Quality indicators for colonoscopy in Peruvian national hospitals: a multicenter cross-sectional study

Indicadores de calidad de colonoscopía en hospitales nacionales peruanos: un estudio transversal multicéntrico

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ABSTRACT

Objectives: To evaluate colonoscopy quality indicators in Peruvian national public hospitals and to estimate the polyp detection rate (PDR) corresponding to adenoma detection rate (ADR) benchmarks of 25% and 35%. **Materials and methods:** A multicenter retrospective study was conducted using colonoscopy reports from July 2023 to June 2024. Rates of adequate bowel preparation and cecal intubation, as well as withdrawal time, polypectomy technique, PDR, and ADR were evaluated. **Results:** A total of 3,758 colonoscopies performed by 63 endoscopists were analyzed. The rate of adequate bowel preparation was 91.1%, and the cecal intubation rate was 95.6%. The withdrawal time was not reported in 75% of procedures without polyp detection. Only 30.2% of polyps measuring 4–9 mm were removed using cold snare polypectomy. The overall PDR was 41.3%, and the overall ADR was 22.8%. The adenoma-to-polyp detection rate quotient was 0.56; a PDR of 62.5% corresponded to an ADR of 35%, and a PDR of 44.7% to an ADR of 25%. **Conclusions:** Colonoscopy quality in Peruvian national public hospitals showed adequate rates of bowel preparation and cecal intubation but suboptimal ADR values and deficient documentation practices, underscoring the need to implement targeted strategies to improve colonoscopy quality.

Keywords: *Colonoscopy; Colonic Polyps; Adenoma; Quality of Health Care; Colonic Neoplasms (source: MeSH NLM).*

RESUMEN

Objetivos: Evaluar los indicadores de calidad de colonoscopia en hospitales nacionales públicos del Perú y estimar la tasa de detección de pólipos (TDP) correspondiente a valores de tasa de detección de adenomas (TDA) de 25% y 35%. **Materiales y métodos:** Se realizó un estudio multicéntrico retrospectivo, utilizando los informes de colonoscopías realizadas entre julio de 2023 y junio de 2024. Se calcularon la tasa de preparación intestinal adecuada, tasa de intubación cecal, tiempo de retirada, técnica de polipectomía, TDA y TDP. Se empleó el cociente de tasa de detección adenoma/pólipo (APDRQ) para estimar la TDP correspondiente a los valores de referencia de TDA. **Resultados:** Se analizaron 3 758 colonoscopías realizadas por 63 endoscopistas. La tasa de preparación intestinal adecuada fue de 91,1% y la de intubación cecal fue de 95,6%. El tiempo de retirada no se registró en el 75% de los procedimientos sin detección de pólipos. Solo el 30,2% de los pólipos de 4–9 mm fueron resecados mediante polipectomía con asa fría. La TDP global fue de 41,3% y la TDA global de 22,8%. El cociente de tasa de detección adenoma/pólipo fue de 0,56; con una TDP de 62,5% correspondiente a una TDA de 35%, y una TDP de 44,7% a una TDA de 25%. **Conclusiones:** La calidad de la colonoscopía en hospitales nacionales públicos del Perú mostró tasas adecuadas de preparación intestinal e intubación cecal, pero valores subóptimos de TDA y deficiencias en el registro de información, lo que resalta la necesidad de implementar estrategias dirigidas a mejorar la calidad de la colonoscopía.

Palabras clave: *Colonoscopía; Pólipos del Colon; Adenoma; Calidad de la Atención de Salud; Neoplasias del Colon (fuente: DeCS Bireme).*

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INTRODUCTION

Colorectal cancer (CRC) is the third most common type of cancer and the second leading cause of cancer-related death worldwide, with approximately 1.93 million new cases and 904,000 estimated deaths in 2022 [1]. In Peru, CRC ranks as the fourth most frequent cancer in both men and women and is one of the leading causes of cancer mortality in the country [2].

Given its high incidence, mortality, and the substantial cost associated with treatment, CRC represents a major public health challenge. In response, various early detection strategies have been implemented, with colonoscopy as the primary screening modality for individuals aged ≥45 years, because it enables not only detection but also resection of precursor lesions [3,4].

Several scientific societies have proposed multiple indicators to assess colonoscopy quality [5–7]. The most relevant include the adenoma detection rate (ADR), adequate bowel preparation rate, cecal intubation rate, appropriate polypectomy technique, and withdrawal time. These indicators are directly associated with clinically relevant outcomes, such as the risk of interval CRC [8–12]; therefore, routine evaluation of colonoscopy quality is a priority, particularly in regions with high CRC-related morbidity and mortality, such as Peru.

There is limited evidence assessing colonoscopy quality in the Peruvian population [13–15], and no prior studies have been conducted in national public hospitals, institutions that provide care to the majority of country's population. Evaluating colonoscopy quality indicators in this setting is essential to identify gaps in endoscopic performance, support quality improvement initiatives, and provide evidence that contributes to improving quality assurance policies and colorectal cancer prevention strategies within the public health system. For this reason, the primary objective of the present study was to evaluate colonoscopy quality indicators in national referral public hospitals in Peru. As a secondary objective, the study estimated the polyp detection rate (PDR) corresponding to adenoma detection rate (ADR) benchmarks of 25% and 35%.

MATERIALS AND METHODS

Study design and setting

A multicenter, retrospective cross-sectional study was conducted in four national referral public hospitals under the Peruvian Ministry of Health: *Hospital Nacional Hipólito Unanue*, *Hospital Nacional Dos de Mayo*, *Hospital María Auxiliadora,* and *Hospital Nacional Arzobispo Loayza*. All hospitals are located in Lima and primarily serve low-income populations. Each institution has a specialized gastroenterology service and a digestive endoscopy unit.

Detailed information on the endoscopic equipment used at each participating hospital during the study period is provided in the Supplementary Material (Table S1). The use of virtual chromoendoscopy technologies (including narrow-band imaging [NBI], i-scan, FICE, or similar modalities) and artificial intelligence-assisted systems was not routinely used in the participating centers during the study period.

Participants

The study population included all adult patients who underwent colonoscopy at the participating hospitals between July 2023 and June 2024. Eligible participants were those aged ≥18 years who underwent colonoscopy with indication of cecal intubation.

Exclusion criteria were: pregnancy; history of hereditary CRC syndromes (e.g., familial adenomatous polyposis), inflammatory bowel disease, or surgically altered colonic anatomy; colonoscopies performed for therapeutic or emergency purposes; and procedures in which cecal intubation was not achieved due to obstructive or structural lesions (e.g., stenosis or proliferative masses).

Variables

Data were collected from colonoscopy reports (physical or digital) at each institution. The following variables were recorded: patient age and sex, type of sedation, bowel preparation quality, cecal intubation, withdrawal time, detection of polyps and adenomas, and the sex and experience of the endoscopist.

Patient sedation was performed in accordance with the institutional protocols at each participating center. Procedures in which the administration of sedation involved an anesthesiologist, as documented in the procedural report, were classified as "administered by anesthesiologist".

Bowel preparation was classified as *adequate* if the Boston Bowel Preparation Scale (BBPS) score was ≥6 (≥2 in each segment) or if described as excellent, good, or adequate [6,16]; otherwise, it was classified as *inadequate*. Cecal intubation was defined as advancement of the colonoscope tip beyond the ileocecal valve and into the cecal dome, with identification of the appendiceal orifice and visualization of the medial cecal wall [17]. Withdrawal time was recorded in minutes, measured from cecal arrival to exit through the anal sphincter, and was reported exclusively for colonoscopies without polyp detection, thereby excluding procedures involving biopsy or polypectomy [7].

For each detected polyp, size, location, and resection technique were recorded. Location was categorized as *proximal colon* (cecum, ascending, and transverse colon) or *distal colon* (descending, sigmoid, and rectum). Adenoma detection was confirmed through histopathological reports from the pathology departments of each participating hospital.

Finally, endoscopist experience was determined by the number of years elapsed since completion of their gastroenterology training up to 2024.

Statistical analysis

Continuous variables were summarized using mean and standard deviation (SD), or median values and interquartile range (IQR), depending on their distribution. Categorical variables were described as absolute frequencies and percentages. For variables with ≥50% missing data, descriptive analyses were limited to reporting the proportion of available observations.

The ADR was calculated as the percentage of colonoscopies performed in patients aged ≥45 years in which at least one histologically confirmed adenoma was identified. Incomplete colonoscopies (without cecal intubation) and procedures performed by endoscopists with <30 colonoscopies during the study period were excluded, in accordance with methodologies adopted in previous studies [14,18]. The PDR was calculated analogously, considering colonoscopies in which at least one polyp was detected, irrespective of histopathological confirmation, location, or size. Both ADR and PDR were reported globally and stratified by patient sex.

The ADR and PDR for each endoscopist were calculated, and the proportion achieving ADR benchmarks of ≥25% and ≥35% was also reported. An exploratory analysis was conducted to assess whether ADR differed according to the sex of the endoscopist using the independent samples *t*-test, or *Mann–Whitney U*-test when normality assumptions were not met. The correlation between endoscopist experience and ADR was evaluated using Spearman's rank correlation coefficient. Additionally, as a sensitivity analysis, an exploratory multivariable analysis was performed using a generalized linear model with Poisson distribution, log link function, and robust variance with clustering at the endoscopist level, to estimate adjusted prevalence ratios (PRs) for adenoma detection according to endoscopist sex and experience, adjusted for patient age and sex.

The Adenoma-to-Polyp Detection Rate Quotient (APDRQ) was used as a conversion factor between ADR and PDR. First, the ADR/PDR ratio was calculated for each endoscopist; the mean of these ratios represented the group APDRQ. The estimated ADR for each endoscopist was then obtained by multiplying their PDR by the mean APDRQ. The correlation between actual and estimated ADRs was assessed using Pearson's correlation coefficient, and agreement between both values was evaluated using a Bland–Altman plot. The PDR corresponding to ADR benchmarks of 25% and 35% was estimated by dividing the target ADR by the mean APDRQ.

A *p*-value <0.05 was considered statistically significant. All analyses were performed using Stata version 18 (StataCorp, College Station, TX, USA).

Ethical considerations

The study was approved by the Department of Gastroenterology of each participating hospital. This study adhered to the principles of the Declaration of Helsinki. The requirement for informed consent was waived due to the retrospective design of the study. No personal identifiers were collected, and all patient data were anonymized prior to analysis to ensure confidentiality.

RESULTS

A total of 3,758 endoscopic procedures met the selection criteria. The mean age of patients was 58 years (SD: 12), and 65.6% were female. The most frequently used sedation regimen was benzodiazepine, either alone or in combination with another sedative (Table 1).

Polyp characteristics

At least one polyp was detected in 37.8% of procedures, and at least one adenoma in 19.9%. Both polyps and adenomas were more frequently found in the proximal colon than in the distal colon, with higher adenoma-to-polyp ratio in the proximal colon (0.52 vs. 0.42) (Table 2).

Table 1. Type of sedation used in colonoscopies performed at Peruvian national hospitals.

Type of sedation[a]	n (%)
Benzodiazepine + propofol	1578 (42)
Benzodiazepine alone	876 (23.3)
Benzodiazepine + pethidine	821 (21.9)
Administered by anesthesiologist	154 (4.1)
No sedation	99 (2.6)
Others[b]	70 (1.9)

[a] Data do not sum to the total because of missing values (type of sedation was not recorded in 4.3% of reports).
[b] Includes pethidine alone, propofol alone, and benzodiazepine + pethidine + propofol.

Table 2. Number of polyps and adenomas by colonic segment.

Colonic segment	Polyps	Adenomas	A/P ratio
Proximal colon	1216	637	0.52
Cecum	255	118	0.46
Ascending colon	503	268	0.53
Transverse colon	458	251	0.55
Distal colon	1130	469	0.42
Descending colon	313	147	0.47
Sigmoid colon	499	217	0.43
Rectum	318	105	0.33

A/P: adenoma/polyp

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Table 3. Polyp size and resection method.

Size (mm)	Biopsy forceps	Cold snare	Hot snare	Not resected
< 4	451 (93.4)	10 (2.1)	0	22 (4.6)
4 - 9	945 (63.1)	452 (30.2)	21 (1.4)	80 (5.3)
> 9	10 (3.2)	34 (10.8)	87 (27.5)	185 (58.5)

Data are presented as number (%).
[a] Data correspond to 98% of identified polyps due to missing information on size and resection technique.

Polyps measuring 4–9 mm were the most common (65.2%), followed by those <4 mm (21%) and those >9 mm (13.8%). Regarding the resection technique, biopsy forceps were the most frequently used for both polyps <4 mm and those 4-9 mm in size; and, in the latter group, only 30.2% were resected using cold snare polypectomy (Table 3).

Colonoscopy quality indicators

The adequate bowel preparation rate was 91.1% (not reported in 19.2% of procedures). Cecal intubation was achieved in 95.6% of procedures; however, only 21.5% of these included photodocumentation of cecum. The withdrawal time was not reported in 75% of colonoscopies without polyp detection.

The overall PDR was 41.3%, with values of 46.2% in male and 38.8% in female patients. The overall ADR was 22.8%, with 26.4% in male and 21% in female patients. Colonoscopy quality indicators for each participating hospital are presented in the Supplementary Material (Table S2).

Endoscopist performance

A total of 63 endoscopists participated, of whom 60% (n = 38) were male. The median experience was 7 years (IQR: 4–15). Among them, 81% (n=51) performed more than 30 procedures, with 43% (n=22) achieving an ADR ≥25% and only 6% (n=3) reaching an ADR ≥35%.

No significant differences in ADR were observed between female and male endoscopists (23.6% vs. 22.3%; mean difference = 1.35%; 95% CI: –3.25 to 5.95; p=0.56). Likewise, there was no significant correlation between endoscopist experience and ADR (Spearman's rho = –0.09; p=0.51). In the exploratory multivariable analysis, increasing patient age (adjusted PR per year: 1.03; 95% CI: 1.02–1.03) and male patient sex (adjusted PR: 1.20; 95% CI: 1.06–1.37) were independently associated with adenoma detection. In contrast, endoscopist sex (adjusted PR: 0.87; 95% CI: 0.70–1.10) and endoscopist experience (adjusted PR per year: 1.00; 95% CI: 0.99-1.02) were not significantly associated with adenoma detection.

APDRQ and estimated PDR

The mean group APDRQ was 0.56, used as a conversion factor to estimate each endoscopist's ADR. The estimated ADR showed a strong correlation with the actual ADR (Pearson correlation coefficient = 0.84; p<0.001) (Figure 1). Consistently, in the Bland–Altman analysis, the mean difference between both measurements was –0.13, with 95% limits of agreement ranging from –8.78 to 8.53; only three endoscopists fell outside these limits (Figure 2).

Finally, using the mean group APDRQ, the estimated PDR corresponded to an ADR of 35% was 62.5%, and for an ADR of 25%, the estimated PDR was 44.7%.

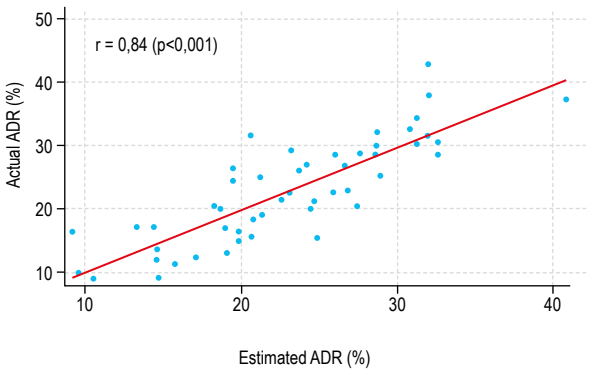

Figure 1. Scatter plot showing the correlation between the actual ADR and the estimated ADR.
ADR: adenoma detection rate.

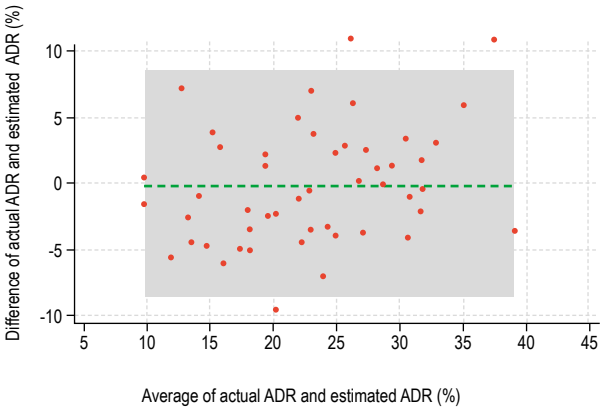

Figure 2. Bland-Altman plot illustrating the agreement between the actual and estimated ADR.
ADR: adenoma detection rate.

DISCUSSION

Our study showed that Peruvian national public hospitals achieved adequate rates of bowel preparation and cecal intubation, consistent with international recommendations [5-7]. However, the ADR was suboptimal, and the polypectomy technique was inadequate in the majority of cases.

The observed ADR (22.8%) was below the minimum benchmarks recommended by international societies, which suggest ADRs of at least 25% and ideally ≥35% [5-7]. This finding contrasts with reports from other regions. A recent meta-analysis including 31 observational studies from different countries reported a pooled ADR of 26.5%, ranging from 10% to 46% [19]. In Latin America, reported ADRs vary from 20-46.8% in Brazil [20,21], 41.8% in Chile [22] and 41% in Argentina [23]. Similarly, studies conducted in private Peruvian hospitals have reported higher ADRs (24.4%–29.7%) [13–15]. The variability in ADRs across centers may be partially explained by differences in patient sex and age distribution, as male sex and older age are associated with a higher likelihood of adenoma detection, a pattern also observed in our study [19]. Moreover, the more frequent use of high-definition colonoscopes, chromoendoscopy, or artificial intelligence–assisted system in private institutions may also contribute to higher ADRs [24], although this information is inconsistently reported across studies.

Other factors have been linked to increased ADRs [5,6,17,19,25]; however, those related to endoscopist characteristics remain unclear. Variables such as the endoscopist's age and sex have shown inconsistent associations with ADR, and both procedure volume and years of experience have yielded heterogeneous findings [26,27]. In our study, neither endoscopist experience nor sex was significantly associated with ADR in bivariate analysis or with adenoma detection in multivariable analysis. These findings suggest that, in the Peruvian context, other factors (such as withdrawal time, second inspection of the proximal colon, or the use of endocuff devices) may play a more influential role in ADR [5,19,25,28,29]. Nevertheless, as our analysis was exploratory, further studies with broader evaluation of endoscopist-related characteristics are warranted to clarify this issue.

Regarding polyp resection, we found that most polyps ≥4 mm (63%) were removed using biopsy forceps, a considerably higher proportion than that reported in other regions, which ranges from 14% to 46% [30-33]. This practice is associated with an increased risk of incomplete resection and residual neoplasia compared with cold snare polypectomy [34-36], hereby contributing to a higher risk of interval CRC [10,12]. For this reason, biopsy forceps should be reserved for polyps smaller than 4 mm. The persistence of this practice in Peruvian public hospitals warrants further investigation.

Routine determination of ADR is often challenging due to the need for both endoscopic and histological data. An alternative approach is to estimate ADR from PDR using the APDRQ. In our study, the APDRQ was 0.56, lower than values reported in other regions (0.64–0.72) [18,37-39], indicating that, in the Peruvian context, a higher PDR is required to achieve an ADR of 25%.

Although cecal intubation rates were high, the low rate of cecal photodocumentation observed in our study likely reflects inconsistencies in documentation practices, which limits objective verification of complete colonoscopy and may affect subsequent evaluation or management of lesions requiring a second intervention, such as planned polypectomy.

Our findings highlight the need to implement quality improvement policies for colonoscopy in Peruvian public hospitals. These include promoting appropriate resection techniques, systematically recording withdrawal times, ensuring photographic documentation of the cecum, and guaranteeing the availability of high-definition equipment. Continuous training and feedback for endoscopists have also been shown to improve ADR [22,40], a strategy that would likely have a favorable impact in Peruvian hospitals. We also recommend the systematic calculation of ADR (both per endoscopist and overall) and limiting the use of the APDRQ derived in our study only when histologic data are persistently unavailable.

Our study has certain limitations. First, the convenience sampling of hospitals and their shared geographic location limit the generalizability of the findings to the entire country, where equipment and resource availability vary widely. Nevertheless, these hospitals are major national referral centers, which could suggest that other public institutions may have comparable or even lower quality indicator values. Second, the lack of standardized recording of colonoscopy indications prevented analysis of ADR by indication. Additionally, incomplete documentation (such as missing data on bowel preparation or withdrawal time) may have affected the precision of some estimates.

As strengths, this is the first multicenter study conducted in national public referral hospitals in Peru, with a substantial number of colonoscopies analyzed. Moreover, ADR calculation included only endoscopists who performed ≥30 procedures during the study period, providing more robust estimates. We also explored the association between endoscopist characteristics (sex and experience) and ADR, a scarcely studied aspect in our context. Finally, the use of APDRQ as a conversion factor is supported by previous literature [18,37], lending methodological consistency to our findings.

In conclusion, Peruvian national hospitals achieved adequate rates of bowel preparation and cecal intubation, but the ADR remained suboptimal. The high frequency of polyp removal using biopsy forceps and the limited documentation of withdrawal time and cecal photographs reveal opportunities for improvement in endoscopic practice. These findings underscore the need to implement strategies aimed at optimizing colonoscopy quality in national public hospitals.

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