG standards as they were above 93% and 24%, respectively. Advanced colonoscopists had better KPIs when compared to the non-advanced colonoscopists, with CIR at 97.6% vs. 93.2% and ADR at 40.8% vs. 26%, respectively.

Conclusions JAG standards were maintained during colonoscopies done on weekdays, evenings, and Saturdays. Advanced colonoscopists had higher CIR and ADRs.

Introduction

Colonoscopy, the “gold standard” investigation for assessing the large bowel, detects and prevents colorectal cancer and allows diagnosis, biopsy, and therapy to be undertaken [1] and is important for both diagnosis and treatment of non-neoplastic conditions [2–4]. In isolated cases, colonoscopy may lead to rare but serious complications [5–7] and suboptimal colonoscopy may be associated with increased rates of interval cancers [8, 9]. As with many technical skills, there may be a variation in

quality of practice among clinicians [10–12]. The most commonly used quality indicator for colonoscopy is adenoma detection rate (ADR) of endoscopists. ADR can be affected by a number of variables, such as quality of bowel preparation, cecal intubation rate (CIR) [9–11], and colonoscopy withdrawal time (CWT) [13–16].

In 2013, the Joint Advisory Group on Gastrointestinal Endoscopy (JAG), the British Society of Gastroenterology (BSG), and the Association of Colo-proctology of Great Britain and Ireland commissioned a new working group to review existing and de-

fine quality assurance measures and key performance indicators (KPIs) for colonoscopy [17]. With the increased demand that endoscopy services are under and the “just about coping” situation, many services are not meeting national waiting time targets. Twenty percent of Acute National Health Service (NHS) units in England, 64% of units in Northern Ireland, 40% units in Scotland, and 42% in Wales were unable to meet urgent suspected cancer targets in 2017 [18].

The national survey of endoscopy done in 2017 [18] showed that endoscopy services are under pressure with many patients not meeting waiting time targets and found that there is a potential to increase endoscopy service to a 7-day working pattern to meet the increased demand. However, evidence suggested that staffing would be a significant issue. JAG recommendations include a minimal unadjusted cecal intubation at 90%, and colonoscopists should aspire to achieve 95% unadjusted cecal intubation [16]. ADR is recommended to be 15% or more with an aspirational ADR of 20%. The polyp detection rate can be used as a marker of ADR [16, 19]

In the 2017 JAG census, shortages of endoscopists and nursing staff were found to be the biggest barrier that impeded units in meeting the demand [18]. Services introduced extended working hours during the week and on weekends to increase capacity; 66% of acute NHS units perform endoscopy most or every weekend. Several NHS hospitals were offering “insourcing” in their unit as well as “outsourcing” patients to other services; both are used by approximately 25% of acute English units [18]. The 2019 JAG UK survey trend suggested that 17.2% of services outsourced activity to external providers and 36.1% of services reported that they insourced activity [20]. Our hospital provides endoscopy service on weekday evenings and all day on Saturday with the service offered by our own staff. This study aimed to assess whether the quality indicators were maintained during the weekends and on Saturdays. We hypothesized that the quality indicators were likely to be maintained during these times, allowing us to add extra endoscopy activities to meet the increasing demands for colonoscopy.

Patients and methods

Study Design

We retrospectively collected data from 17634 patients who underwent non-screening colonoscopies in Sheffield Teaching Hospitals, United Kingdom, from January 2016 to November 2018. Ethical approval was obtained from the hospital’s endoscopy user group. The majority of our colonoscopies done out-of-hours (OOH) were non-screening. Taking this into consideration and the fact that screening colonoscopies have high polyp detection, we excluded bowel cancer screening colonoscopies to avoid the risk of selection bias.

Data collection and outcomes

The quality indicators for colonoscopy defined by the JAG include cecal intubation rate (CIR) and ADR. We also calculated the mean polyps per procedure (MPPP) for each group. ADR is a validated quality measure for a colonoscopy; it was calculated

as the proportion of procedures in which at least one adenoma was detected for an endoscopist over the total number of colonoscopies. MPPP and mean numbers of adenomas per procedure were defined as the total number of polyps or adenomas detected divided by the total number of colonoscopies performed, respectively. Evenings (5:30 pm to 9 pm) and Saturdays were defined as OOH periods. We compared the outcomes of the procedures done in these against the working hours of the weekdays. We also wanted to explore whether outcomes were different among endoscopists. Therefore, we classified endoscopists as advanced and non-advanced colonoscopists. Advanced colonoscopists were defined as BCSP (Bowel cancer screening program)-accredited colonoscopists or those that were performing advanced SMSA (size, morphology, site, access) level 3, 4 colonic polypectomies regularly [21].

Statistical analysis

Data were analyzed using SPSS version 25 (SPSS Inc., Chicago, Illinois, United States). Numerical data were expressed as mean and standard deviation or median and range as appropriate. Qualitative data were expressed as frequency and percentage. Chi-square test (Fisher’s exact test) was used to examine the relation between qualitative variables. For quantitative data, a comparison between two groups was done using either a student’s t-test or Mann-Whitney test (non-parametric t-test) as appropriate. A Kruskal-Wallis test used for comparing more than two groups. $P \leq 0.05$ was considered significant. Logistic regression was done to give an adjusted odds ratio and measure the magnitude of the effect of different factors on ADR and CIR; factors entered into models were: timing of the procedure, working team, and adequacy of bowel preparation.

Results

During the study period, 17634 colonoscopies were performed: 20.4% in patients >70 years old and 56.9% in patients <70 years old. The ages of 3992 patients (22.6%) were unavailable (► **Table 1**). There was a significant difference in the distribution of age group with the working times, as Saturdays and evenings had a lower distribution of patients >70 years compared to weekdays. Overall, CIR was >90% and ADR was over 15% during all three sessions.

CIR was significantly higher in patients <70 years old (93.8%) compared to the ≥ 70 years old group (90.3%). ADR was higher in the ≥ 70 years old group at 36% vs. 24.6% in the <70 years old group. The MPPP was significantly higher in the ≥ 70 years old group (0.70) compared to the <70 years old group (0.45), $P < 0.001$. (► **Table 2**)

The most common indication for colonoscopy in the study group was a change in bowel habits (► **Fig. 1**). ADR was higher in patients undergoing colonoscopy for polyp surveillance and patients presenting with abnormal radiological investigations. CIR was higher in patients scoped for polyp surveillance and IBD-related indications (► **Table 3**).

The adequacy of bowel preparation was analyzed based on procedure time, i.e., weekdays, evenings, and Saturdays. We categorized the quality of bowel preparation into excellent,

► **Table 1** Age of patients

Age of patients		N (%)
Valid	≥ 70	3601 (20.4%)
	< 70	10041 (56.9%)
	Total	13642 (77.4%)
Unavailable data		3992 (22.6%)
Total		17634 (100%)

adequate, and inadequate. Overall, the quality of bowel preparation was better during the evenings (► **Table 4**).

There was no significant overall difference in the CIR for procedures done during weekdays, Saturdays, or evenings. ADR was higher for procedures done on weekdays (28.8%) when compared to those done in the evenings (24.4%) and Saturdays (24.2%). Although both groups met JAG standards, advanced colonoscopists had statistically significant higher KPIs with CIR of 97.6% and ADR of 40.8% when compared to the non-advanced colonoscopists, who had CIR of 93.2% and ADR of 26% (► **Table 5** and ► **Fig. 2**).

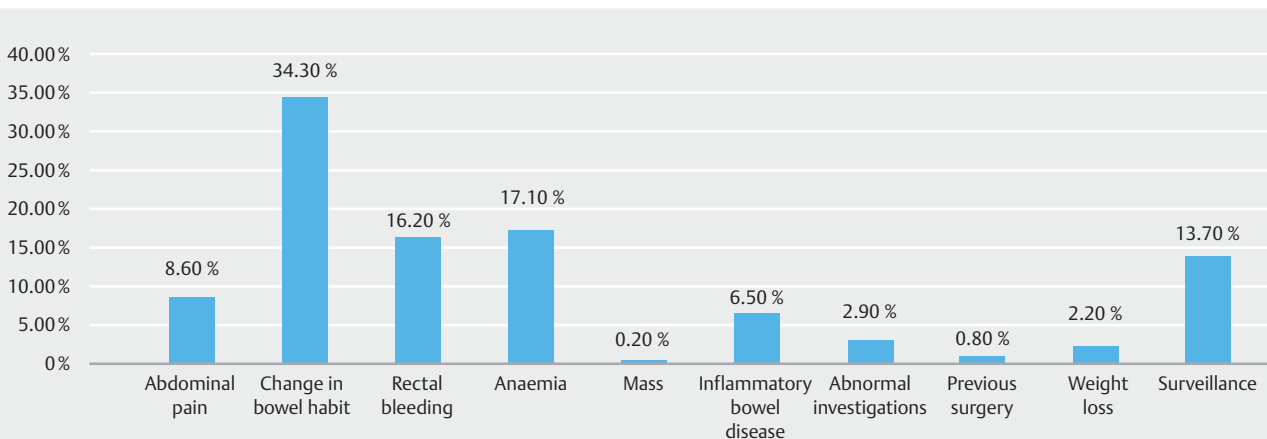
ADR was higher in patients that had adequate preparation (29.4%) when compared to those with preparation that was excellent (24.6%) or inadequate (28.9%). CIR was statistically significantly higher in patients with adequate or excellent (94.9%, 95.1%) compared to those with inadequate preparation (90.1%). MPPP was significantly higher in the advanced colonoscopist group and for procedures done during weekdays and procedures with adequate bowel preparation (► **Table 5**).

Multiple logistic regression models for factors affecting ADR demonstrated that colonoscopies that were done on Saturdays and evenings were less likely to detect polyps when compared to weekdays, adjusted for other factors in the model and confounders (OR = 0.92, 95% CI: 0.81–1.04, $P = 0.175$). This is likely due to the larger number of patients on weekdays in comparison to Saturdays and evenings. Patients with inadequate preparation were less likely to have adenomas detected in comparison to those with adequate preparation adjusted for other factors in the model and confounders. (OR = 0.94, 95% CI: 0.85–1.04, $P = 0.281$). Advanced colonoscopists were significantly more likely to detect adenomas in their procedures after controlling for other factors in the model OR = 1.86, 95% CI: 1.65–2.11, $P < 0.001$ (► **Table 6**).

► **Table 2** Age at procedure and different study variables

Variables		70 or over	Under 70	P value
		N (%)	N (%)	
Working time	Weekdays	3204 (89%)	7576 (75.5%)	<0.001
	Saturdays	245 (6.8%)	1224 (12.2%)	
	Evenings	152 (4.2%)	1241 (12.4%)	
CIR	Yes	3252 (90.3%)	9417 (93.8%)	<0.001
ADR	Yes	1295 (36%)	2473 (24.6%)	<0.001
MPPP mean(SD)		0.70 (1.22)	0.45 (0.99)	<0.001

Data for age available only for 13624 patients. $P \leq 0.05$ was considered statically significant. CIR, cecal intubation rate; ADR, adenoma detection rate; MPPP, mean polyp per procedure.

► **Fig. 1** Indications for colonoscopy.

► **Table 3** Indication for colonoscopy with ADR and CIR

Indication	ADR%	P value	CIR%	P value
Abdominal pain	18.7%	<0.001	93.1%	0.27
Anemia	26.2%	<0.001	91.7%	<0.001
Inflammatory bowel disease	12.0%	0.03	96.0%	<0.001
Polyp surveillance	41.1%	<0.001	96.4%	0.001
Abnormal radiological investigations	31.2%	<0.001	87.7%	<0.001
Weight loss	26.2%	0.08	90.5%	0.001

► **Table 4** Adequacy of bowel preparation in relation to working hours

Adequacy of bowel preparations	Weekdays	Saturdays	Evenings	P value
	N (%)	N (%)	N (%)	
Adequate	7043 (51.6%)	1055 (52.6%)	688 (53.8%)	<0.001
Excellent	3600 (26.4%)	500 (24.9%)	395 (30.9%)	
Inadequate	3013 (22.1%)	450 (22.4%)	196 (15.3%)	

$P \leq 0.05$ is statistically significant.

► **Table 5** ADR and CIR with different variables

Variables		CIR	P value	ADR	P value	MPPP	P value
Timing	Weekday	12696 (93.6%)	0.068	3906 (28.8%)	0.009	0.49 (0.99)a	0.009
	Saturday	1962 (94.9%)		500 (24.2%)		0.38 (0.84)b	
	Evening	1876 (93.6%)		490 (24.4%)		0.39(0.85)b	
Team	Advanced	2090 (97.6%)	0.009	875 (40.8%)	0.009	0.65 (1.06)	0.009
	Non-advance	14444 (93.2%)		4021 (26%)		0.44 (0.94)	
Quality	Adequate	8320 (94.9%)	0.009	2579 (29.4%)	0.009	0.49 (0.98)b	0.009
	Excellent	4279 (95.1%)		1107 (24.6%)		0.40 (0.89)a	
	Inadequate	3280 (90.1%)		1050 (28.9%)		0.49 (1)b	

CIR, cecal intubation rate; ADR, adenoma detection rate; MPP, mean polyp per procedure.

Variables sharing same letters are not statistically different from each other, while those with different letters are significantly different after Bonforoni correction.

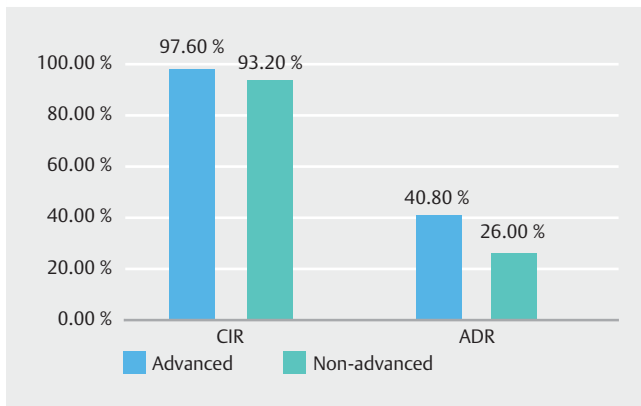
In a multiple logistic regression model for factors affecting CIR, colonoscopies that were done on Saturdays had more likelihood for CIR in comparison to weekdays (OR = 1.14, 95% CI: 0.91–1.43, $P = 0.256$), while those done in evening shifts were associated with lower CIR, adjusted for other factors in the model. Colonoscopies with excellent preparation had the highest likelihood of high CIRs; however, we could not identify a significant association between excellent preparation and CIR in the adjusted model. Advanced colonoscopists were more likely to have higher CIR than non-advanced colonoscopists after controlling for other model factors (► **Table 7**). After adjusting these findings to age, we found that advanced teams were more likely to achieve high CIRs (OR = 2.53; 95% CI: 1.84–3.48, $P < 0.001$).

Discussion

There is evidence to suggest that when quality is overseen, outcomes are improved in colonoscopy [22, 23]. Quality indicators of colonoscopy such as CIR and ADR need to be met to give patients the maximum benefit of the service provided, so our study aimed to explore the KPIs at various sessions. Our study found that JAG standards were maintained for colonoscopies done on weekdays, evenings, and Saturdays.

A cost-benefit analysis was not performed as this was not in the study's remit, but we found that by utilizing evenings and Saturdays, an additional 2005 and 2067 colonoscopies were done at those respective times.

With NHS and other service providers aspiring to deliver a seven-day service for all our patients, these additional activities



► **Fig. 2** KPIs of advanced versus non-advanced colonoscopists.

could hugely complement these aspirations. In a large study survey of more than 750,000 responders relating to primary care services, the majority of responders who mentioned that they had issues accessing services mentioned that having healthcare provision on Saturdays would be helpful for them [23]. Some patients may find evenings and Saturdays more suitable. This was anecdotally noticed during the study period,

but we did not collect data on it. All patients were given a choice, based on the availability of slots and urgency based on indications.

The OOH sessions were also utilized for other emergency and planned endoscopies, such as upper gastrointestinal endoscopies, flexible sigmoidoscopies, BCSP colonoscopies, bowel scopes, and endoscopic retrograde cholangiopancreatography. As the purpose of our study was to look at non-BCSP colonoscopies only, we did not include these in this study.

Although JAG standards were maintained overall, advanced colonoscopists had higher CIR, ADR, and MPPP. These factors should be considered when job plans and operational plans are made for utilization of capacity.

We also noted that the quality of bowel preparation was better in the evenings. Previous studies have shown variations in the quality of bowel cleansing between sessions [24], including evening sessions [25]. As noted by Subaramanian et al [25], this could be related to patients having evening scopes being given same-day preparation instructions as opposed to split dosing or the day before. Further studies may be required to look at cleansing quality in evenings specifically.

The ADR and CIR showed comparable results on Saturdays and evenings to regular weekdays, and KPIs were preserved. We also note that at the time of submission of this manuscript,

► **Table 6** Multivariate analysis of factors affecting ADR

Factors affecting ADR	Unadjusted OR, 95% CI	P value for unadjusted OR	Adjusted OR, 95% CI	P value for adjusted OR
Weekday	(Reference)			
Saturday	0.82 (0.73–0.93)	0.002	0.92 (0.81–1.04)	0.175
Evening	0.81 (0.71–0.92)	0.002	0.97 (0.85–1.10)	0.610
Adequate	(Reference)			
Excellent	0.83 (0.76–0.91)	<0.001	0.87 (0.79–0.95)	0.003
Inadequate	0.96 (0.86–1.06)	0.445	0.94 (0.85–1.04)	0.281
Advanced Team	1.88 (1.67–2.11)	<0.001	1.86 (1.65–2.11)	<0.001

ADR, adenoma detection rate; OR, odds ratio. 95% CI for OR = 95% confidence interval for the odds ratio. $P \leq 0.05$ was considered significant, adjusted OR, CI, and P value for confounders

► **Table 7** Multivariate analysis of factors affecting CIR

Factors affecting CIR	Unadjusted OR, 95% CI	P value for unadjusted OR	Adjusted OR, 95% CI	P value for adjusted OR
Weekday	(Reference)			
Saturday	1.20 (0.96–1.51)	0.107	1.14 (0.91–1.43)	0.256
Evening	0.93 (0.76–1.15)	0.522	0.86 (0.69–1.06)	0.147
Adequate	(Reference)			
Excellent	1.09 (0.90–1.30)	0.361	1.06 (0.89–1.27)	0.521
Inadequate	0.41 (0.35–0.48)	<0.001	0.42 (0.36–0.49)	<0.001
Advanced Team	2.48 (1.80–3.40)	<0.001	2.53 (1.84–3.48)	<0.001

CIR, cecal intubation rate; OR, odds ratio.

95%CI for OR = 95% confidence interval for the odds ratio. $P \leq 0.05$ was considered significant, adjusted OR, CI, and P value for confounders

units across the world were likely to face huge challenges to meet the huge backlog demands following restrictions secondary to COVID-19 [26, 27]. Units should consider performing colonoscopies on weekends and evenings as an alternative route to meet targets.

We note that other studies had been done on the quality of OOH service in specialties such as orthopedic trauma [28]. However, to the best of our knowledge, this is the first study looking at planned endoscopy activity done OOH. There has only been a conference poster presentation looking at OOH colonoscopies that were presented from our unit in 2017 [29].

Conclusions

In conclusion, the JAG quality standards for colonoscopy were maintained during colonoscopies done in the evening and on Saturdays, the same as on weekdays, which may allow for extra list slots to face the service demand. Similarly, we found that advanced colonoscopists had higher CIR and ADRs than non-advanced colonoscopists.

Competing interests

The authors declare that they have no conflict of interest.

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