

The 'ins and outs' of colonoscopy at Wits Donald Gordon Medical Centre, South Africa: A practice audit of the outpatient endoscopy unit

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Background. In South Africa, there are no national guidelines for the conduct or quality assessment of colonoscopy, the gold standard for investigation and diagnosis of bowel pathology.

Objectives. To describe the clinical profile of patients and evaluate the practice of colonoscopy using procedural quality indicators at the Wits Donald Gordon Medical Centre (WDGMC) outpatient endoscopy unit (OEU).

Methods. We conducted a prospective, clinical practice audit of colonoscopies performed on adults (≥ 18 years of age). A total of 1 643 patients were included in the study and variables that were collected enabled the assessment of adequacy of bowel preparation, length of withdrawal time and calculation of caecal intubation rate (CIR), polyp detection rate (PDR) and adenoma detection rate (ADR). We stratified PDR and ADR by sex, age, population group, withdrawal time and bowel preparation. CIR, PDR and ADR estimates were compared between patient groups by the χ^2 test; Fisher's exact test was used for 2×2 tables. A p -value < 0.05 was used. Benchmark recommendations by the American Society for Gastrointestinal Endoscopy (ASGE)/American College of Gastroenterology (ACG) Task Force on Colorectal Cancer (CRC) were used in this audit to assess individual endoscopist performance and that of the endoscopy unit as a whole.

Results. The mean age of patients was 55.7 (standard deviation (SD) 14.4; range 18 - 91) years, ~60% were female, and the majority (75.5%) were white. Of the outpatients, 77.6% had adequate bowel preparation (ASGE/ACG benchmark $\geq 85\%$). The CIR was 97.0% overall, and screening colonoscopy was 96.3% (ASGE/ACG benchmark $\geq 90\%$ overall and $\geq 95\%$ for screening colonoscopies). The median withdrawal time for negative-result screening colonoscopies was 5.7 minutes (interquartile range (IQR) 4.2 - 9.3; range 1.1 - 20.6) (ASGE/ACG benchmark ≥ 6 minutes), and PDR and ADR were 27.6% and 15.6%, respectively (ASGE/ACG benchmark ADR $\geq 25\%$). We demonstrated a 23.7% increase in PDR and 14.1% increase in ADR between scopes that had mean withdrawal times of ≥ 6 minutes and < 6 minutes, respectively. Although the number of black Africans in the study was relatively small, our results showed that they have similar ADRs and PDRs to the white population group, contradicting popular belief.

Conclusions. The WDGMC OEU performed reasonably well against the international guidelines, despite some inadequacy in bowel preparation and lower than recommended median withdrawal times on negative-result colonoscopy. Annual auditing of clinical practice and availability of these data in the public domain will become standard of care, making this audit a baseline for longitudinal observation, assessing the impact of interventions, and contributing to the development of local guidelines.

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Colonoscopy is regularly used for investigation of bowel pathology and has become the gold standard for screening and diagnosis of colorectal cancer (CRC).^[1] The procedure has diagnostic and therapeutic benefits, such as direct visualisation of the entire colon and removal of precancerous polyps, which is associated with a lowered risk of CRC.^[2] Colonoscopy is a skill-intensive procedure and poses a risk to the patient, even if performed by a trained endoscopist in an appropriate setting.^[1] Therefore, there is a need

for standardised practice and regular audit of endoscopists to ensure consistent, high-quality care.^[3]

Based on the 'adenoma-carcinoma sequence' hypothesis for developing CRC, screening and surveillance colonoscopy aim to detect and remove polyps, particularly adenomatous polyps, with the intention of reducing the incidence of CRC.^[4] Therefore, the polyp detection rate (PDR) and adenoma detection rate (ADR) are two key indicators of the quality of endoscopy. Other measurable

factors, such as adequate bowel preparation, reaching the caecum or terminal ileum and scope withdrawal time, all affect the clinician's ability to detect polyps and should be scrutinised alongside ADR and PDR.^[2,5] Unfortunately, there are no locally derived guidelines or benchmarks for measurement of quality of colonoscopy in South Africa (SA). International guidelines, such as the American Society for Gastrointestinal Endoscopy (ASGE)/American College of Gastroenterology (ACG) Task Force on Colorectal Cancer can be used to benchmark our performance as a unit and that of individual endoscopists.^[6]

Wits Donald Gordon Medical Centre (WDGMC) in Johannesburg, SA is part of the University of the Witwatersrand academic teaching hospital complex and was the first private academic hospital in SA. In 2006, a formal outpatient endoscopy unit (OEU) was established that currently hosts 14 endoscopists. All endoscopists have medical or surgical specialist training in endoscopy. In this audit, we aimed to describe the clinical profile of patients undergoing colonoscopy at WDGMC and to evaluate the practice of colonoscopy in the OEU by assessing intraprocedural quality indicators.

Methods

We conducted a prospective, clinical practice audit of colonoscopies performed on adults (≥ 18 years of age) between 1 March 2018 and 28 February 2019 at the WDGMC OEU. Each endoscopist agreed to participate in the audit, and we obtained written informed consent from all patients. The attending nurse collected details of the colonoscopy at the time of the procedure using a standardised data collection sheet (Appendix A: <http://samj.org.za/public/sup/14419-a.pdf>) and data were imported into REDCap (Research Electronic Data Capture).^[7] Bowel preparation prior to colonoscopy was prescribed according to the endoscopist's preference and was not standardised for the OEU. Adequacy of bowel preparation at the time of colonoscopy was assessed by the endoscopist using a non-standardised score, graded as: (i) good; (ii) fair; (iii) poor; and (iv) bad. The variables collected enabled the calculation of caecal intubation rates (CIR) and PDR. We did not record any information on size, grade, histological type, morphology and anatomical location of polyps or detail regarding the technique of removal (biopsy v. endoscopic mucosal resection). To calculate ADR, histological reports were accessed to confirm whether polyps were adenomatous. In the analysis, we further stratified PDR and ADR by sex, age, population group, withdrawal time and bowel preparation. We analysed data overall and per endoscopist if a minimum of 50 colonoscopies were performed during the review period.

Definitions

CIR: number of colonoscopies where the caecum or terminal ileum was reached, divided by the number of colonoscopies where the intended endpoint was the caecum or terminal ileum; PDR: number of screening colonoscopies in which polyps were detected, divided by the total number of screening colonoscopies; and ADR: number of screening colonoscopies in which an adenoma was detected, divided by the total number of screening colonoscopies.

Benchmarks

CIR: $\geq 90\%$ overall, and $\geq 95\%$ for screening colonoscopies; adequate outpatient bowel preparation rate: $\geq 85\%$; average withdrawal time for negative-result screening colonoscopies: ≥ 6 minutes; ADR: $\geq 25\%$ overall ($\geq 30\%$ for men and $\geq 20\%$ for women);^[2] PDR: $\geq 40\%$ for men and $\geq 30\%$ for women (there is no definitive benchmark for PDR from the ASGE/ACG Task Force or other governing bodies, such as the British Society of Gastroenterology (BSG) or the Joint Advisory

Group on gastrointestinal endoscopy (JAG). However, Williams *et al.*^[8] concluded that a PDR of $\geq 40\%$ for men and $\geq 30\%$ for women was the minimum requirement to yield an ADR of $>25\%$ and $>15\%$ for men and women, respectively.^[7,9]

Data analysis

CIR, PDR and ADR estimates were compared between patient groups by the χ^2 test; Fisher's exact test was used for 2×2 tables. Data analysis was done using SAS version 9.4 for Windows (Microsoft, USA). A *p*-value < 0.05 was used.

Ethical approval

The study was approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand (ref. no. M171142).

Results

Demographic characteristics of patients undergoing colonoscopy

We recruited 1 643 patients from 1 March 2018 to 28 February 2019; their demographic characteristics are summarised in Table 1. The mean age of patients was 55.7 (standard deviation (SD) 14.4; range 18 - 91) years, $\sim 60\%$ were female and the majority (75.5%) were white. Although this is an outpatient unit, 9.1% were hospital inpatients referred for colonoscopy to the OEU.

Indications for colonoscopy

The most common indications for colonoscopy were screening (41.7%), polyp surveillance (9.7%) and cancer surveillance (8.7%) (Table 2).

Quality indicators for colonoscopy

Overall and screening CIR, adequacy of bowel preparation and withdrawal time on screening colonoscopy are shown in Table 3.

Table 1. Demographic characteristics of outpatients undergoing colonoscopy at Wits Donald Gordon Medical Centre

Characteristic	All colonoscopies (N=1 643), n (%)	Screening colonoscopies (n=686), n (%)
Age, years		
18 - 39	239 (14.6)	43 (6.3)
40 - 49	266 (16.2)	115 (16.8)
50 - 59	407 (24.8)	204 (29.7)
60 - 69	440 (26.8)	217 (31.6)
70 - 79	248 (15.1)	93 (13.6)
≥ 80	43 (2.6)	14 (2.0)
Sex		
Male	688 (41.9)	276 (40.2)
Female	955 (58.1)	410 (59.8)
Population group		
White	1 241 (75.5)	543 (79.2)
Indian/Asian	225 (13.7)	74 (10.8)
Black	131 (8.0)	54 (7.9)
Mixed race	40 (2.4)	12 (1.7)
Other	4 (0.2)	2 (0.3)
Missing	2 (0.1)	1 (0.1)
Outpatient/inpatient status		
Outpatient	1 489 (90.6)	620 (90.5)
Inpatient	150 (9.1)	64 (9.3)
Missing	4 (0.2)	2 (0.3)

Table 2. Indications for colonoscopy

Indication*	n (%) (N=1 643)
Screening	686 (41.7)
Polyp surveillance	160 (9.7)
Cancer surveillance	142 (8.7)
Change in bowel habits	135 (8.2)
Investigation of diarrhoea	108 (6.6)
Rectal bleeding	93 (5.7)
Anaemia	83 (5.1)
Abdominal pain	82 (5.0)
Inflammatory bowel disease surveillance	75 (4.6)
Inflammatory bowel disease symptoms	60 (3.7)
Constipation	16 (1.0)
Other	21 (1.3)
Missing	1 (0.1)

*More than one indication per procedure is possible.

For screening colonoscopies, PDR and ADR stratified by sex, population group and withdrawal time are described in Table 4. Benchmarks for each quality indicator were included, where available.^[2] We demonstrated a 23.7% increase in PDR and 14.1% increase in ADR between scopes that had mean withdrawal times of ≥ 6 minutes and < 6 minutes. Of the 686 screening colonoscopies performed, 176 polyps/specimens were sent for histological analysis, and in these, 1 malignancy was diagnosed (grade 1 neuroendocrine tumour).

We were able to compare the performance of 10 of the 14 endoscopists who participated in the study – each had completed > 50 colonoscopies during the study period. All of these endoscopists achieved an overall CIR above the benchmark of 90%; half (5/10) met the benchmark of $\geq 95\%$ for screening colonoscopies; 2 achieved the $\geq 85\%$ benchmark for adequate outpatient bowel preparation; 3 had a median withdrawal time of ≥ 6 minutes for negative-result screening colonoscopies; and only 1 met the benchmark of $\geq 40\%$ and $\geq 30\%$ for men and women, respectively, for PDR, and $\geq 25\%$ for ADR.

Table 3. Quality indicators

Quality indicator	n/N (%)*	Benchmark
Caecal intubation rate		
All colonoscopies	1 582/1 631 (97.0)	$\geq 90\%$
Screening colonoscopies only	659/684 (96.3)	$\geq 95\%$
Good/fair bowel preparation		
All colonoscopies	1 248/1 642 (76.0)	-
Outpatients	1 155/1 448 (77.6)	$\geq 85\%$
Inpatients	92/150 (61.3)	-
Withdrawal time on screening		
Time (min.), median (IQR; range) (n=628)	6.3 (4.2 - 9.3; 1.1 - 43.3)	-
< 6 min.	284/628 (45.2)	-
≥ 6 min.	344/628 (54.8)	-
≥ 8 min. [†]	214/628 (34.1)	-
Time for negative-result screening colonoscopies (min.), median (IQR; range) (n=458)	5.7 (4.2 - 9.3; 1.1 - 20.6)	≥ 6 min.

IQR = interquartile range.
*Unless otherwise indicated.
[†]Subset of ≥ 6 min.

Table 4. Polyp and adenoma detection rates for screening colonoscopies

	Polyp detection rate			Adenoma detection rate		
	n/N (%)	p-value	Benchmark, %	n/N (%)	p-value	Benchmark, %
Overall	186/685 [‡] (27.2)		-	107/686 (15.6)		≥ 25
Sex						
Male	100/276 (36.2)	0.0001	≥ 40	56/276 (20.3)	0.0071	≥ 30
Female	86/409 (21.0)		≥ 30	51/410 (12.4)		≥ 20
Population group [†]						
White	149/542 (27.5)	0.76	-	83/543 (15.3)	0.75	-
Indian/Asian	19/74 (25.7)		-	13/74 (17.6)		-
Black	17/54 (31.5)		-	10/54 (18.5)		-
Withdrawal time						
< 6 min.	40/284 (14.1)		-	21/284 (7.4)		-
≥ 6 min.	130/344 (37.8)	< 0.0001	-	74/344 (21.5)	< 0.0001	-
		(v. < 6 min.)			(v. < 6 min.)	
≥ 8 min. [‡]	97/214 (45.3)	< 0.0001	-	56/214 (26.2)	< 0.0001	-
		(v. < 6 min.)			(v. < 6 min.)	
		0.080			0.20	
		(v. ≥ 6 min.)			(v. ≥ 6 min.)	

[‡]One polyp was reported as unknown and therefore excluded from the polyp detection rate calculation.
[†]Where n $>$ 30.
[‡]Subset of ≥ 6 min.

Discussion

This preliminary clinical audit was our first attempt to evaluate the practice of colonoscopy in the OEU, with results proving promising for the future performance of the unit. It was expected that the majority of the scopes would be for screening (41.7%), surveillance for polyps (9.7%) and cancer (8.7%), as some of the endoscopists perform screening colonoscopies as part of the standard requirements for liver transplantation (WDGMC runs the largest liver transplant programme and has one of the largest oncology units in SA). Additionally, international guidelines recommend screening colonoscopy for those >50 years of age.^[2] Therefore, it is reasonable that, when compared with an audit from Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) and international audits from Canada, the UK and Greece, the proportion of screening colonoscopies done at WDGMC was almost double (WDGMC: 41.7% v. 9.7% - 28.7%).^[1,5,10-12]

When assessing the key quality indicators of screening colonoscopies, results showed that our PDR (27.2%) and ADR (15.6%) were low compared with international benchmarks and published data from high-income countries. These studies reported PDRs between 32.1% and 59.7%, and ADRs between 27.1% and 54.0%.^[1,10,13-15] The obvious explanation might be that our patient profile is different, requiring locally derived, population-appropriate benchmarks for South Africans and, preferably, the sub-Saharan African (sSA) region. While a small proportion of patients in this clinical audit were black Africans, it is noteworthy that PDRs and ADRs for this group were similar to those of other population groups, despite the historical belief that black Africans 'do not get polyps'.^[16] When compared with neighbouring countries, a study from Harare, Zimbabwe reported polyps in 5% of black Zimbabweans compared with 8% of white Zimbabweans.^[17] Studies from Zambia and Nigeria reported overall PDRs of 10% and 7.4%, respectively.^[18,19] Unfortunately, none of the studies from our region reported ADRs, as very few of the colonoscopies performed were true screening scopes. For the same reason, these PDRs must be interpreted with caution. The audit from CMJAH reported a PDR of 25.2%, which is similar to our PDR of 27.2%.^[5] Overall, the higher PDR reported for different sites in Johannesburg – the largest and wealthiest urban metropole in the country – might reflect relative affluence, and evidence of an epidemiological sociodemographic transition from rural to urban living for its residents, with associated dietary and lifestyle changes. SA might be at a more advanced stage of this transition than other sSA countries. Interestingly, it is well documented that African Americans, who have similar genetic origins to black Africans, have a higher prevalence of polyps than their white counterparts, suggesting a gene-environment interaction that might alter clinical phenotypes.^[20]

Alternatively, we could also question the quality of our clinical practice. Average withdrawal times >6 minutes were significantly associated with higher PDR/ADR and our withdrawal time on negative-result screening colonoscopies was just under the recommended target of ≥6 minutes. Although some endoscopists challenge the association between withdrawal times and PDR/ADR (as increasing withdrawal time alone will not improve an ADR/PDR that is already adequate), data suggest that longer withdrawal times are strongly associated with an increase in PDR and ADR, particularly when endoscopists do not achieve accepted benchmarks.^[1,13,19,21]

Another factor that could have affected our PDR/ADR was the adequacy of our outpatient bowel preparation, which was below the ASGE/ACG Task Force benchmark of ≥85%. Interestingly, our results showed that inadequate bowel preparation yielded similar PDRs and ADRs to adequate bowel preparation, which could indicate that we

are 'over-calling' poor bowel preparation as opposed to it actually being inadequate.^[1,2] This could be owing to our clinicians not prescribing a standardised bowel preparation product or not using the same bowel preparation assessment tool when reporting the adequacy of this metric.

Despite not meeting the benchmark for bowel preparation, CIR was above the ASGE/ACG Task Force recommendation of ≥90% for all colonoscopies and ≥95% for screening colonoscopies. International audits from Canada, the UK and New Zealand report CIRs on par with ours.^[1,11,13] It must be noted that in our calculation of CIR, we accounted for the starting intention of the colonoscopy, whereas other studies could have used the total number of screening colonoscopies, regardless of the intention. Other audits from SA report variable CIRs, both above and below the ASGE/ACG benchmark.^[5,22]

As part of the continuation of this audit in years to come, we shared our overall results with all healthcare workers in the OEU, which stimulated productive discussion regarding areas for improvement and additional variables for inclusion. For example, we will implement the Harefield cleansing scale for assessing bowel preparation.^[23] For results per endoscopist, the clinicians requested open sharing of their data in an anonymised format. Each endoscopist also received a confidential report of their performance metrics. The published literature suggests that confidential feedback to each individual on their metrics, without unit-wide intervention, makes a difference to PDR and withdrawal time.^[24-26] On this basis, the endoscopists at WDGMC agreed to use results from this audit as a baseline for comparison in the next annual audit. The annual report is accessible in the public domain.

Study limitations

This audit is limited by the patient pool, as it reflects an urban, single-centre experience of health-insured individuals, and our findings may not be generalisable. The sample may be biased because the OEU screens all patients receiving liver transplants at WDGMC. Therefore, the screening population may not be average-risk asymptomatic individuals. There are no national guidelines or benchmarks for South Africans, or for different population groups within SA, which make interpreting low PDRs and ADRs difficult.

Conclusions

The audit of the WDGMC OEU revealed that 77.6% of outpatients had adequate bowel preparation, the CIR was 97.0% overall, and 96.3% for screening colonoscopies. The median withdrawal time for negative-result screening colonoscopies was 5.7 minutes. For screening colonoscopies, the PDR and ADR were 27.6% and 15.6%, respectively, which are lower than benchmarks from HIC regions with a 3-fold higher incidence of CRC, yet relatively higher than rates reported from other sSA countries. While short withdrawal times might affect the PDR and ADR, the validity of using externally derived high-income population benchmarks in SA deserves scrutiny. Given there are no standardised national benchmarks and guidelines on colonoscopy in SA, we hope these data will contribute to developing local guidelines. Annual auditing of clinical practice, and these data thus being available in the public domain, will be standard of care in our OEU, therefore making this year's audit a baseline for longitudinal observation and assessing the impact of interventions, as highlighted in our recommendations.

Recommendations

The clinicians have agreed to standardise education of patients regarding bowel preparation (with input from clinicians who achieve

good bowel preparation rates) on the choice of bowel preparation and the use of a validated bowel preparation score.^[27] Although adequate bowel preparation may seem straightforward, increasing patient adherence may incur a cost, such as employing a nurse educator who would be responsible for proper education of patients.^[28] Furthermore, increasing withdrawal time should be strongly considered as a straightforward and relatively low-cost intervention. Due to the resource-intensive nature of recording histological results for calculation of the ADR, the creation of an average adenoma-to-polyp detection rate quotient for the OEU could be cost-effective and useful in determining ADR from PDR, without needing these results. This will be feasible in time, as data from each annual audit can be used as a local reference.

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Conflicts of interest. None.

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