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Predictors of Prolonged Hospital Stay After Colorectal Surgery: A Five-Year Retrospective Chart Review in Addis Ababa, Ethiopia

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ABSTRACT

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Declaration:

Authors' Contributions:

N.S.: Conceptualization, methodology, formal analysis, investigation, resources, original draft, visualization, funding acquisition. J.S.: Formal analysis, investigation, resources, data curation. M.D.: Conceptualization, methodology, validation, review and editing, supervision, project administration. All authors approved the manuscript.

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Background: Prolonged hospital stay after colorectal surgery is an important issue from a clinical and health-system perspective, as this may increase consumption of health resources and may represent postoperative complications and delayed recovery. But evidence for factors of prolonged hospitalization in colorectal patients in Ethiopia is lacking.

Method: A quantitative institution-based retrospective chart review study was performed on adult patients who underwent colorectal surgery at MCM Comprehensive Specialized Hospital from 1st of January 2021 to 31st of December 2025. Data was collected from the medical records and analyzed using computer statistical package for social science (SPSS) version 27. The cutoff point of prolonged hospitalization was defined as equal or greater than the 75th percentile of the study population. Bivariable and multivariable binary logistic regression was used to test association.

Results: Among 115 patients, 31 (27.0%) had prolonged hospital stay, defined as ≥ 12 days. Absence of preoperative bowel preparation (aOR=4.58; 95% CI: 1.32–15.87) and minor postoperative complications (aOR=19.04; 95% CI: 3.02–119.66) were independently associated with prolonged stay.

Conclusion: Prolonged hospital stay occurred in more than one-fourth of patients. Absence of bowel preparation and postoperative complications were significant predictors, highlighting the importance of standardized perioperative care.

Keywords: Colorectal surgery; Prolonged hospital stays; Length of stay; Postoperative complications; Bowel preparation

INTRODUCTION

Colorectal surgeries are essential procedures conducted to address diverse colorectal ailments. Some of the common colorectal ailments that necessitate surgery include colorectal cancer (1.93 million new cases in 2020), inflammatory bowel disease (4.9 million cases in 2019), intestinal atony, Crohn's disease, and many others (1). Duration of hospital stay is frequently used as a surrogate endpoint indicating the success of excisional colorectal surgery (2).

Colorectal procedures are widely recognized as carrying increased risk of postoperative complications and prolonged LOS in comparison to general surgery (3). Major elective colorectal surgery is also associated with a morbidity rate of 15–20% that can lead to extended admission (4). The identification of risk factors associated with hospital length of stay may play an important role in understanding how to reduce resource consumption and enhance quality of care. Previous studies have shown that prolonged hospital stay is associated with patient demographic and clinical characteristics, provider characteristics, intraoperative factors, and postoperative complications (5). Some of the identified factors include age, American Society of Anesthesiologists (ASA) score, extensive operating time, presence of a stoma, open surgery, and postoperative complications (6).

Colorectal surgery in Ethiopia highlights a rising burden of lower gastrointestinal diseases, prominent late-stage colorectal cancer presentations, and significant postoperative complication rates primarily managed via open surgeries in major referral centers (7). Factors associated with prolonged hospital stay can be broadly grouped into patient-, disease-, perioperative-, and postoperative-related factors. These include patient characteristics such as underweight status and preoperative anemia, disease-related factors such as advanced malignancy and complicated colorectal conditions, perioperative factors including referral status and prolonged operative duration, and postoperative complications such as hospital-acquired pneumonia that may delay recovery and discharge. An institution-based cross-sectional study done in Ethiopia showed a prevalence of prolonged hospital stay of 26.5%. Patients referred from another public health facility, hospital-acquired pneumonia, duration of surgery >110 minutes, being underweight, and preoperative anemia were factors associated with prolonged hospital stays in the study (8). Prolonged hospital stay is associated with increased mortality, hospital-acquired infection, and unnecessary utilization of hospital beds and other resources. Predicting length of hospital stay facilitates resource planning and initiates quality improvement activities(9).

However, to the best of our knowledge, evidence from Ethiopia examining predictors of prolonged hospital stay specifically among patients undergoing colorectal surgery remains limited, as existing Ethiopian studies on length of hospital stay have largely included heterogeneous populations of surgical patients. This limits the ability to identify colorectal-specific factors that contribute to prolonged hospitalization. This study aims to analyze the factors associated with prolonged hospital stay after colorectal surgeries in Addis Ababa, Ethiopia, over a period of 5 years. Besides filling the gap in the current literature, the results will act as evidence for clinical decision-making and support changes in surgical outcomes.

METHODS

A quantitative, institution-based analytic retrospective chart review was conducted among patients who underwent colorectal surgery at MCM Comprehensive Specialized Hospital from January 1, 2021, to December 31, 2025. The data collection period was August 17 - August 30, 2026.

Total population sampling was used, including all eligible patients who met the inclusion criteria during the specified study period, due to the small size of the target population. Initially, 130 patients were identified; however, 15 patients were excluded due to >80% missing data. A total of 115 patients who met the inclusion criteria during the specified study period were included in the final analysis. Trained data collectors and investigators collected data from patients' medical charts, including personal information, clinical notes and diagnoses, laboratory results, and imaging reports, from January 1, 2021– December 31, 2025. The procedure was undertaken using a data extraction checklist adapted from various research studies (4, 10, 11) modified accordingly. Completed checklists were submitted daily to the

principal investigator for completeness checks. The research secured ethical clearance from the local Institutional Review Board (IRB), with protocol Number PRO-120926.

Major colorectal surgery is defined as surgery that involves wide resection of the colon and anastomosis. (12). This involves total/subtotal colectomy, right hemicolectomy, extended right hemicolectomy, transverse colectomy, left hemicolectomy and sigmoid colectomy, anterior resection, abdominoperineal resection, hartmann's resection, proctocolectomy (13). The dependent variable of the study is prolonged hospital stay (cutoff determined at the 75th percentile), and independent variables included sociodemographic, preoperative, intraoperative, and postoperative factors. SPSS version 27 was used to analyze the data. Descriptive analysis was done, and the results are presented in tables and graphs. Binary logistic regression was used to test the association. The cutoff for bivariate analysis was a p-value of <0.25, while for multivariate analysis, < 0.05 was used.

RESULTS

Sociodemographic and Baseline Characteristics

Final analysis was performed on 115 patients who had colorectal surgery. The mean age of all patients studied was 54.34 ± 17.01 years, with patient ages ranging from 18 to 94 years. The percentage of male patients was 59.1% (n=68), and women were 40.9% (n=47). Thirty (26.1%) patients had a history of past abdominal surgical procedures. The dominant previous operative procedures were recorded as previous colorectal operations (n=15, 13.0%) and previous obstetric or gynecologic procedures (n=10, 8.7%). Other previous operations noted were hepatobiliary (n=2, 1.7%), Urological (n=2, 1.7%), and abdominal wall (n=1, 0.9%).

Most (61, 53.0%) of the patients underwent surgery for a malignant disease. Of these colorectal malignancy cases, the most common primary tumor site was the right colon (n=15, 24.6%). (Table 1), Stage III malignancy was the most common stage using AJCC staging (n=30, 49.2%) followed by stage II diseases (n=15, 24.6%), stage IV diseases (n=10, 16.4%), and stage I diseases (n=6, 9.8%).

Table 1 Demographic and Baseline Characteristics of patients who had major colorectal surgeries at MCM Comprehensive Specialized Hospital from 2021-2025

Demographic / Clinical Characteristic	Value / Frequency, n (%)
Age (years)	
Mean $\pm$ SD	54.34 $\pm$ 17.01
Range	18–94
Sex	
Male	68 (59.1%)
Female	47 (40.9%)
Primary Tumor Site in Malignant Cases (53% of total cohort, n = 61)	
Right colon	15 (24.6%)

Demographic / Clinical Characteristic	Value / Frequency, n (%)
Multiple synchronous sites	14 (23.0%)
Rectum	12 (19.7%)
Left colon	10 (16.4%)
Sigmoid colon	8 (13.1%)
Transverse colon	2 (3.2%)
Benign Diagnoses (54% of total cohort, n= 47)	
Redundant sigmoid colon	36 (31.3%)
Inflammatory/infectious colorectal conditions	9 (7.8%)
Mechanical colorectal diseases (Intussusception, aganglionic megacolon)	4 (3.5%)
Bowel perforation	3 (2.6%)
Traumatic injuries	2 (1.7%)

Overall, 48 patients (41.7%) had medical comorbidities. The most common comorbidities were hypertension (n=18, 15.7%), followed by Diabetes mellitus (n=8, 7.0%). Thirteen patients (11.3%) had 2 or more concurrent comorbidities.

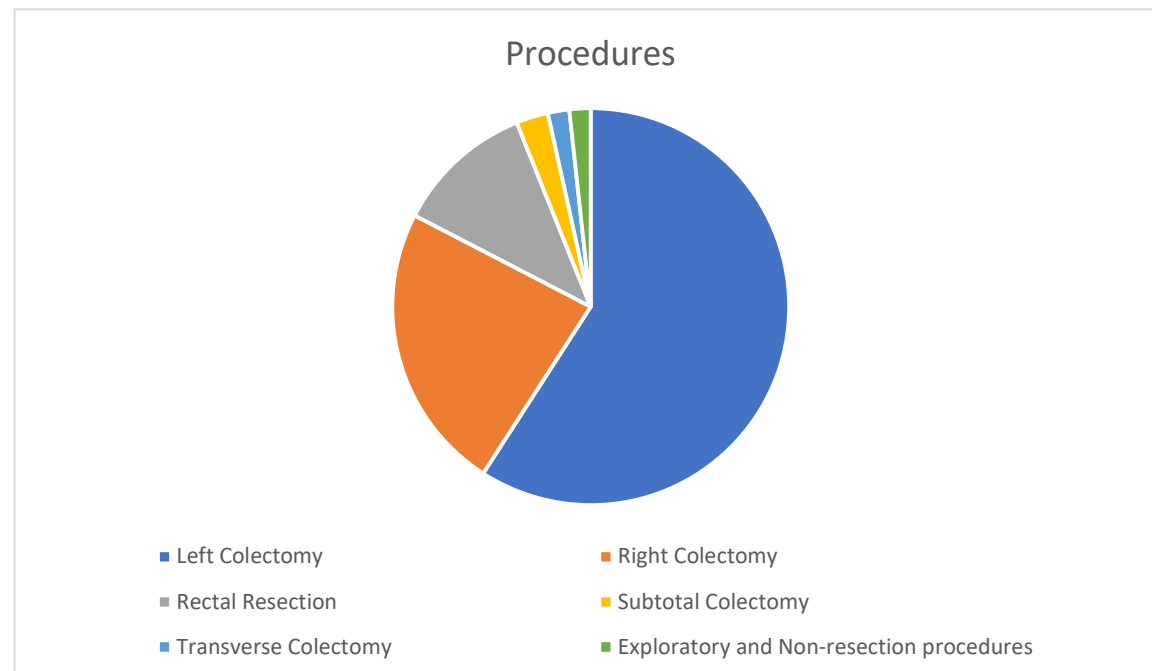
Table 2: Comorbidity and surgical duration distribution of patients who had colorectal surgery at MCM Comprehensive Specialized Hospital from 2021-2025

Characteristic	Frequency (n)	Percentage (%)
Comorbidities		
Hypertension	18	15.7%
Diabetes mellitus	8	7.0%
Retroviral infection	2	1.7%
Degenerative neurological disease	2	1.7%
Crohn's disease	2	1.7%

Characteristic	Frequency (n)	Percentage (%)
Bronchial asthma	1	0.9%
Cardiovascular disease	1	0.9%
Secondary malignancy	1	0.9%
2 or more concurrent comorbidities	13	11.3%
Procedure Duration		
≤120 minutes	8	7.0%
121–240 minutes	66	57.4%
> 240 minutes	41	35.7%

In the ASA physical status classification, most patients were ASA I (58.3%, n=67), 33.9% (n=39) were ASA II and 7.8% (n=9) were ASA III, representing a severe systemic disease. Nearly two-thirds (64.3%) of procedures (n=74) were elective.

Figure 1 Types of major colorectal procedures done at MCM Comprehensive Specialized Hospital from 2021-2025



Most of the procedures were performed via an open approach (n=101, 87.8%), with a laparoscopic approach completed in 8.7% of cases (n=10) and the rest (n=4, 3.5%) converted. Postoperative complications were noted in 20 patients, with an overall complication rate of 17.4%. Of the patients who experienced a complication, half (10, 8.7%) experienced multiple (2 or more) simultaneous adverse events. Isolated complications included surgical site infection (n=2, 1.7%), pneumonia/respiratory complication (n=2, 1.7%), cardiovascular complication (n=1, 0.9%), wound dehiscence (n=1,

0.9%), anastomotic leak (n=1, 0.9%), postoperative bowel obstruction (n=1, 0.9%), urinary tract infections (n=1, 0.9%), and systemic sepsis (n=1, 0.9%).

Minor complications (Clavien-Dindo Grades I and II) were recorded in 1.7% (n=2) and 6.1% (n=7) of patients, respectively. Surgical grade severe complications (Clavien-Dindo Grade III or above) involved 11 patients, accounting for 9.6%. 5 patients (4.3%) required surgical or endoscopic intervention under general anesthesia (Clavien-Dindo Grade IIIb) 1 patient (0.9%) had an ICU level single organ (Clavien-Dindo Grade IVa) and multiple organ dysfunction (Clavien-Dindo Grade IVb) each, while overall the 30-day postoperative mortality (Clavien-Dindo Grade V) was recorded in 3.5% (n=4) of patients.

Unplanned surgical re-intervention was necessary in 9 patients, corresponding to an overall reoperation rate of 7.8% (n=9). The most common reason for reoperation was anastomotic leak, which occurred in over half of reexplorations (n=5, 4.3% of total cohort). Abdominal wall dehiscence/wound failure accounted for the remaining 4 cases (3.5%), including a case in which an enterocutaneous fistula formed after reexploration. Unplanned hospital readmission within 30 days of discharge was necessary in 3 patients, with an overall readmission rate of 2.6% (n=3). Indications for readmission included presentation of a delayed anastomotic leak (n=2, 1.7%) and mechanical small bowel obstruction (n=1, 0.9%). By taking the 75th percentile of all study participants, prolonged hospital stay in this study is defined as hospitalization ≥ 12 days. The prevalence of prolonged hospital stay in this study was 27% (n=31).

Predictors of Prolonged Hospital Stay

In the final multivariable model, absence of preoperative bowel preparation and severity of postoperative complication were independently tied to a prolonged hospital stay. Lacking preoperative bowel preparation conferred more than a 4-fold increased adjusted odds of a prolonged stay (AOR=4.58, 95% CI: 1.32-15.87, $p=0.017$), relative to patients who had bowel preparation. Severity of postoperative complication was also an independent predictor of increased hospital stay ($p=0.003$), and the presence of minor postoperative complication (Clavien-Dindo Grade I-II) conferring a 19-fold increased adjusted odds compared to those without complication (AOR=19.04, 95% CI: 3.03-119.66, $p=0.002$). There was a trend toward increased odds of prolonged stay with major complication grade (Grade III-V), though this did not reach statistical significance (AOR=4.05, 95% CI: 0.93-17.59, $p=0.062$). The overall multivariable regression model demonstrated excellent goodness-of-fit, as confirmed by the Hosmer and Lemeshow test ($\chi^2=3.428$, "df"=8, $p=0.905$).

Table 3 Bivariable and multivariable binary logistic regression analysis to identify associated factors for prolonged hospital stay

Variable	Category	Prolonged Stay: No (n=84)	Prolonged Stay: Yes (n=31)	Crude OR (95% CI)	Adjusted OR (95% CI)	P-value
Age (years)	Continuous	—	—	1.004 (0.98-1.029)	0.98 (0.95 – 1.01)	0.235
Sex	Female (<i>Ref</i>)	37	10	1	1	—
	Male	47	21	1.65 (0.69 – 3.94)	0.58 (0.22 – 1.57)	0.283

Variable	Category	Prolonged Stay: No (n=84)	Prolonged Stay: Yes (n=31)	Crude OR (95% CI)	Adjusted OR (95% CI)	p-value
Bowel Preparation	Yes (<i>Ref</i>)	54	24	1	1	—
	No	30	7	1.90 (0.73 – 4.94)	4.58 (1.32 – 15.87)	0.017*
Abdominal Drainage	No (<i>Ref</i>)	52	14	1	1	—
	Yes	32	17	1.97 (0.86 – 4.54)	0.50 (0.20 – 1.27)	0.145
Clavien-Dindo Classification	No Complication (<i>Ref</i>)	75	20	1	1	—
	Minor Complication (Grade I & II)	3	6	7.50 (1.72 – 32.65)	19.04 (3.03 – 119.66)	0.002*
	Major Complication (Grade III-V)	6	5	3.12 (0.86 – 11.30)	4.05 (0.93 – 17.59)	0.062

Sensitivity Analysis

To explore the possible impact of survival bias introduced by the early migration of patients with short hospitalizations, the multivariable model was reanalyzed excluding in-hospital mortality (n=4) and limited only to those patients surviving to hospital discharge (n=111). The sensitivity model supported the robustness of the primary findings. As in the original model, lack of preoperative bowel preparation was an independent predictor of prolonged stay and increased the adjusted odds fourfold (aOR=4.05, 95% CI: 1.14-14.43, p=0.031).

The effect of complication severity on the prolonged stay outcome was also preserved (p=0.002). On the sub-analysis of only those patients surviving to hospital discharge, patients with minor complications (aOR=17.10, 95% CI: 2.77-105.57, p=0.002) and those with major complications (aOR=6.65, 95% CI: 1.10-40.16, p=0.039) both had a lot increased adjusted odds of prolonged stay relative to patients without complications. Patient age (p=0.433), sex (p=0.556), and intra-abdominal drain use (p=0.101) were still not significant predictors of prolonged stay.

Table 4: Primary and sensitivity multivariable logistic regression analyses of predictors of prolonged hospital stay

Predictor	Primary analysis (N=115) aOR (95% CI)	p-value	Sensitivity analysis* aOR (95% CI)	p-value
Bowel preparation: No vs Yes	4.57(1.32–15.87)	0.017	4.05 (1.13–14.43)	0.031
Abdominal drainage: Yes vs No	0.50 (0.20–1.26)	0.145	0.46 (0.18–1.17)	0.101
Age, per 1-year increase	0.98 (0.95–1.01)	0.235	0.99 (0.96–1.02)	0.433
Sex: Male vs Female	0.58 (0.25–1.57)	0.283	0.74 (0.27–2.04)	0.556
Clavien–Dindo classification, overall	p=0.003	—	p=0.002	—
Clavien–Dindo Grade I–II vs No complication	19.04 (3.03–119.66)	0.002	17.10 (2.77–105.57)	0.002
⌞ Grade III–V vs No complication	4.051 (0.933–17.591)	0.062	6.650 (1.101–40.156)	0.039

*Sensitivity analysis excludes in-hospital deaths, N = 111

DISCUSSION

This study investigated the prevalence of prolonged postoperative hospital stay and its predictors after major colorectal surgeries. 27%(n=31) of the patients had prolonged hospital stay after major colorectal surgery. This figure, quite logically, falls within the range of the majority of studies, which were reported globally on colorectal procedures (17.7- 34.8%)(5, 6, 14, 15) and studies done in Ethiopia on general surgical patients (24.7-29.2%)(8, 9, 16). However, there are studies that reported rates both higher and lower than this range. A prospective cohort study of 394 adult general surgery patients across public hospitals in Addis Ababa, Ethiopia reported a much higher (51%) rate of prolonged hospital stay (17). The inclusion of patients with diverse surgical procedures and differences in study populations and outcome definitions may further explain the variation. Another systematic review and meta-analysis of twenty-five trials of open or laparoscopic surgery for cancer or noncancer conditions found a prolonged hospital stay rate of 11% (18). These differences can be attributed to access to quality care and application of multimodal optimizations such as early mobilization, early oral intake, and routine drain/catheter removal, which prevent further complications that prolong hospital stays.

In this study, complications occurred in 17.4% (n=20) of patients, categorized by the Clavien–Dindo classification as Grade I in 1.7% (n=2), Grade II in 6.1% (n=7), Grade IIIb requiring surgical intervention under general anesthesia in 4.3% (n=5), Grade IVa single-organ dysfunction in 0.9% (n=1), Grade IVb multi-organ dysfunction in 0.9% (n=1), and Grade V 30-day postoperative mortality in 3.5% (n=4). Our study showed the presence of minor postoperative complications (Clavien–Dindo Grade I–II: "AOR"=19.04,95%, " p=0.002) as one of the core drivers of prolonged hospital stay after colorectal surgery. However, the low event (n=31) caused an events-per-variable ratio less than the commonly recommended minimum of 10 events per predictor, exposing it to the likelihood of overfitting, as indicated by the broad adjusted odds ratio.

Similarly, most previous studies showed postoperative complications as a predictor for prolonged hospital stay. A 2023 study done in the United States from 2005-2014 analyzed a retrospective cohort of 7,874 adult colorectal surgery patients at Cleveland Clinic Foundation and identified predictors across short-term (≤ 7 days), medium-term (8-30 days), and long-term (>30 days) hospital stays, revealing that prolonged stay (>7 days) was significantly driven by postoperative superficial or organ-space surgical site infections along with increased operative duration, open surgical approach, advanced age, preoperative coagulopathy, fluid and electrolyte disorders, severe weight loss (1). In Ethiopia, most studies focus on general surgery patients with one hospital-based cross-sectional study done in 2022 evaluating 316 adult surgical inpatients in the Arsi Zone, Ethiopia, showing a prolonged hospital stay rate (>12 days) that was independently driven by surgical site infections ("AOR"=5.02,95% CI: " 1.97"- " 12.80,p<0.05), comorbid

conditions ("AOR"=4.59,95% CI: " 2.46"- " 8.56,p<0.05), and hospital-acquired pneumonia ("AOR"=3.43,95% CI: " 1.36"- " 8.64,p<0.05) (19).

Another predictor of a longer hospital stay found in this study is preoperative bowel preparation ("AOR"=4.58,95%, " p=0.017). It was administered to 67.8% (n=78) of the cohort, while 32.2% (n=37) did not receive preoperative bowel preparation. Historically, the benefits of bowel preparation have been debated. A 2011 systematic review noted that, despite including more studies with a total of 5805 participants, there is no statistically significant evidence that patients benefit from mechanical bowel preparation or rectal enemas. In colorectal surgery, bowel cleansing can be safely omitted and induces no lower complication rate.(20) Following this, ERAS also recommended the omission of bowel preparation in colorectal surgeries. (21) However, multiple studies done since then showed improved postoperative complications and thus reduced length of hospital stay. (22, 23) An Ethiopian modified Delphi study of 32 multidisciplinary panelists used two rounds of expert consensus (80% agreement) to develop a context-specific ERAS protocol. While Western ERAS guidelines do not recommend routine MBP, the Delphi panelists suggested that, in Ethiopian practice, selective preoperative MBP for colorectal surgery, mostly left-sided resections or stenosing lesions, may be beneficial given the local dietary habits and the presentation of late-stage cancers. MBP with oral antibiotics reduces the risk of SSI and post-operative complications, which may hasten recovery and so decrease prolonged length of hospital stay. However, the Delphi study reflects expert consensus rather than direct evidence that MBP reduces prolonged hospital stay in Ethiopian patients.(24)

LIMITATIONS

There are a number of limitations in this study that need to be acknowledged by the authors. Most particularly, the retrospective chart review design precludes the possibility of determining causality between exposures and outcomes. The use of a single center and a rather small sample size might lead to a decrease in the statistical power of the analysis. Besides this, some key patient-related factors, e. g., nutritional status including body mass index, recent weight loss, time to oral diet resumption, and performance status, were also not systematically captured and may represent potential sources of residual confounding.

CONCLUSION

A quarter of all patients undergoing major colorectal surgery have an extended hospital stay. Failure to receive preoperative bowel preparation and the presence of postoperative complications are related to a prolonged hospital admission. A standardized approach should be adopted to perioperative management, with routine bowel preparation and specific measures to avoid complications of surgery.

RECOMMENDATIONS

There are multiple stakeholders responsible for improving prolonged hospitalization after colorectal surgeries. The hospital administration should define standard perioperative clinical pathways that include, for all elective colorectal procedures, routine bowel preparation, including both mechanical bowel preparation and oral prophylactic antibiotics.

Government and public health bodies, like the Ministry of Health and regional health bureaus, should revise national surgical protocols to build in existing evidence for combining bowel preparation in colorectal surgery. Health authorities should support national surgical quality registries to monitor the surgical patient pathway and should fund ongoing professional development programs of ERAS-specific protocols for surgical teams based in tertiary and referral hospitals.

Healthcare personnel, such as surgeons, anesthesiologists, and surgical nursing staff, should be diligent with prescribing and documenting preoperative bowel preparation before every elective colorectal operation, refraining from unnecessary omissions. Surgical teams should vigilantly monitor for early signs of postoperative complications

to instigate corrective measures before a minor complication becomes a prolonged hospitalization or severe morbidity.

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ETHICAL APPROVAL

Ethical approval was obtained from the Myung Sung Medical College (MMC) Research Ethics Committee (Institutional Review Board), Addis Ababa, Ethiopia (Protocol No. PRO-120926).

DECLARATIONS

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Author Contributions (Credit)

Nathan Suga (N.S.): Conceptualization, methodology, formal analysis, investigation, resources, writing – original draft, visualization, and funding acquisition.

Jochebed Suga (J.S.): Formal analysis, investigation, resources, and data curation.

Prof. Megbar Dessalegn (M.D.): Conceptualization, methodology, validation, writing - review and editing, supervision, and project administration.

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