Adenoma Detection Rate and Polyp Detection Rate among Gastroenterology Fellows and Consultants in a Tertiary Hospital in the Philippines: A Cross-sectional Study

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ABSTRACT

Background and Objective. Colorectal cancer (CRC) is the third most commonly diagnosed cancer and the fourth leading cause of cancer mortality worldwide. Likewise in the Philippines, the prevalence of CRC has shown to be increasing. Colonoscopy, a screening procedure for CRC, has parameters to gauge quality of detection. One of which is the Adenoma Detection Rate (ADR). Higher ADR has been linked to improved cancer detection. This study aimed to determine the ADR and Polyp Detection Rate (PDR) among Gastroenterology practitioners in a tertiary government university hospital in the Philippines, estimate ADR from PDR, and identify factors associated with ADR.

Methods. An analytical, cross-sectional study among patients who underwent colonoscopy for the years 2021 and the first half of 2022 at the Central Endoscopy Unit (CENDU) of the Philippine General Hospital. Demographic data of fellows and consultants were collected through an online form, while those from patients were obtained from electronic records. Colonoscopy details and histopathology results were accessed through the hospital's Open Medical Record System (MRS). ADR, PDR, and estimated ADR were computed using established formulas. To evaluate the strength of the relationship between the estimated and actual ADR, Pearson's correlation coefficient was used. Chi-square analysis, Mann-Whitney U test, and Kruskal-Wallis H test were performed to identify the factors that might influence the ADR. A cut-off of $p < 0.05$ was considered statistically significant.

Results. The total computed ADR of consultants and fellows combined is 22%. The difference between the ADRs of Gastroenterology consultants and Fellows-in-Training is statistically significant at 31.6% and 18.7%, respectively (p= 0.017). The total Polyp Detection Rate is 57.6% while the weighted group average Adenoma to Polyp Detection Rate Quotient (APDRQ) is 0.4085 or 40.85%. The estimated ADR has a moderate degree of correlation with the actual ADR when an outlier was excluded (r=0.521 (95% CI, 0.072-0.795, p=0.0266). Significant factors related to ADR include endoscopists' years of practice (p=0.020), number of colonoscopies done (p=0.031), and patient tobacco use (p=0.014).

Conclusion. The overall ADR among consultants and fellows is at par with the standard guidelines. A moderate degree of correlation exists between actual and estimated ADR when an outlier is excluded; however, more studies are needed to determine the APDRQ in the wider local setting. Longer years in practice, total number of colonoscopies performed, and patient tobacco use are associated with increased ADR.

Keywords: adenoma, adenoma detection rate, colonic polyp, colorectal cancer, colonoscopy

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INTRODUCTION

Colorectal cancer (CRC) ranks as the third most commonly diagnosed cancer and the fourth leading cause of cancer mortality in the global setting.[1] In 2012, new cases of CRC were estimated at 1.4 million, with approximately 700,000 related deaths.[1] In the Philippines, it is the third leading site of malignancy.[2] Moreover in 2020, it is reported as the most common gastrointestinal tract malignancy.[3] There is an exponential growth of 66% in the incidence rates in most of Asia over the period of 2010-2015.[4] Estimated survival rates for colon cancer have been less than promising, with 38.1% and 33.9% over 3 to 5 years, respectively.[2]

Potential precursors of CRC are colorectal adenomas, which are categorized as advanced and non-advanced adenomas.[5] The prevalence of colonoscopy findings are as follows: adenoma (23.9%; 95% CI, 22.2%–25.8%), advanced adenoma (4.6%; 95% CI, 3.8%–5.5%), and CRC (0.4%, 95% CI, 0.3%–0.5%).[1] Advanced adenomas are further classified into the following: tubular, tubulovillous, villous, and high grade dysplasia.[5] Among individuals with advanced adenomas, the 10-year cumulative risk of developing CRC ranges from 25.4% to 42.9% in women, and from 25.2% to 39.7% in men.[1]

Understanding the facets of CRC, such as its epidemiology and genetics, has led to the development of improved diagnostic tests and treatments, resulting in better survival and cure rates.[4] The importance of screening is further stressed by increasing detection of colorectal and prostate cancer in the local setting.[4] Early diagnosis could increase the 5-year relative survival rate.[6] International societies differ with regard to age cut-off for early screening, ranging from ages 45-50.[6] In the Philippines, the recommended age for asymptomatic healthy adults is set at 50 years old.[7]

To ensure the quality of colonoscopy as a diagnostic tool, certain measures have been instituted. One of these is the Adenoma Detection Rate (ADR) which is defined by the proportion of colonoscopies with at least one detected adenoma over total number of colonoscopies done.[5] As identification and prevention of CRC are the primary goals of most colonoscopies, ADR has emerged as the most important and the most widely studied quality measure in colonoscopy.[8] Different guidelines recommend a target ADR ranging from 20% to 25% because higher ADRs have been correlated to a lower risk of postcolonoscopy interval cancers.[5] Sex-specific targets vary according to different countries, ranging from 25%-30% in men and 15%-20% in women.[6] However, some studies have argued that improvement in ADR mainly results in increased detection of clinically irrelevant non-advanced adenomas.[5]

Significant patient determinants associated with the presence of adenomas include comorbidity of diabetes mellitus, prior history of adenoma, and increasing age.[6] Procedural aspects that influence ADR are insertion and withdrawal times of the scope, and bowel preparation.[6,9]

While ideal, the use of the ADR as a quality metric in endoscopy is cumbersome because it requires a histopathological diagnosis. For settings that are resource-limited or have logistical constraints, an alternative is the Polyp Detection Rate (PDR), computed as the ratio of the number of patients with at least one polyp to the total number of patients who underwent colonoscopy.[8] Certain mathematical formulas have been investigated to accurately determine the ADR from the PDR. A study by Francis et al.[10] included colonoscopies performed regardless of indications, and included both sexes and age groups. Excluded were polyps that measured less than 5mm, assessment of bowel preparation as inadequate, inability to visualize the cecum, and less experienced endoscopists qualitatively described as having performed not more than 200 colonoscopies during the year prior. In their study, they proposed a possible conversion factor to estimate ADR from PDR, based on the average ADR to PDR quotient (APDRQ) among a diverse group of endoscopists. Their basis for this was that ADR is always a proportion of the PDR. Their study was able to determine a coefficient of 0.64 with a significant positive correlation of estimated ADR with the actual ADR (0.85 95% CI, 0.65-0.93, P= .000001).[10] Another study by Niv,[11] sought to confirm the prior study's findings by conducting a meta-analysis involving a total of 94 controlled published studies. ADR and PDR were collected and relative ratio was computed. The estimated coefficient from the studies was close to the 2011 study of Francis et al. at 0.688 (95% CI, 0.680-0.695, P <0.0001). However, the heterogeneity test for the included studies revealed significant differences (Q=492.753, d.f. (Q) 41, P <0.0001, and I^2 91.679).[11] They also cited that one of the limitations of the study was the assumption that the ratio between ADR and PDR will be the same for every indication, and for all populations.[11]

The accepted standard for ADR and PDR differs for countries with some setting ADR and PDR at 25% and 40%, respectively.[12] Estimations of ADR from PDR likewise vary with some suggesting that ADR is half of the PDR (i.e., 15% to 30%) while others have a different approximation (i.e., 25% ADR to 40% PDR).[12]

OBJECTIVES

The primary objective of the study is to provide both the ADR and PDR data from a tertiary hospital in the Philippines in order to assess the adequacy of colonoscopy in this setting.

General Objective

This study aimed to identify the Adenoma Detection Rate among Gastroenterology fellows-in-training and consultants in a tertiary government university hospital in the Philippines.

Specific Objectives

1. To determine and compare the Adenoma Detection Rates (ADR) of PGH Gastroenterology fellows and consultants
2. To compute the Polyp Detection Rates (PDRs) of PGH Gastroenterology fellows and consultants
3. To estimate the ADR using PDR and compare it with the actual ADR
4. To identify factors affecting Adenoma Detection Rate

Operative Definition of Terms

1. **Adenoma Detection Rate (ADR)** – proportion of the number of patients with at least one adenoma divided by the number of screening colonoscopies done[13]
2. **Polyp Detection Rate (PDR)** – defined as identification of at least one polyp and computed as the quotient of the number of patients where at least one polyp was found divided by the total number of patients who underwent colonoscopy[6]
3. **Estimated Adenoma Detection Rate** – estimated or assumed ADR from the PDR using the Adenoma to Polyp Detection Rate Quotient (APDRQ)
4. **Screening Colonoscopy** – defined as a colonoscopy done with no surveillance or diagnostic indication[14]
5. **Surveillance Colonoscopy** – defined as a colonoscopy with no diagnostic indication but was done to patients who had colonoscopy in the last 10 years or a sigmoidoscopy in the last 5 years; or those with history of polyps or CRC[14]
6. **Diagnostic Colonoscopy** – defined as colonoscopy done for patients with previous history of the following: positive for fecal occult blood test, abdominal pain, iron deficiency anemia, melena/hematochezia, weight loss, bowel changes, suspicious abdominal imaging findings, diagnosis of inflammatory bowel disease in the last 10 years, etc.[14]

Figure 1 shows the conceptual framework of the study. Screening colonoscopy results of patients were reviewed. Once polyps were identified, their characteristics such as size, type, and description were noted. Subsequently, histopathology results were retrieved to confirm the presence of adenomas. Polyp and Adenoma Detection Rates were then computed. Electronic patient charts were also reviewed to identify relevant patient demographics and comorbidities. Statistical analyses were then employed to identify possible risk factors for ADR.

MATERIALS AND METHODS

Study Design and Setting

An analytical, cross-sectional study among patients who underwent colonoscopy from March 1, 2021 until July 31, 2022 at the Central Endoscopy Unit (CENDU) of the Philippine General Hospital (PGH). The choice of study period was based on the availability of data through electronic records. The study was conducted in the PGH, a tertiary referral center in the country with patients from different provinces for screening colonoscopies.

Study Participants

Inclusion Criteria

Physicians

a. PGH Gastroenterology fellows-in-training from 2021 to 2022
b. Gastroenterology consultants who performed colonoscopy at PGH in 2021 to 2022

Patients

a. Adult Filipino patients
b. Outpatients and inpatients
c. Underwent screening colonoscopy last 2021 to July 2022 at PGH CENDU

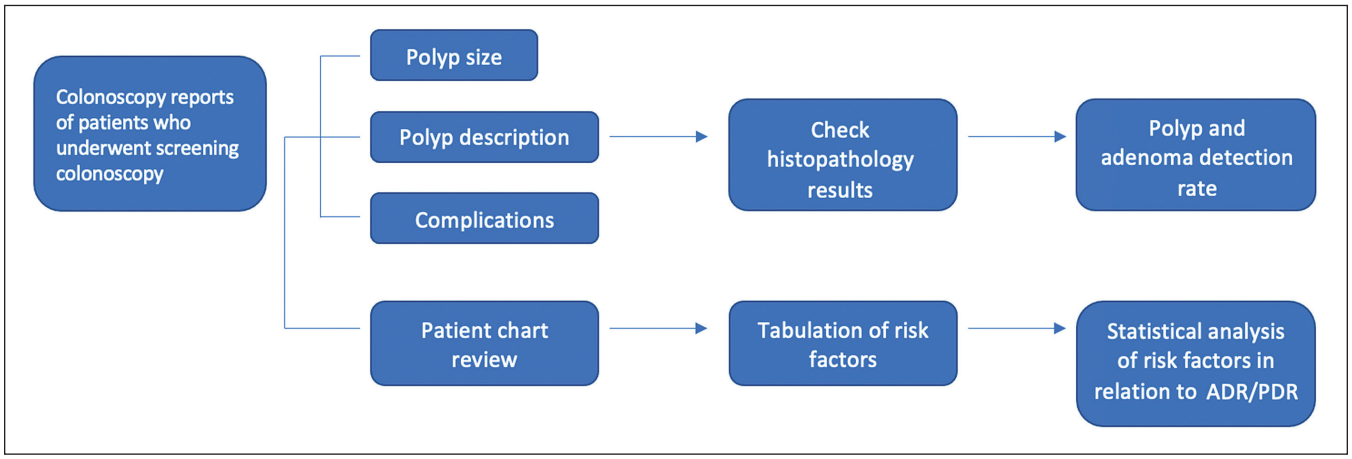

Figure 1. Conceptual Framework.

Exclusion Criteria

a. Patients who underwent colonoscopy due to an existing gastrointestinal symptom or complaint
b. Patients with known history of inflammatory bowel disease (IBD), polyposis syndromes, CRC, colorectal surgery, or contraindication to biopsy

Data Collection

Colonoscopy Results

Figure 2 summarizes the diagrammatic workflow of the study. The list of procedures performed at CENDU was reviewed to identify colonoscopy procedures. Patient case numbers were collected and subsequently accessed through the Open Medical Record System (OpenMRS), which is the official electronic record of PGH. Colonoscopy records in OpenMRS were checked for the indication of the procedure. If the indication was for screening, it was included in the sample pool. The following data were then gathered: primary endoscopist, overall polyp size and description, bowel preparation, total time of procedure, and complications of the procedure. Unfortunately, cecal intubation time and withdrawal time were not available and were therefore omitted.

Patient Demographics

The authors and research assistants obtained from electronic medical records the following data: patients' sex, age, chief complaint, procedure time, type of anesthesia, ethnic group, family history of colorectal cancer, risk factors for colon polyps (such as diabetes mellitus, coronary artery disease, BMI, alcohol use, tobacco use, aspirin use, hormone replacement therapy, non-steroidal anti-inflammatory drugs use). Patients were anonymized and given a code name and any missing information was reported.

Physician Data

Once consent was obtained, a questionnaire was accomplished with the following information regarding the endoscopist: whether a Gastroenterology fellow-in-training or consultant, number of colonoscopies done, years of practice, and medical training information. Their names were anonymized using code names and their data were summarized in aggregate form.

Histopathology Results

Final histopathology results were retrieved via Open Medical Record System (MRS).

Data Management and Statistical Analysis

Continuous data were presented as means ± standard deviation (SD). For categorical data, absolute and relative frequencies were used. Adenoma detection rate (ADR) of fellows and consultants was computed as the number of colonoscopies with at least one detected adenoma divided by the total number of screening colonoscopies within the study period. Likewise, Polyp Detection Rate (PDR) was calculated as the number of colonoscopies with at least one detected polyp divided by the total number of screening colonoscopies within the study period.

Adenoma Detection Rate was also estimated using PDR. First, Adenoma to Polyp Detection Rate Quotient (APDRQ) was determined for all individual endoscopists by dividing ADR by PDR. The weighted average of APDRQ for the entire group was then used as a conversion factor/multiplier for each endoscopist's PDR to estimate ADR. To evaluate the strength of the relationship between the estimated and actual ADR, Pearson's correlation coefficient was used.

Chi-square analysis was used to determine whether patient risk factors are significantly associated with adenoma detection. Mann-Whitney U test was used for age and bowel preparation score, while Kruskal-Wallis H test was used for endoscopist years of experience. A cut-off of $p<0.05$ was considered statistically significant.

Sample Size Estimation

Total enumeration of all eligible participants was included in the study. All screening colonoscopies done within the time period of the study (January 1, 2021 to July 31, 2022) were included in the computation of ADR and PDR. However, due to lack of electronic medical records from January to February, these were excluded from analysis.

In order to estimate a strong positive correlation of r=0.80 between polyp detection rate and adenoma detection rate from a baseline correlation of r=0.70, a minimum of 149 endoscopic and histopathologic matched observations were needed, assuming an alpha error probability of 0.05, power of 80%, two-tailed.[15] Assuming an attrition of 20% from incomplete or missing reports, a total of 166 matched

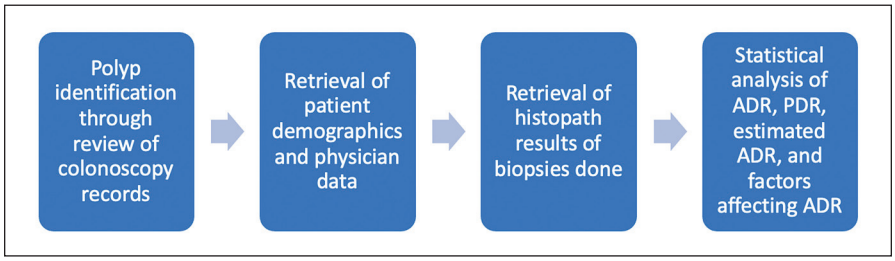

Figure 2. Diagrammatic Workflow.

observations were required. The minimum sample size was estimated using G*Power version 3.1.9.7. The minimum sample size for a power of 85%, 90%, and 95% are shown in Figure 1 in the Appendix.

Ethics Approval

The study protocol was submitted for review and was approved by the University of the Philippines Manila Research Ethics Board (UPMREB). A waiver of informed consent for the patients was requested from the UPMREB panel due to the design and nature of the study. Informed consent of the Gastroenterology fellows and consultants who performed colonoscopies was obtained. All data collected remained confidential. Data collection forms were anonymized and destroyed after electronic encoding was completed. Sensitive personal information of patients, except for age, sex, and diagnosis, were removed prior to storing in digital format. Only relevant sensitive personal information pertinent to achieving the study objectives was retained. The collected data, although anonymized, cannot be used for secondary analysis unless a new study-specific protocol is submitted and approved by UPMREB.

Data was stored on a password-protected electronic drive in a secure location, with access restricted to the co-investigators. Responses were tabulated electronically in encrypted spreadsheet files stored on a password-protected device or cloud storage, accessible only to study personnel. The investigators, with the help of a research assistant, collected the pertinent data. No attempts were done to re-identify the participants throughout the study period. There was no risk to privacy in this study. In the event that such events occurred, it was planned to be directed to the PGH Data Privacy Officer. The results of this study may be used to assess the quality of colonoscopies done at PGH and implement quality control measures for the improvement of fellows and consultants performing colonoscopies. This would in turn translate to better adenoma detection.

RESULTS

A total of 19 endoscopists performed colonoscopies during the study period with their baseline characteristics shown in Table 1. One endoscopist did not provide consent for the study, so the baseline characteristics were omitted in the analysis. Majority of the endoscopists were less than 40 years old (61%), followed by the 40-49 age group (22%), the 60-69 age group (11%), and the 50-59 age group (6%).

Majority had less than 5 years of practice (56%), followed by 5-10 years (17%), 16-20 years (16%), and 11-15 years (11%). Based on literature, the determination of seniority level of endoscopists was based on the number of colonoscopies done. Previous studies considered an endoscopist as senior when at least 3,000 colonoscopies were performed[16] or considered highly experienced with at least 1,000 endoscopies per year or performed a total of 10,000 colonoscopies or more[17]. For the current study, seniority was determined by at least 3,000 colonoscopies in a lifetime. Twenty-seven percent (27%) of the endoscopists can be considered senior status based on the adapted definition. In terms of medical training background, 72% graduated from University of the Philippines College of Medicine, and 78% did their residency training in PGH.

Table 1. Demographic Characteristics of Endoscopists

Endoscopist characteristic	n (%)
Age, in years	
<40	11 (61%)
40-49	4 (22%)
50-59	1 (6%)
60-69	2 (11%)
Years of practice	
<5	10 (56%)
5-10	3 (17%)
11-15	2 (11%)
16-20	3 (16%)
Experience based on number of colonoscopies performed	
Senior Endoscopist (≥3,000)	5 (27%)
Junior Endoscopist (<3,000)	13 (73%)
Medical school	
University of the Philippines	13 (72%)
Other medical schools	5 (28%)
Residency training	
UP-Philippine General Hospital	14 (78%)
Other local institutions	2 (11%)
Foreign institutions	2 (11%)

In total, 309 patients underwent colonoscopies between March 2021 to July 2022. Those performed in January and February were excluded due to lack of electronic medical records. Five patients had no final histopathology results and were excluded in the final analysis. Out of the 304 patients included in the study, 40.3% were males and 59.7% were females. The Mean age of the participants was 58 years (SD 9.50). Majority of the patients are in their 50s (n=108; 35.5%) followed by patients in their 60s (n=103; 33.9%). The total average time of the colonoscopy procedure was 39.5 minutes (SD 17.31). Majority of these procedures had bowel preparation that was adequate (95.7%). For significant comorbidities affecting adenoma development – hypertensives proved to be more common compared to non-hypertensives while the majority of the patient population were non diabetic, had no coronary artery disease, no alcohol and medication use, as outlined in Table 2. Majority of the patients also had an American Society of Anesthesia (ASA) status of II (51.6%) followed by ASA I (49.3%).

Majority of the bowel preparation utilized was polyethylene glycol (Surelax) (93.4%), followed by castor oil (4.28%) as shown in Table 3. All underwent intravenous (IV) sedation. Majority of the procedures were completed, with only three being incomplete. Reasons cited for non-completion included 1) poor bowel preparation, 2) resistance

upon further advancement and patient discomfort, and 3) presence of an obstructing mass. The terminal ileum was intubated in a majority of the procedures (97.4%). There were no reported procedure-related complications.

Most polyps noted during the colonoscopies were solitary (45.6%), with most having a pathological classification of adenoma (37.2%), as shown in Table 4. No biopsy was done in 24% as these were deemed to be hyperplastic during colonoscopy with high confidence. The sigmoid colon was the most frequent bowel location where polyps were detected (n=64, 35.6%), followed by rectum (n=55, 30.6%) and ascending colon (n=50, 27.8%). Majority of the polyps had 1-10 mm size (n=149, 82.8%), with the most common Paris classification being Ip or pedunculated polyp (79.4%).

Majority of the adenomas were found in the 60-69 years old age group (28.2%) followed by the 50-59 years old age group, as shown in Table 5. No adenomas were detected in individuals younger than 40 years old in the study.

Ninety-nine percent (99%) of the cases included in the study had adequate bowel preparation as determined by a Boston Bowel Preparation Score of 6 or more, as shown in Table 6. 79.1% of the total cases had the highest bowel preparation score.

Adenoma Detection Rate

The total computed adenoma detection rate was 22%. There was a statistically significant difference in the ADR between Gastroenterology consultants and fellows-in-training at 31.6% and 18.7% (p=0.017), respectively. When subgroup analysis was done with regard to sex of endoscopists, no statistically significant difference was found (23.3% for males; 14.9% for females, p value=0.199), as shown in Table 7.

Polyp Detection Rate

The total polyp detection rate was 57.6%. There was no statistically significant difference between PDR of consultants at 63.3% and fellows-in-training at 55.6% (p value=0.231), as shown in Table 7.

Estimated ADR from PDR

Individual Adenoma to Polyp Detection Rate Quotients (APDRQ) were calculated for each endoscopist by dividing

Table 2. Patient Characteristics

Characteristics	All patients (N=304)
Age, in years	58.84 ± 9.50
≥70	39 (12.8%)
60-69	103 (33.9%)
50-59	108 (35.5%)
40-49	43 (14.1%)
30-39	7 (2.3%)
<30	1 (0.33%)
Total time of colonoscopy, in minutes	39.5 ± 17.31
Sex	
Female	184 (59.7%)
Male	124 (40.3%)
ASA status	
I	150 (49.3%)
II	157 (51.6%)
III	2 (0.66%)
Family medical history of adenoma	
None	179 (58.9%)
Yes	1 (0.33%)
Not mentioned	124 (40.8%)
Family medical history of colon cancer	
None	165 (54.3%)
Yes	17 (5.5%)
Not mentioned	122 (40.1%)
Diabetes mellitus	
None	169 (55.6%)
Yes	43 (14.1%)
Not mentioned	92 (30.3%)
Hypertension	
None	89 (29.3%)
Yes	123 (40.5%)
Not mentioned	92 (32.2%)
Coronary artery disease	
None	191 (62.8%)
Yes	19 (6.25%)
Not mentioned	94 (30.9%)
Tobacco use	
No/Never	151 (49.7%)
Yes	40 (13.2%)
Not mentioned	113 (62.8%)
Alcohol use	
No/Never	146 (48%)
Yes	46 (0.15%)
Not mentioned	112 (36.8%)
ASA use	
No	194 (63.8%)
Yes	18 (5.9%)
Not mentioned	92 (30.3%)
NSAID use	
No	198 (65.1%)
Yes	12 (3.95%)
Not mentioned	94 (30.9%)
Folate use	
No	202 (66.4%)
Yes	6 (1.97%)
Not mentioned	96 (31.6%)
Calcium/Vitamin D use	
No	186 (61%)
Yes	22 (7.2%)
Not mentioned	96 (31.6%)

ADR by PDR. The weighted group average APDRQ was 40.85% as shown in Table 1 in the Appendix. This value was then used as a constant multiplier for each endoscopists' PDR to derive the estimated ADR, as shown in Table 8. Also shown in the rightmost column are the actual ADRs for comparison.

Pearson's correlation coefficient was then used to assess the relationship between the estimated and the actual ADR.

Table 3. Procedural Characteristics

Characteristics	n (%)
Bowel preparation	
Surelax (PEG)	284 (93.4%)
Castor Oil	13 (4.28%)
Picoprep	7 (2.30%)
Boston Score (average)	8 ± 0.83
Boston Score Rank	
Inadequate sum <6.0 or anyone ≤1.0	10 (3.3%)
Adequate Sum ≥6.0 and everyone >1.0	291 (95.7%)
Completeness	304 (99%)
Extent of the procedure	
Cecum	7 (2.30%)
Hepatic Flexure	1 (0.33%)
Terminal ileum	296 (97.4%)
Complications	None

Table 4. Characteristics of Polyps

Characteristics	n (%)
Number of polyps	180
1	82 (45.6%)
2-3	41 (22.8%)
4-6	9 (5%)
>6	33 (18.3%)
Pathological classification	
Adenoma	67 (37.2%)
Hyperplastic	36 (20%)
Hyperplastic/No biopsy done	24 (13.3%)
Location	
Rectum	55 (30.6%)
Sigmoid	64 (35.6%)
Descending	49 (27.2%)
Transverse	43 (23.9%)
Ascending	50 (27.8%)
Cecum	26 (14.4%)
Size	
<1 mm	12 (6.7%)
1-10 mm	149 (82.8%)
>1 cm	4 (2.22%)
Paris classification	
Is	2 (1.11%)
Ip	143 (79.4%)
Isp	10 (5.56%)
IIa	1 (0.55%)
IIb	0
IIc	0

No significant correlation was shown between the estimated and the actual ADR with a wide interval estimate (r=0.442; 95% CI, -0.016-0.746, p=0.0581). Excluding the outlier sample with an ADR of 0 improved the correlation marginally and was statistically significant (r=0.521; 95% CI 0.072-0.795, p=0.0266). Figures 3a and 3b illustrate the comparison between the estimated and actual ADR when an outlier was included and excluded, respectively.

Factors Affecting Adenoma and Polyp Detection Rate

Patient Characteristics

Patient characteristics were compared between patients with and without adenoma. As shown in Table 9, there was no statistically significant difference between the two groups with regard to age (p=0.235) and sex of the patients (p=0.473).

Only tobacco use was proven to have a significant association with ADR (p=0.014). Other comorbidities, including hypertension (p=0.358), diabetes mellitus (p=0.824), and coronary artery disease (p=0.90) were not significantly associated with ADR. Familial history of adenoma (p=0.592), and familial history of colon cancer (p=0.186) were similarly not significantly associated with ADR. In addition, alcohol use was not significantly correlated (p=0.190) as well as

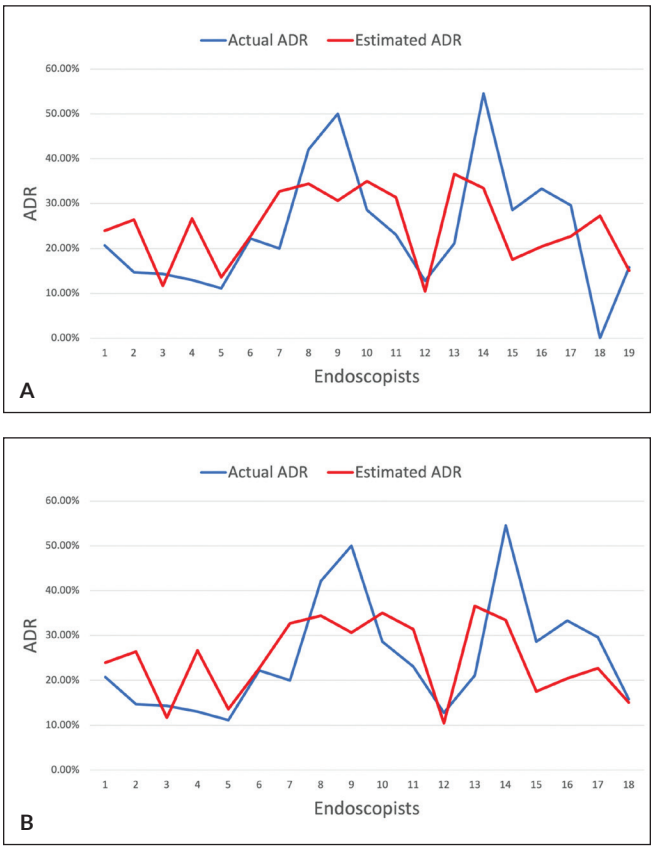

Figure 3. Line charts of estimated versus actual ADR; **(A)** with outlier **(B)** with outlier excluded.

Table 5. Adenoma Prevalence across Ages

Characteristics	All patients (N=304)	Adenoma detected (n)	Adenoma prevalence
Age, in years	58.84 ± 9.50		
≥70	39 (12.8%)	7	17.9%
60-69	103 (33.9%)	29	28.2%
50-59	108 (35.5%)	24	22.2%
40-49	43 (14.1%)	7	16.3%
30-39	7 (2.3%)	0	0%
<30	1 (0.33%)	0	0%

Table 6. Boston Bowel Preparation Score (BBPS)

BBPS	Cases
5	2 (0.68%)
6	12 (4.05%)
7	18 (6.08%)
8	30 (10.1%)
9	234 (79.1%)
Total	296

various medication intake such as aspirin, calcium and vitamin D supplements, folate, and NSAIDs.

Endoscopist Characteristics

The data was analyzed using Kruskal-Wallis statistics as shown in Table 9. The endoscopists' grouped ages in relation to ADR were found to have no significant association with adenoma detection (p=0.140). The endoscopists' experience, defined as years of practice as Gastroenterology consultant, showed significant association in relation to ADR (p=0.020). A subgroup analysis revealed that those with less than five years of experience have significantly less adenoma detection compared to those with 5-10 years of experience (t= -35, p=0.002). The number of colonoscopies performed, which was the basis for distinguishing junior and senior endoscopists, also showed a significant difference in relation to ADR (p=0.031).

Table 7. ADR and PDR

	n/n	%	*P* value
Adenoma Detection Rate (overall)	67/304	22.0	
Adenoma Detection Rate			
Fellows	42/225	18.7	0.017
Consultants	25/79	31.6	
Males	60/257	23.3	0.199
Females	7/47	14.9	
Polyp Detection Rate (overall)	175/304	57.6	
Fellows	125/225	55.6	0.231
Consultants	50/79	63.3	

Table 8. Estimated ADR Using the Conversion Factor of 0.4085

Endoscopist	PDR	APDRQ multiplier	Estimated ADR	Actual ADR
1	58.60	0.4085	23.94	20.70
2	64.70	0.4085	26.43	14.70
3	28.60	0.4085	11.68	14.30
4	65.20	0.4085	26.63	13.00
5	33.30	0.4085	13.60	11.10
6	55.60	0.4085	22.71	22.20
7	80.00	0.4085	32.68	20.00
8	84.20	0.4085	34.40	42.10
9	75.00	0.4085	30.64	50.00
10	85.70	0.4085	35.01	28.60
11	76.90	0.4085	31.41	23.10
12	25.50	0.4085	10.42	12.80
13	89.50	0.4085	36.56	21.10
14	81.80	0.4085	33.42	54.50
15	42.90	0.4085	17.52	28.60
16	50.00	0.4085	20.43	33.30
17	55.60	0.4085	22.71	29.60
18	66.70	0.4085	27.25	0.00
19	36.84	0.4085	15.05	15.79

Bowel Preparation

The Boston Bowel Preparation Scale (BBPS) is a scoring system tool used to objectively assess the adequacy of bowel cleanliness for colonoscopy. It uses a 4-point system for the colon which is divided into three segments: 1) cecum and ascending colon; 2) hepatic and splenic flexure; 3) descending, sigmoid colon, rectum.[18] The point system is scored from 0 to 3 with the following qualifiers: score of 0 pertains to no visualization of the mucosa due to adherent stool; score of 1 if the mucosa of the colon is seen but others are not; score of 2 if the entire mucosa is seen well with only minimal residual staining; score of 3 if the entire colon segment mucosa is visualized with no staining.[18] The higher the score, the more adequate the bowel preparation. In relation to ADR, it had been shown that the distribution of BBPS scores did not significantly affect the ADR (p=0.529). Even on group analysis, aggregating those with adequate Boston Score rank (i.e., BBPS score of 6 and above) and those with inadequate score (BBPS score of below 6), no significant difference between the two groups was found (p=0.931).

DISCUSSION

ADR is one of the major quality measures proposed for monitoring endoscopists' performance.[13] The overall adenoma detection rate among endoscopists at PGH was 22.0%. Different guidelines recommend a target ADR ranging from greater than 20 to 25%.[5] According to Penz et al., an ADR >20% leads to reduction of patients' risk for interval cancer.[5] When a comparison between fellows and consultants was made, the results differed. The collective ADR from fellows-in-training was 18.7%, which was below the recommended target. On the other hand, the collective ADR of consultants was at par at 31.6%. This could possibly be attributed to

Table 9. Factors Relating to Adenoma Detection

	Adenoma Negative	Adenoma Positive	*p*-value
Age (N = 304)	58.22 ± 10.44	60.06 ± 8.25	0.235*
Sex (n =303)			
Female	140	43	0.473
Male	96	24	
FMH of Adenoma (n = 180)			
Absent	139	40	0.592
Present	1	0	
FMH of Colon CA (n = 182)			
Absent	130	35	0.186
Present	11	6	
Diabetes Mellitus (n = 212)			
Absent	135	34	0.824
Present	35	8	
Hypertension (n = 212)			
Absent	74	15	0.358
Present	96	27	
Coronary Artery Disease (n = 210)			
Absent	153	38	0.904
Present	15	4	
Tobacco Use (n = 191)			
Absent	125	26	0.014
Present	26	14	
Alcohol Use (n = 192)			
Absent	118	28	0.190
Present	33	13	
Aspirin Use (n = 212)			
Absent	155	39	0.831
Present	14	4	
NSAID Use (n = 210)			
Absent	160	38	0.234
Present	8	4	
Folate Use (n = 208)			
Absent	161	41	0.827
Present	5	1	
Calcium / Vitamin D Use (n = 208)			
Absent	149	37	0.754
Present	17	5	
Endoscopist Age (n = 297)			
<40	192	50	0.140**
40 - 49	17	10	
50 - 59	8	4	
60 - 69	14	2	
Endoscopist Years of Experience (n = 297)			
<5	181	42	0.020**
5 - 10	19	14	
11 - 15	9	4	
16 - 20	22	6	
Experience based on number of colonoscopies performed (n = 297)			
Junior Endoscopist (<3,000 colonoscopies)	203	51	0.031
Senior (≥3,000 colonoscopies)	28	15	
Classification of Patient (n = 304)			
Charity	174	48	0.772
Pay	63	19	
Boston Bowel Preparation Score (n = 296)	8.64 ± 0.82	8.63 ± 0.84	0.529*
Boston Score Rank			
Sum <6.0 or anyone ≤1.0	8	2	0.931
Sum ≥6.0 and everyone >1.0	223	63	

**Mann-Whitney U test **Kruskal-Wallis H test*

years of experience by the latter in contrast to that of the former. Subgroup analysis by endoscopist sex showed no significant differences, with men at 23.3% and women at 14.9%. The overall PDR in this study was 57.6%. The PDR of fellows at 55.6% and consultants at 63.3% were within the standard target of 40% for PDR regardless of indication of colonoscopy.[12]

In this study, the estimated ADR from Polyp Detection Rate was noted to have a statistically significant moderate correlation when an outlier was excluded. There was one endoscopist who performed three colonoscopies for the given time period of the study but with no adenomas detected. This translated to an ADR of 0 which significantly skewed the distribution. The computed APDRQ in this study was 0.4085, which is different from the computed quotient from other studies. Zorron et al. determined a quotient of 0.68, while Francis et al. computed a quotient of 0.64.[13,10] Possible reasons for this discrepancy included the large number of colonoscopies with approximately 2,657 and 3,367 colonoscopies done in the study of Zorron and Francis, respectively.[10,13] A meta-analysis done by Niv et al. yielded a conversion factor of 0.68 (95% CI: 0.680-0.695, p <0.0001) from a pool of 25 studies and 42 data sets, performed in 31,623 patients in nine different populations.[11] However, Niv et al. mentioned that the limitation of their study was the assumption that the ratio between ADR and PDR will be similar for every indication; when in fact, the prevalence of different kinds of polyps may vary in different age groups, sexes, and in different parts of the world.[11] This could be one of the reasons why the computed conversion factor in this study was lower since the sample set was limited to screening as indication for colonoscopy. Estimated ADR derived from PDR may be used as surrogate measure for ADR especially in hospitals with resource or logistical constraints.[10]

Multiple factors influence the adenoma and detection rates both with respect to patient type, procedural aspects, and endoscopist factors. The results of the present study are in congruence with former studies depicting the association of length of practice with ADR. In the study of Huang et al., senior endoscopists, defined as those who performed a minimum of 3,000 colonoscopies, showed significantly greater ADRs as opposed to those of junior endoscopists (i.e., less than 3,000 procedures) (p=0.031).[16] This correlation of colonoscopy experience with greater ADR has been well-replicated and other studies have also shown that more advanced, smaller adenomas are more detected among senior endoscopists,[16] which further highlights the importance of experience enhancing skill. The number of years of being a Gastroenterology consultant were aggregated to five-year intervals as seen on Table 1. In contrast to findings of Jover et al. (2015) which showed that age of endoscopists have a significant effect on adenoma detection (OR 1.11; p=0.01 95% CI 1.01-1.21)[19], age was not a significant factor in this study. There seems to be an immediate assumption that age is directly related to experience; however, in this present study, it showed that the age of endoscopists does not always uniformly translate to more performed colonoscopies.

Among the different patient factors postulated to affect adenoma development, only tobacco use was noted to be significantly associated with adenoma (OR=0.951, p =0.016; 95%CI 1.1-5.6) in this study. All other patient risk factors were not shown to have significant association with adenoma detection as shown in Table 9. This is in contrast to a study by Wang et al., wherein the occurrence of adenoma was associated with age, gender, BMI, family history of colon cancer, diabetes, and tobacco use.[6] These could be attributed to a significant number of the electronic medical records reviewed which had no mention of the pertinent patient risk factors as seen in Table 2. Majority of the adenoma detected are in the ages >50 years old, with a prevalence of 68.3% (50-59: 22.2%; 60-69:28.2%; and ≥ 70: 17.9%), compared to those <50 years old, with a prevalence of 16.3%. This supports the current recommendation in the local setting of colorectal screening at age 50.[7]

BBPS and ADR were shown to have an insignificant correlation. While adequacy of bowel preparation is intuitively linked to higher ADR due to better visualization, some studies in fact have discovered a rather counterintuitive finding regarding BPSS and polyp detection. A study by Calderwood et al.[20] showed that a BBPS of 9 is correlated to a lower rate of polyp detection compared to lower BBPS scores of 6, 7, 8. It is postulated that mucus cap or debris can potentially highlight visualization of polyps thus increasing PDR despite a low BBPS. Another plausible explanation is the preoccupation with bowel cleaning might lead to a missed detection of a polyp resulting in a high BBPS but low PDR.

Limitations

Colonoscopy records from January to February 2021 were not retrieved due to accessibility issues. Procedural aspects related to adenoma detection, such as cecal intubation time and withdrawal time, were also lacking, and therefore, were omitted in the statistical analysis. Several patient information such as comorbidities, medication intake, and familial history were not available. The study population was also limited to a single center, specifically a tertiary public university hospital with the majority of patients belonging to a lower socio-economic class with difficulty gaining access to healthcare. Thus, the results of the study may have limited generalizability to the broader Filipino patient population.

CONCLUSION

The total computed adenoma detection rate among consultants and fellows at the PGH Division of Gastroenterology is 22% which is within the recommended ADR target. Subgroup analysis showed a statistical difference in ADR between consultants and fellows. Estimated ADR computed from the PDR showed a moderate degree of

correlation when an outlier is excluded. Longer years in practice, total number of colonoscopies done, and patient tobacco use are correlated with ADR.

Recommendations

A prospective study is recommended for future research endeavors. Active collection of relevant information from endoscopists, patients, and procedures can ensure data accuracy. Future research could investigate the size and histopathology of adenomas concerning endoscopy experience, examine the type of bowel preparation's relation to adenoma detection, and conduct cross-sectional analyses among different training institutions to determine quality and institutional factors affecting colonoscopies in diverse settings. Determination of ADRPQ for the Filipino population is also likewise recommended so PDR can be used to estimate ADR which can prove to be useful in resource-limited settings.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

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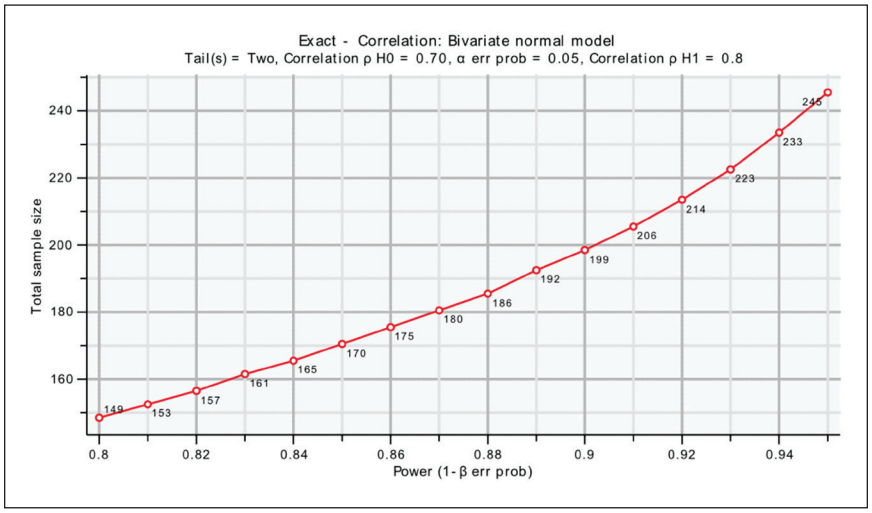
APPENDICES

Appendix Table 1. Computation of Adenoma to Polyp Detection Rate Quotient

Endoscopist	ADR (%)		PDR (%)		APDRQ (%) (=ADR/PDR)
1	6/29	20.70	17/29	58.60	35.32
2	5/34	14.70	22/34	64.70	22.72
3	1/7	14.30	2/7	28.60	50.00
4	3/23	13.00	15/23	65.20	19.94
5	1/9	11.10	3/9	33.30	33.33
6	2/9	22.20	5/9	55.60	39.93
7	1/5	20.00	4/5	80.00	25.00
8	8/19	42.10	16/19	84.20	50.00
9	2/4	50.00	3/4	75.00	66.67
10	2/7	28.60	6/7	85.70	33.37
11	3/13	23.10	10/13	76.90	30.04
12	6/47	12.80	12/47	25.50	50.20
13	4/19	21.10	17/19	89.50	23.58
14	6/11	54.50	9/11	81.80	66.63
15	2/7	28.60	3/7	42.90	66.67
16	4/12	33.30	6/12	50.00	66.60
17	8/27	29.60	15/27	55.60	53.24
18	0/3	0.00	2/3	66.70	0.00
19	3/19	15.79	7/19	36.84	42.86
				Mean APDRQ	**40.85**



Appendix Figure 1. Exact-Correlation: Bivariate normal model.