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Factors Influencing Postoperative Hospital Stay Following Colorectal Cancer Resection

Naseralla J Elsaadi Suliman[1]*, Sara I. El Fallah
Department of General Surgery, Faculty of Medicine, University of Benghazi, Libya

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Abstract: Colorectal cancer, a prevalent ailment with a growing prevalence due to aging populations, presents surgical, chemotherapy, and radiation therapy as its chief treatment modalities. Our study sought to pinpoint the determinants of hospitalization duration (LOS) in colorectal cancer patients, encompassing both planned and emergency admissions, acknowledging the considerable impact on healthcare costs nationally and internationally. conducting a retrospective data analysis encompassing patients subjected to colorectal cancer surgery at Benghazi Medical Centre (BMC) from January 2016 to December 2018, we meticulously compiled and assessed demographics, clinical symptoms, surgical particulars, postoperative complications, comorbidities, and LOS. Statistical significance was ascertained at a threshold of $P < 0.05$. amongst the cohort of ninety-eight colorectal cancer surgery recipients, the exclusion of four due to missing data resulted in a study cohort of ninety-four cases. The median LOS stood at 11.7 days, with five notable factors significantly extending LOS: enter cutaneous fistula, wound infection, diabetes mellitus (DM), emergency procedures, and postoperative complications. This investigation conducted at BMC ascertained that diabetes mellitus, emergency admissions, postoperative wound infections, and fistula development correlated with prolonged LOS. A discernible increase in hospital stays was evident in elderly patients afflicted with comorbidities and diabetes. These revelations bear substantial financial implications.

العوامل المؤثرة على طول مدة الإيواء بعد إجراء جراحة لاستئصال ورم سرطاني من الأمعاء الغليظة والمستقيم

الكلمات المفتاحية :
سـ . رطان القولـ . ون والمستقيم؛ الأوضـ اع الاختيارية والطوارئ؛ مدة الإيواء؛ مضاعفات ما بعد الجراحة العلاج الإشعاعي؛ جراحة.

المستخلص: سرطان القولون والمستقيم، هو مرض شائع مع انتشار متزايد بسبب شيخوخة السـ كان. إذ يعتبـ ر الاستئصال بالتدخل الجراحي هو العلاج الأساسي إلى جانب العلاج الإشعاعي الكيميائي. يهـ دف هـ ذا البحـ ث للتعرف على العوامل المؤثرة في طول مدة الإيواء للمرضى بسرطان القولون والمستقيم ويشمل كلا من عمليات قبول المرضى المخطط لها والطارئة. حيث تعتبر طول مدة الإيواء من الدلالات على مستوى الخدمات وجـ ودة الرعاية الطبية. تم اجراء هذا البحث بدراسة استرجاعية، تضمنت مراجعة سجلات جميع المرضى الـ ذي تـ م إيوائهم وخضعوا لجراحة استئصال ورم سرطاني من القولون أو المستقيم في مركز بنغازي الطبي، في الفتـ رة من يناير 2016 إلى ديسمبر 2018. تم تجميع وتقييم التركيبة السـ كانية والأعـ راض السـ ريرية والتفاصـ يل الجراحية ومضاعفات ما بعد الجراحة والأمراض المصاحبة وخسارة الوزن بدقة. تـ م التأكـ دـ مـ ن الأهميـ ة الإحصائية عند عتبة $P < 0.05$. كان مجموع الحالات 98 حالة، استبعد منها 4 حالات وذلـ ك لعـ دم تـ وفر البيانات الكافية عليها. ومتوسط مدة الإيواء في المستشفى 11.7 يوم. ولوحظ خمسة عوامل تعمل على زيادة مدة الايواء بشكل كبير: الناسور المعوي الجلدي، والتهاب الجرح، ومرض السكري (DM)، وإجراءات الطـ وارئ، ومضاعفات ما بعد الجراحة. تم تقييم العلاقة بين المتغيرات المدخلة ومدة الإقامة في المستشـ فى تبـ ين وجـ ود علاقة بدلالة احصائية مع ثلاث متغيرات، مرض داء السكري، التدخل الجراحي الطارئ والمضاعفات ما بعـ د الجراحة خاصةً (التهاب الجرح والناسور المعوي الجلدي). حيث ادت إلى زيادة طول مدة الإيواء في المستشفى. وكانت الزيادة الملحوظة في الايواء بالمستشفى للمرضى المسنين المصابين بأمراض مصاحبة ومرض السكري. تحمل هذه الاكتشافات آثارًا مالية كبيرة.

***Corresponding author:** Naseralla J Elsaadi Suliman: *elsaadidawn@gmail.com* , Department of General Surgery, Faculty of Medicine, University of Benghazi, Libya

INTRODUCTION

Colorectal cancer (CRC) is a highly prevalent cancer and the third most common type worldwide. As the population ages, the number of cases is expected to increase. In 2018, it accounted for 10.2% of new cancer cases (1.8 million cases) and was the second leading cause of cancer-related deaths globally, with 862,000 fatalities (WHO, 2018). Colorectal cancer is the most common cancer among men in western Libya, with the highest regional incidence rate due to dietary and lifestyle habits. Improved accessibility and detection through endoscopic procedures may also contribute to the rapid increase in incidence rates (Bodalal et al., 2014). CRC is more complex and common in people over 50 (Brunicardi et al., 2018). Age is a significant risk factor; survival rates differ between genders (Yang et al., 2017). Behavioral and nutritional factors, such as inactivity, alcohol and cigarette use, high BMI, and poor diet, contribute to cancer and mortality. Family history is a risk factor for 20% of cases, emphasizing the need for genetic testing (Brunicardi et al., 2018)..

Colonoscopy is the most precise and sensitive diagnostic method for colorectal diseases, enabling polypectomy and biopsy when needed. CT scan with barium enema is occasionally useful, and metastasis can be detected via CT scan (Bailey et al., 2018). Screening programs significantly reduce morbidity and mortality from colorectal cancer. Starting at age 50, moderate-risk individuals should undergo colonoscopies every ten years, flexible sigmoidoscopies every five years, barium enemas every five years, and fecal occult blood testing (FOBT) annually (Lambert, 2013). Treatment for colorectal cancer varies depending on the cancer's stage, typically including a combination of chemotherapy, radiation, and surgery. Surgery is the only effective option for curing early and minimally metastatic disease (stage I-IV) (ASCO. 2018).

Our study on hospital LOS after colorectal resection was conducted at Benghazi Medical Centre, a public hospital without external budgetary constraints or fast-track treatment plans. We investigated how demographic factors, preoperative co-morbidities, clinical presentation, surgical methods, admission type, and postoperative complications affect hospital stay. Prolonged stay can have emotional, social, and financial consequences for patients, families, and society. Identifying risk factors associated with longer LOS can lead to more cost-effective care delivery. Preoperative preparation and postoperative treatment can be modified accordingly. These findings have significant cost implications for healthcare services and strategies to reduce emergency admissions and LOS.

This study aims to identify variables that prolong the stay after colorectal surgery. Hospital stay is a measure of treatment quality, and identifying its underlying causes can promote best practices, improve services, and reduce the stay period after colorectal cancer surgery.

MATERIALS AND METHODS

Study design and sitting: We conducted a retrospective cross-sectional study to identify all colorectal cancer patients admitted and operated on at BMC from January 2016 to December 2018. The study aims to determine how demographic factors, preoperative co-morbidities, surgical treatment, and postoperative complications impact hospital stay after colon cancer surgery.

Study population and data collection: Data was collected from medical records and operation notes of CRC patients admitted to the surgical department of BMC between Jan 2016 and Dec 2018 using a data sheet (Appendix). Demographics (Gender, Age), preoperative comorbidities (Diabetes mellitus (DM), hypertension (HTN), ischemic heart disease (IHD), cerebrovascular acci-

dent (CVA), bronchial asthma (BA), epilepsy, chronic obstructive pulmonary disease (COPD), and end-stage kidney disease (ESKD) are registered among the categories of variables used in the data collection sheet. The main clinical presentation (abdominal pain, constipation, per-rectal bleeding, anemia, acute obstruction, and perforation) is recorded. Operative procedures (low anterior resection (LAR), proctocolectomy, right colectomy, left colectomy, sigmoidectomy, complete colectomy, and abdominoperineal resection (APR) were detected. Mode of admission (emergency vs. elective), operative technique (laparoscopic vs. open), and postoperative complications (wound infection, wound dehiscence, seromas, hemorrhage, bowel leak, fistula, ileus, deep venous thrombosis [DVT], atelectasis, chest infection, and organ failure) are recorded.

Inpatient stay length was the primary outcome, and patients with incomplete data (<80%) were excluded.

This study defined prolonged hospital stay as a length exceeding the 75th percentile of the entire cohort. Accordingly, a prolonged hospital stay was defined as a length exceeding 20 days (about 3 weeks), representing the 75th percentile of the entire cohort.

Data statistical analysis: Data was analyzed using SPSS for Windows 21.0 (SPSS Inc., Chicago, IL, USA). Descriptive analysis was used to characterize the study population's variables, while multivariable logistic regression was utilized to identify factors predicting prolonged hospital stay. Variables were included in the model if they were significant ($p < 0.1$) on likelihood ratio tests.

RESULTS

Over 36 months (about 3 years), 98 patients underwent significant colon surgical resections for colorectal cancer at BMC. After removing 4 cases with missing data, 94 patients were included in the analysis. Their mean age was 56.4 years (range, 18-80), with 55 males (58.5%) and 39 females (41.5%). Most patients (47%) were between 51 and 70 years old. Figure 1 displays the age distribution, and Table 1 shows gender frequencies.

Table: (1). Age groups frequency of study sample

	Frequency	Percent	Valid Percent	Cumulative Percent
<50	31	33.0	33.0	33.0
51-60	22	23.4	23.4	56.4
61-70	25	26.6	26.6	83.0
71-79	14	14.9	14.9	97.9
>80	2	2.1	2.1	100.0
Total	94	100.0	100.0	

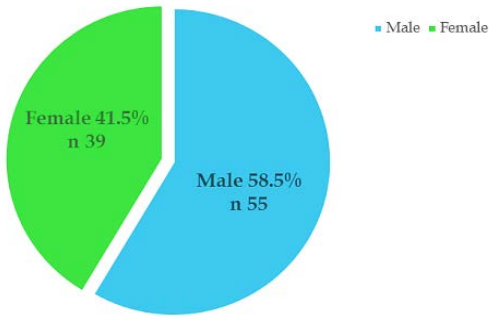

Figure: (1). Gender distribution of the study sample.

Comorbidities were present in 60 patients (63.8%). DM was the most prevalent in 29 cases (30.9%), followed by IHD (10.6%), HTN (9.5%), bronchial asthma (6.4%), anemia (5.3%), and COPD (3 cases) (3.1). ESKD, CVA, and epilepsy occurred in only one patient (1.06%) (Figure 2).

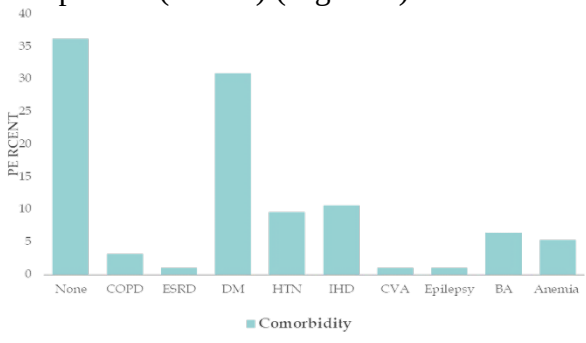

Figure: (2). Co-morbidity distribution of study sample.

The most frequent clinical manifestation was an acute intestinal blockage in 25.5%,

unexplained abdominal discomfort in 24.5%, constipation in 22.3%, rectal bleeding in 19.1%, anemia in 5.3%, and perforation in 3.2% (Figure 3). The tumor was commonly located at the sigmoid colon (43.6%), ascending colon (18.1%), splenic flexure (12.8%), rectum (8.5%), hepatic flexure (7.4%), descending colon (5.3%), and transverse colon (4.3%) (Figure 4).

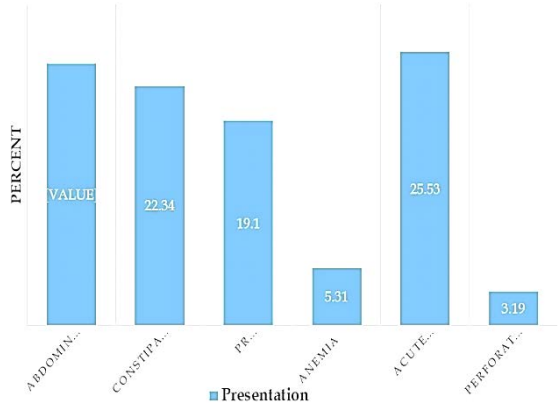

Figure: (3). Distribution of colorectal cancer presentation.

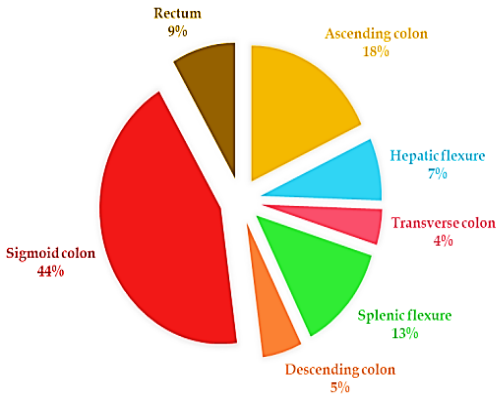

Figure: (4). Frequencies of tumor location.

Regarding surgical access, 71 cases (75.5%) were open, and 23 cases (24.5%) were laparoscopic (Figure 5). Sigmoid colectomies were performed in 42 cases (44.7%), right colectomies in 27, left colectomies in 16, APRs in 5, LARs in 3, and complete colectomies in one case (1.1%). Of the 94 patients, 45 (47.9%) were admitted as emergency cases, while 49 (52.1%) were elective admissions. The typical stay was 11.7 days (range 3-45 days), with 58 patients (61.7%) having a LOS between 6 and 20 days (Figure 6).

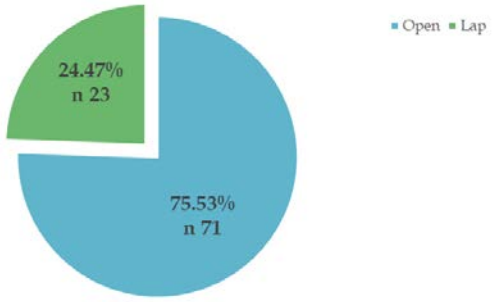

Figure: (5). Frequencies of surgical access.

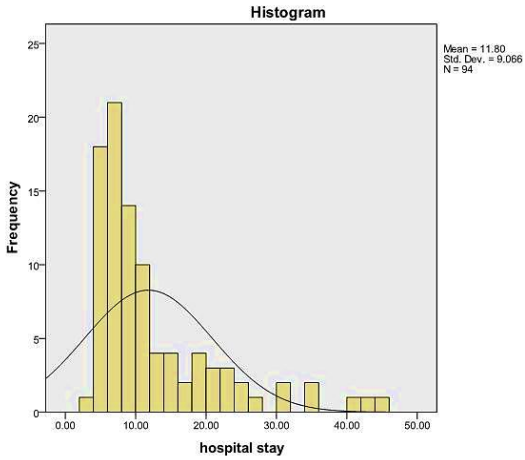

Figure: (6). Distribution of length of hospital stay (by days).

Compared to patients without DM (63.1%), those with DM (30.9%) had a longer median LOS (9 vs. 13.7 days (about 2 weeks), (P = 0.009) (Table 2). Emergency cases (47.9%) had a longer LOS (13 days) compared to elective cases (52.1%) with an LOS of 9.4 days (P = 0.002) (Table 3). Patients with postoperative problems (39.4%) had a longer median LOS (18 days) compared to those without (60.6%) with an LOS of 8 days (P = 0.006) (Table 4).

In regression analysis, wound infections and enterocutaneous fistula were identified as surgical complications that increased LOS. Patients with wound infections had a median LOS of 17 days (about 2 and a half

weeks), compared to 10.5 days for those without (P = 0.014). Patients with enterocutaneous fistula had a median LOS of 34 days, compared to 10 days for those without (P = 0.001). Age, gender, tumor location and type, surgical access, and other comorbidities did not predict hospital stay.

Table: (2). Hospital stay / Co-morbidity Cross tabulation

hospital stays	Co-morbidity									Total
	None	COPD	ESRD	DM	HTN	IHD	CVA	Epilepsy	BA	
<5	10	2	0	3	0	0	0	0	3	18
6-20	23	1	1	17	6	5	1	1	3	58
>21	1	0	0	9	3	5	0	0	0	18
Total	34	3	1	29	9	10	1	1	6	94

Table: (3). Hospital stay / Urgency Cross tabulation.

hospital stays	Urgency		Total
	Elective	Emergency	
<5	14	4	18
6-20	29	29	58
>21	6	12	18
Total	Total	45	94

Table: (4). Hospital stay / Complications Cross tabulation

Hospital Stay	Complications													Total
	wound infection	CVA	atelectasis	chest infection	organ failure	DVT	ileus	wound dehiscence	seroma	bleeding	collection	leaking	fistula	
<5	0	0	0	0	0	0	1	0	0	0	0	0	0	18
6-20	4	0	1	4	4	1	0	0	1	1	2	1	0	58
>21	5	1	0	1	2	1	0	1	0	0	1	1	4	18
Total	9	1	1	5	6	2	1	1	1	1	3	2	4	94

DISCUSSION

After colorectal resection, LOS patterns were examined, and factors contributing to "optimal" (5 days), or "prolonged" (21 days) hospital stays were analyzed via multivariable logistic regression.

Comparisons of LOS between countries: The healthcare system and LOS reduction measures should be considered when comparing median LOS among studies. Despite being conducted in a healthcare system without government initiatives, this study reported a longer median LOS than comparable studies in other countries. Surgery remains the primary treatment, and hospital stays are costly. Shortening stays raises concerns about patient safety and readmissions.

Reducing the hospital stay after major surgery indicates surgical success and lowers patient care costs (Nascimbeni et al., 2005). Hospital stay is the time between resection and discharge, typically lasting 10-12 days for colorectal surgeries (Aravani et al., 2016; King et al., 2006). A "fast track" reg-

imen aims to achieve a 2-day postoperative stay (Stephen & Berger, 2003).

Colorectal cancer is the most common digestive system cancer, with over 140,000 new cases and 50,000 deaths annually in the US (Deenadayalu & Rex, 2007). It ranks as the third most prevalent cancer in males worldwide and the most common cancer among men in eastern Libya (Bodalal et al., 2014). Although CRC can affect anyone, 90% of cases are diagnosed in those over 50, making age a significant risk factor (Brunicardi et al., 2018). Our investigation found that most cases fell between the ages of 51 and 70, which was consistent with prior research (Elzouki et al., 2014). Despite being common in Libya, few studies have investigated colorectal malignancies in this population. Our demographic analysis showed that men were more affected than women, consistent with a meta-analysis that found women have better survival rates (Yang et al., 2017). However, our study did not establish a statistically significant correlation between gender and survival due to the lack of long-term follow-up after discharge.

CRC symptoms are often nonspecific and present at advanced stages, with changes in bowel habits and rectal bleeding being the classic first signs (Brunicardi et al., 2018). However, our study found that abdominal discomfort and intestinal obstruction were the most common presenting symptoms, indicating larger tumors and advanced disease at diagnosis, consistent with another research (Aquina et al., 2017; Menegozzo et al., 2019; Xu et al., 2017). To improve early detection and optimal management, it is recommended that Libya establish colorectal cancer surveillance systems. Although colon cancer is commonly associated with the left side, there has been a rise in incidence on the right or proximal side in Europe, North America, and Asia (Kim et al., 2015; Vuik et al., 2019; Widmaier et al., 2007). In our study, over 60% of patients had tumors on the left side, with the sigmoid colon being the most frequently affected area.

The American Society of Clinical Oncology recommends combining surgery and radiochemotherapy for colorectal cancer treatment, based on the cancer's stage (Lambert, 2013). The primary treatment is oncological resection with curative intent, involving the removal of the tumor and lymphovascular supply. Surgical choice depends on the patient's condition, comorbidities, and clinical presentation, with en-block resection and sufficient lymphadenectomy being ideal. A diverting colostomy may be an option (Nelson et al., 2001). Although routine, colorectal resection may prolong hospital stay, causing a financial and psychological burden for patients.

Recent studies on hospital stay length after CRC procedures have focused on the impact of expedited pathways to reduce LOS (Sailhamer et al., 2007; Schwenk et al., 2008), while our study focuses on identifying risk factors with the most significant impact on hospital stay. Identifying these risk factors can inform pre- and postoperative treatment to deliver high-quality, cost-effective care. Median LOS varies between nations due to differences in practice styles and healthcare systems (Martin et al., 2016). For instance, Leung et al. found a median LOS of 8 days in the US (Leung et al., 2009), while Faiz et al. reported a median LOS of 11-14 days for colectomy and 13-15 days (about 2 weeks) for rectal surgeries in English NHS trusts (Faiz et al., 2011), which is more comparable to the findings in this study. In contrast to previous studies (Koperna et al., 1997; Tartter, 1988), advanced age was not associated with longer LOS in this study. However, given the elderly population studied (average age 56.4), the impact of age on LOS may be challenging to discern. Additionally, no significant difference in LOS was observed between genders, with men and

women having a LOS of 11.9 and 10.2 days, respectively.

DM was the only preoperative Co-morbidity found to be a risk factor for the increased stay period. Previous research has linked DM to post-operative complications, including slow wound healing, respiratory infections, cardiac issues, and ICU hospitalization (Chiu et al., 2017; Colibaseanu et al., 2018; Jin et al., 2019). After colorectal surgery, the body undergoes physiological and metabolic changes that can prolong hospital stays (Duggan et al., 2017). Hyperglycaemia can reduce tissue perfusion and oxygenation, leading to longer recovery times. Diabetes mellitus can also increase the risk of infections due to a deficiency in innate immunity. A systematic review and meta-analysis found that preoperative Hyperglycaemia harms short-term outcomes after colorectal surgery) (Reudink et al., 2021). This highlights the importance of preoperative treatment for improving recovery and reducing complications.

No significant association between LOS and co-morbidities such as HTN, IHD, COPD, ESKD, CVA, Epilepsy, and BA was found. Surgical complications significantly increased hospital stays, consistent with previous research (McNicol et al., 2007). In this study, enterocutaneous fistula and wound infections were the most common complications associated with longer LOS. In other studies, wound infections have been shown to prolong hospital stays by 7 to 10 days (Galie & Whitlow, 2006; Young & Khadaroo, 2014).

Preventative measures can reduce wound infections, such as maintaining cleanliness during surgery, using aseptic procedures, and limiting antibiotic use. Although rare, enterocutaneous fistulas can extend hospital stays by an average of 21-60 days (about 2 months) and increase mortality rates by up to 36%, with complications such as malnutrition and sepsis (Islam et al., 2018). Complications and prolonged LOS have a reciprocal relationship, leading to more problems like DVT and nosocomial infections. Early identification and management of postoperative complications are crucial (Nelson et al., 2001). We analyzed LOS and emergency readmissions in a population-based study. 63% of admissions were elective, and 37% were emergency cases. Median stay for elective and emergency admissions was 14 days (IQR = 11-20) and 21 days (about 3 weeks), respectively (McNicol et al., 2007; Xu et al., 2017). Emergency surgery patients had longer stays, due to additional testing needed for diagnosis before surgery. This highlights the importance of early screening programs for colorectal cancer (Schwenk et al., 2008).

Individuals who undergo emergency surgery for colorectal cancer often have advanced illness and may have distant metastases, which increases the risk of postoperative morbidity and longer stay (Kumar et al., 2014). Therefore, screening programs to detect colorectal cancer early are needed. Numerous studies have shown that laparoscopic surgery can reduce stay periods due to small incisions, less pain, and quicker recovery. However, this study did not find evidence of reduced hospital stays from laparoscopic surgery due to the small number of cases analyzed (Ueda et al., 2020). The study could not investigate the impact of increasing laparoscopic procedures on LOS due to the inability to distinguish between open and laparoscopic surgeries in the data.

Limitations of this study include its retrospective nature, with some patient file data missing. Factors influencing postoperative morbidity and hospital stay duration were not considered, such as operation duration, ASA grading, histology reports, illness staging, surgeon experience, and surgical volume. Additionally, the study's sample size was small, encompassing patients from only one institution, restricting the identification of further predictive variables. Furthermore,

failure to find matches may arise from typographical errors, missing data, or the absence of cancer mentions.

CONCLUSION

This retrospective cross-sectional study provides valuable insights into the factors associated with prolonged hospital stays in colorectal cancer patients undergoing surgery. The results emphasize the importance of addressing comorbidities, particularly diabetes mellitus, and implementing infection prevention measures to reduce wound infections and enterocutaneous fistulas. While the study has limitations, its findings have implications for optimizing patient care and resource utilization in colorectal cancer surgery. Further research is needed to validate these findings and explore additional factors affecting hospital stay duration.

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REFERENCES

American Society of Clinical Oncology ASCO. (2018). Colorectal Cancer: Types of Treatment. Approved by the Cancer. 2018.

Aquina, C. T., Becerra, A. Z., Xu, Z., Boscoe, F. P., Schymura, M. J., Noyes, K., Monson, J. R., & Fleming, F. J. (2017). Nonelective colon cancer resection: A continued public health concern. *Surgery, 161*(6), 1609-1618.

Aravani, A., Samy, E. F., Thomas, J. D., Quirke, P., Morris, E. J., & Finan, P. J. (2016). A retrospective observational study of length of stay in hospital after colorectal cancer surgery in England (1998–2010). *Medicine, 95*(47).

Bailey, M. H., Tokheim, C., Porta-Pardo, E., Sengupta, S., Bertrand, D., Weerasinghe, A., Colaprico, A., Wendl, M. C., Kim, J., & Reardon, B. (2018). Comprehensive characterization of cancer driver genes and mutations. *Cell, 173*(2), 371-385. e318.

Bodalal, Z., Azzuz, R., & Bendardaf, R. (2014). Cancers in eastern Libya: First results from Benghazi medical center. *World journal of gastroenterology: WJG, 20*(20), 6293.

Brunicardi, F., Andersen, D., Billiar, T., Dunn, D., Hunter, J., Matthews, J., & Pollock, R. (2018). *Schwartz's principles of surgery, 10e*. McGraw-hill.

Chiu, H.-C., Lin, Y.-C., Hsieh, H.-M., Chen, H.-P., Wang, H.-L., & Wang, J.-Y. (2017). The impact of complications on prolonged length of hospital stay after resection in colorectal cancer: A retrospective study of Taiwanese patients. *Journal of International Medical Research, 45*(2), 691-705.

Colibaseanu, D. T., Osagiede, O., McCoy, R. G., Spaulding, A. C., Habermann, E. B., Naessens, J. M., Perry, M. F., White, L. J., & Cima, R. R. (2018).

Proactive protocol-based management of hyperglycemia and diabetes in colorectal surgery patients. *Endocrine Practice, 24*(12), 1073-1085.

Deenadayalu, V. P., & Rex, D. K. (2007). Colorectal cancer screening: a guide to the guidelines. *Reviews in Gastroenterological Disorders, 7*(4), 204-213.

Duggan, E. W., Carlson, K., & Umpierrez, G. E. (2017). Perioperative hyperglycemia management: an update. *Anesthesiology, 126*(3), 547-560.

Elzouki, A.-N., Habel, S., Alsoaeiti, S., Abosedra, A., & Khan, F. (2014). Epidemiology and clinical findings of colorectal carcinoma in two tertiary care hospitals in Benghazi, Libya. *Avicenna journal of medicine, 4*(04), 94-98.

Faiz, O., Haji, A., Burns, E., Bottle, A., Kennedy, R., & Aylin, P. (2011). Hospital stay amongst patients undergoing major elective colorectal surgery: predicting prolonged stay and readmissions in NHS hospitals. *Colorectal Disease, 13*(7), 816-822.

Galie, K. L., & Whitlow, C. B. (2006). Postoperative enterocutaneous fistula: when to reoperate and how to succeed. *Clinics in Colon and Rectal Surgery, 19*(04), 237-246.

Islam, M., Gafur, M., Mahmud, A., Mahiuddin, M., Khan, S., Reza, E., Rahman, M., Mahmud, M., Karim, M., & Hoque, M. (2018). Clinicopathological Study of Enterocutaneous Fistula in Mymensingh Medical College Hospital. *Mymensingh Medical Journal: MMJ, 27*(3), 513-519.

Jin, L., Zhang, X., Lin Deng, W. W., Shao, W., Yin, L., & Lin, R. (2019). Analysis of risk factors for concurrent pulmonary infection after operation for colon cancer. *Hypertension, 50*, 10.29.

Kim, S.-E., Paik, H. Y., Yoon, H., Lee, J. E., Kim, N., & Sung, M.-K. (2015). Sex- and gender-specific disparities in colorectal cancer risk. *World journal of gastroenterology: WJG, 21*(17), 5167.

King, P., Blazeby, J., Ewings, P., Longman, R., Kipling, R., Franks, P., Sheffield, J., Evans, L., Soulsby, M., & Bulley, S. (2006). The influence of an enhanced recovery programme on clinical outcomes, costs and quality of life after surgery for colorectal cancer. *Colorectal Disease, 8*(6), 506-513.

Koperna, T., Kisser, M., & Schulz, F. (1997). Emergency surgery for colon cancer in the aged. *Archives of Surgery, 132*(9), 1032-1037.

Kumar, S., Kafle, P., Patowary, B., Belbase, N., Agrawal, S., Shrestha, S., & Maharjan, N. (2014). Surgical outcome and clinical profile of emergency versus elective cases of colorectal cancer in college of medical sciences, Nepal. *Journal of College of Medical Sciences-Nepal, 9*(2), 25-30.

Lambert, R. (2013). The Future of Colorectal Cancer Prevention in Developing Countries. *Screening, 18*(1).

Leung, A. M., Gibbons, R., & Vu, H. N. (2009). Predictors of length of stay following colorectal resection for neoplasms in 183 Veterans Affairs patients. *World journal of surgery, 33*, 2183-2188.

Martin, E. T., Kaye, K. S., Knott, C., Nguyen, H., Santarossa, M., Evans, R., Bertran, E., & Jaber, L. (2016). Diabetes and risk of surgical site infection: a systematic review and meta-analysis. *infection control & hospital epidemiology*, *37*(1), 88-99.

McNicol, L., Story, D. A., Leslie, K., Myles, P. S., Fink, M., Shelton, A. C., Clavisi, O., & Poustie, S. J. (2007). Postoperative complications and mortality in older patients having non‐cardiac surgery at three Melbourne teaching hospitals. *Medical journal of Australia*, *186*(9), 447-452.

Menegozzo, C. A. M., Teixeira-Júnior, F., Couto-Netto, S. D. d., Martins-Júnior, O., Bernini, C. d. O., & Utiyama, E. M. (2019). Outcomes of elderly patients undergoing emergency surgery for complicated colorectal cancer: a retrospective cohort study. *Clinics*, *74*.

Nascimbeni, R., Cadoni, R., Fabio, F. D., Casella, C., & Salerni, B. (2005). Hospitalization after open colectomy: expectations and practice in general surgery. *Surgery today*, *35*, 371-376.

Nelson, H., Petrelli, N., Carlin, A., Couture, J., Fleshman, J., Guillem, J., Miedema, B., Ota, D., & Sargent, D. (2001). Guidelines 2000 for colon and rectal cancer surgery. *Journal of the National Cancer Institute*, *93*(8), 583-596.

Reudink, M., Slooter, C., Janssen, L., Lieverse, A., Roumen, R., & Slooter, G. (2021). Metabolic syndrome; associations with adverse outcome after colorectal surgery. A systematic review and meta-analysis. *Annals of Medicine and Surgery*, *71*, 102997.

Sailhamer, E. A., Sokal, S. M., Chang, Y., Rattner, D. W., & Berger, D. L. (2007). Environmental impact of accelerated clinical care in a high-volume center. *Surgery*, *142*(3), 343-349.

Schwenk, W., Günther, N., Wendling, P., Schmid, M., Probst, W., Kipfmüller, K., Rumstadt, B., Walz, M., Engemann, R., & Junghans, T. (2008). "Fast-track" rehabilitation for elective colonic surgery in Germany—prospective observational data from a multi-centre quality assurance programme. *International journal of colorectal disease*, *23*, 93-99.

Stephen, A. E., & Berger, D. L. (2003). Shortened length of stay and hospital cost reduction with implementation of an accelerated clinical care pathway after elective colon resection. *Surgery*, *133*(3), 277-282.

Tartter, P. I. (1988). Determinants of postoperative stay in patients with colorectal cancer: implications for diagnostic-related groups. *Diseases of the colon & rectum*, *31*(9), 694-698.

Ueda, Y., Shiraishi, N., Kawasaki, T., Akagi, T., Ninomiya, S., Shiroshita, H., Etoh, T., & Inomata, M. (2020). Short-and long-term outcomes of laparoscopic surgery for colorectal cancer in the elderly aged over 80 years old versus non-elderly: a retrospective cohort study. *BMC geriatrics*, *20*, 1-9.

Vuik, F. E., Nieuwenburg, S. A., Bardou, M., Lansdorp-Vogelaar, I., Dinis-Ribeiro, M., Bento, M. J., Zadnik, V., Pellisé, M., Esteban, L., & Kaminski, M. F. (2019). Increasing incidence of

colorectal cancer in young adults in Europe over the last 25 years. *Gut, 68*(10), 1820-1826.

WHO, W. H. O. (2018). Cancer Key Facts. Geneva: World Health Organization; 2018.

Widmaier, U., Karrer, M., & Schoenberg, M. (2007). " Fast-track" and elective, laparoscopic colo-rectal surgery. *Zentralblatt fur Chirurgie, 132*(4), 342-348; discussion 348.

Xu, Z., Becerra, A. Z., Aquina, C. T., Hensley, B. J., Justiniano, C. F., Boodry, C., Swanger, A. A., Arsalanizadeh, R., Noyes, K., & Monson, J. R. (2017). Emergent colectomy is independently associated with decreased long-term overall survival in colon cancer patients. *Journal of Gastrointestinal Surgery*, *21*, 543-553.

Yang, Y., Wang, G., He, J., Ren, S., Wu, F., Zhang, J., & Wang, F. (2017). Gender differences in colorectal cancer survival: a meta‐analysis. *International journal of cancer, 141*(10), 1942-1949.

Young, P. Y., & Khadaroo, R. G. (2014). Surgical site infections. *Surgical Clinics, 94*(6), 1245-1264.