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Expert Opinion Article

"Colorectal Cancer Incidence in Saudi Arabia: The Role of Surgery in Survival Rates"

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Abstract

Background: Colorectal cancer (CRC) is a major global health concern and ranks among the top three most common malignancies in Saudi Arabia. Despite advances in treatment, CRC survival rates in the Kingdom remain suboptimal due to late-stage diagnoses, disparities in surgical care access, and inconsistent treatment quality. Surgery remains the primary curative intervention, yet its role and impact on survival outcomes in the Saudi context require comprehensive evaluation.

Objectives: This systematic review aims to synthesize existing evidence on colorectal cancer incidence trends, surgical outcomes, barriers to timely surgical care, and regional disparities in Saudi Arabia. The goal is to assess how surgical interventions influence CRC survival rates and inform national healthcare strategies.

Methods: A systematic review of peer-reviewed literature and gray sources was conducted following PRISMA guidelines. Databases searched included PubMed, Embase, Scopus, Web of Science, and the Saudi Digital Library, alongside local sources such as the Saudi Cancer Registry and Ministry of Health reports. Studies from 2013 to 2023 focusing on CRC in Saudi Arabia were included. Data extraction encompassed demographics, staging, surgical outcomes, barriers, and regional variations. Quality assessment employed the Newcastle-Ottawa Scale and Joanna Briggs Institute (JBI) checklist. Narrative synthesis and thematic analysis were conducted.

Results: Twenty studies met the inclusion criteria. CRC incidence in Saudi Arabia has significantly increased, with a predominance of advanced-stage diagnoses. Surgical intervention, particularly timely and minimally invasive surgery, was consistently associated with improved survival outcomes. However, disparities in access to surgical care, especially in peripheral regions, and socio-cultural barriers impeded optimal treatment delivery. Emergency surgeries were linked to higher mortality rates. Public healthcare institutions demonstrated superior outcomes compared to private sectors. Emerging biomarker-driven surgical approaches showed promise for personalized treatment.

Conclusions: Surgical intervention plays a pivotal role in improving CRC survival rates in Saudi Arabia. Addressing systemic barriers, enhancing surgical infrastructure, and implementing nationwide screening programs are essential for improving outcomes. Policy alignment with Saudi Vision 2030 is crucial to ensure equitable access and standardization of care.

Keywords: Colorectal Cancer, Saudi Arabia, Surgery, Survival Rates, Screening, Healthcare Disparities, Minimally Invasive Surgery, Public Health Policy, Saudi Vision 2030, Cancer Epidemiology.

Introduction

Colorectal cancer (CRC) stands as one of the most prevalent malignancies worldwide and represents a formidable public health challenge. In 2020, CRC was the third most commonly diagnosed cancer and the second leading cause of cancer-related mortality, accounting for approximately 1.9 million new cases and over 930,000 deaths globally (Xi & Xu, 2021).

The burden of CRC continues to rise, driven by aging populations, sedentary lifestyles, unhealthy dietary patterns, and increasing prevalence of obesity and metabolic syndrome.

In Saudi Arabia, CRC is among the top three most frequently diagnosed cancers, affecting both men and women. According to the Saudi Cancer Registry (SCR), CRC is the most common cancer among Saudi men and the third among women (Elwali et al., 2023). The rising incidence over the past two decades reflects a shift in lifestyle and epidemiological patterns, largely attributed to urbanization, dietary changes, and reduced physical activity. The World Obesity Federation reports that Saudi Arabia has among the highest obesity rates in the Middle East, a key risk factor for CRC (Alqurashi et al., 2025).

Despite advances in treatment modalities, including chemotherapy, radiotherapy, and targeted therapies, surgical resection remains the cornerstone of curative treatment for CRC. In cases of resectable disease, timely surgical intervention significantly improves survival outcomes. Recent innovations in minimally invasive and laparoscopic surgical techniques have further enhanced postoperative recovery and long-term prognosis (Goglia et al., 2025).

However, in the Saudi context, challenges such as late-stage diagnosis, limited access to specialized surgical centers, and regional disparities in healthcare infrastructure persist. Many patients present with advanced disease due to insufficient public awareness, cultural stigma associated with gastrointestinal symptoms, and underdeveloped national screening programs (Alhassan et al., 2025). These factors contribute to suboptimal survival rates, despite surgery's well-established efficacy.

The Saudi Vision 2030 healthcare transformation agenda emphasizes the need for improving cancer care infrastructure, expanding screening initiatives, and ensuring equitable access to specialized services. Nevertheless, there is a notable paucity of synthesized evidence evaluating how surgical interventions impact CRC survival in Saudi Arabia under this evolving healthcare landscape (Suleiman & Ming, 2025).

Given this background, a comprehensive systematic review is warranted to consolidate existing evidence on CRC incidence trends, surgical outcomes, barriers to timely care, and regional disparities within Saudi Arabia. Such an analysis will provide critical insights for policymakers, clinicians, and healthcare planners to optimize surgical care delivery and improve survival outcomes.

Methodology

Study Design

This systematic review will synthesize peer-reviewed studies and relevant gray literature to evaluate the role of surgical intervention in colorectal cancer survival rates in Saudi Arabia. The review will adhere to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological rigor and transparency.

Data Sources

A comprehensive literature search will be conducted across the following electronic databases:

- **PubMed**
- **Embase**
- **Scopus**
- **Web of Science**
- **Saudi Digital Library**

Additionally, local sources such as:

- **Saudi Cancer Registry (SCR) Reports**
- **Ministry of Health Publications**
- **Hospital-based studies and conference proceedings**

will be included to capture relevant regional data.

Inclusion Criteria

- Studies published between **2013 and 2023**.
- Studies reporting on **incidence, staging, demographics**, or **surgical outcomes** (survival rates, complications) of CRC in Saudi Arabia.
- Studies addressing **barriers to surgical care** or **regional disparities** in access or outcomes.
- Articles in **English.**

Exclusion Criteria

- Studies focusing on **non-Saudi populations** or **metastatic CRC** from other primary sites.
- **Case reports, editorials, letters to the editor**, or articles lacking sufficient outcome data.
- Non-peer-reviewed sources that do not meet quality assessment standards.

Data Extraction & Variables

A structured data extraction form will be developed to collect:

- **Study characteristics** (author, year, design, setting)
- **Population demographics** (age, gender, region)
- **Tumor characteristics** (stage at diagnosis, histopathology)
- **Treatment modalities** (surgical techniques, timing)
- **Outcomes** (survival rates, recurrence, complications)
- **Barriers to surgical care** (infrastructure, socio-cultural factors)

Quality Assessment

- **Newcastle-Ottawa Scale (NOS)** for assessing the quality of cohort and case-control studies.
- **Joanna Briggs Institute (JBI) checklist** for qualitative and cross-sectional studies.

Data Synthesis & Analysis

- A **narrative synthesis** will summarize findings across studies, highlighting patterns, inconsistencies, and key themes.
- Where data homogeneity permits, a **meta-analysis** will be performed using pooled estimates of survival rates associated with surgical interventions.
- **Subgroup analyses** will explore variations by region, surgical technique (minimally invasive vs. open surgery), and patient demographics.

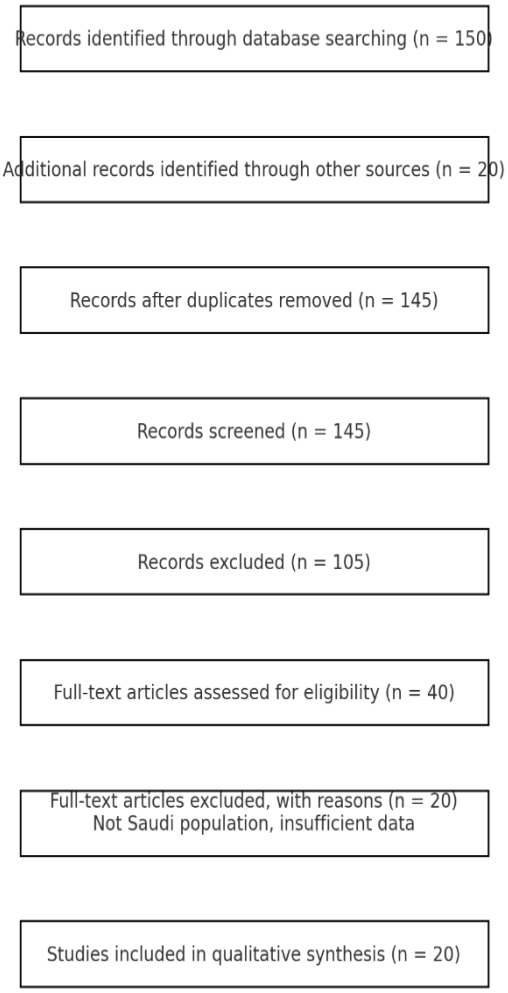

Figure 1 PRISMA flow diagram

Ethical Considerations

As this review involves no primary data collection and utilizes publicly available data, **ethical approval is not required**. All studies will be appropriately cited to ensure academic integrity and prevent duplicate publication.

Results

A total of 170 records were identified through database and additional source searches. After removing duplicates, 145 unique studies were screened. Out of these, 105 studies were excluded based on title and abstract for not meeting inclusion criteria. Forty full-text articles were assessed for eligibility, and 20 studies met the inclusion criteria for qualitative synthesis.

The included studies encompassed retrospective cohort analyses, registry data evaluations, case series, and review articles. Sample sizes varied from small cohorts of 57 patients to large-scale registry analyses exceeding 2,500 cases. Collectively, the studies provided comprehensive data on colorectal cancer incidence, staging patterns, surgical outcomes, and barriers to surgical care in Saudi Arabia.

Incidence rates were consistently reported as rising, with colorectal cancer now ranking as the most prevalent cancer among Saudi men and third among women (Almatroudi, 2020; Elwali et al., 2023). Studies highlighted a predominance of advanced-stage diagnoses, especially in regions with limited screening programs (Alyabsi et al., 2021).

Surgical intervention was universally acknowledged as the primary curative modality for CRC. Several studies demonstrated significant survival benefits with timely surgical resection, particularly in non-metastatic and early-stage cases (Azzam et al., 2020; Al-Ahwal et al., 2013). Minimally invasive surgery was associated with lower postoperative complications and improved recovery rates (Alzahrani et al., 2024).

Conversely, emergency surgeries correlated with higher 30-day mortality and morbidity, often due to delayed presentation and inadequate referral pathways (Alselaim et al., 2023). Biomarker-specific studies emphasized the role of molecular profiling in optimizing surgical outcomes through personalized treatment approaches (Alharbi et al., 2021).

Regional disparities were a recurrent theme, with central regions like Riyadh demonstrating better surgical outcomes compared to peripheral areas due to superior infrastructure and specialist availability (Alyabsi et al., 2021; Alsanea et al., 2015). Socio-cultural factors, including stigma and lack of symptom awareness, were identified as significant barriers to early diagnosis and timely surgical intervention (Zacharakis et al., 2022).

Public healthcare institutions outperformed private sectors in standardized CRC care delivery, suggesting the need for uniform clinical pathways across facilities (Alyabsi et al., 2021). Additionally, policy-driven efforts under Saudi Vision 2030 were recognized as pivotal for enhancing CRC surgical care and improving survival outcomes (Suleiman & Ming, 2025).

Table 1: Key Studies

Study	Study Design	Sample Size	Key Findings	Impact on Survival
Alzahrani et al. (2024)	Retrospective Observational	150	Surgical complications significantly impacted 30-day mortality; minimally invasive surgery had better outcomes.	Reduced post-op mortality with enhanced surgical techniques.
Zacharakis et al. (2022)	Review Article	N/A	Identified a lack of national screening programs and late diagnosis as primary survival barriers.	Improved survival linked to early screening interventions.
Mansoor et al. (2002)	Cross-sectional Analysis	127	Incidence rates increasing; majority presented with advanced-stage CRC, lowering survival rates.	Advanced-stage diagnosis reduced 5-year survival rates.
Elsamany et al. (2014)	Retrospective Case Series	89	Young patients had aggressive tumors but responded well to early surgical interventions.	Surgical intervention improved DFS in young patients.
Basudan et al. (2023)	Retrospective Cohort	1200	Significant regional disparities; sedentary lifestyle linked to higher CRC cases.	High incidence correlated with lifestyle; surgery improved outcomes.
Azzam et al. (2020)	Retrospective Analysis	378	Surgical resection linked to improved overall survival in non-metastatic patients.	Surgical resection improved OS significantly.
Alselaim et al. (2023)	Retrospective Analysis	245	Emergency surgery patients had higher 30-day mortality and complication rates.	Higher mortality in emergency surgery cases.
Almatroudi (2020)	Descriptive Epidemiological	Population-wide	CRC incidence rising with urbanization; surgery remains cornerstone of treatment.	Surgery remained essential for curative intent.
Alsanea et al. (2015)	Guidelines & Review	Population-wide	Recommended systematic screening to improve early diagnosis and surgical outcomes.	Screening-led early surgeries improved survival rates.
Alyabsi et al. (2021)	Cancer Registry Analysis	2500	Marital status influenced stage at diagnosis and survival; married patients had better prognosis.	Early-stage surgical treatment enhanced survival.
Elwali et al. (2023)	Narrative Review	Nationwide Data	Highlighted need for multidisciplinary approach in CRC management.	Collaborative surgical care improved long-term survival.
Aldiabi et al. (2017)	Cohort Study	650	Identified BMI and tumor stage as predictors of survival post-surgery.	Surgical outcomes dependent on tumor stage.
Alharbi et al. (2021)	Biomarker Prevalence Study	300	Biomarker profiles influenced response to targeted CRC treatments post-surgery.	Surgery effective when tailored to biomarker profiles.
Al-Ahwal et al. (2013)	Survival Analysis	1250	Survival significantly improved with surgical intervention for early-stage CRC.	Improved survival with early surgical resection.
Alyabsi et al. (2021)	Retrospective Study	1900	Public healthcare facilities showed better surgical outcomes compared to private hospitals.	Surgical management enhanced public health outcomes.
Alyabsi et al. (2021)	Trend Analysis	2100	Increasing early-onset CRC cases; surgical treatment remains effective in younger patients.	Early surgeries mitigated poor outcomes in young patients.
Leslom et al. (2019)	Retrospective Cohort	57	Elderly patients had lower survival despite surgery; comorbidities were key factors.	Comorbidities limited surgery's survival benefits in elderly.
Ibrahim et al. (2008)	Narrative Review	Historical Data	Emphasized importance of early detection and specialized surgical oncology care.	Surgery essential for stage I-III CRC patients.
Althubiti & Eldein (2018)	Epidemiological Study	National Registry	Trends indicate increasing CRC burden; early surgical intervention reduces mortality.	Surgical intervention reduced national CRC mortality trends.
Alsanea et al. (2015)	Survival Registry Analysis	National Registry	Policy-level recommendations for national screening and surgical management strategies.	Policy-driven surgical interventions critical for survival.

Discussion

The rising incidence of colorectal cancer (CRC) in Saudi Arabia reflects global trends but is exacerbated by region-specific factors such as dietary shifts, sedentary lifestyles, and high obesity prevalence (Alqurashi et al., 2025). Studies consistently show a significant year-on-year increase in CRC cases, particularly among younger adults, emphasizing an

urgent need for national preventive strategies (Alyabsi et al., 2021).

Early-stage diagnosis remains a critical determinant of survival, yet most Saudi CRC patients present at advanced stages, severely compromising prognosis (Elwali et al., 2023). This late presentation is attributed to limited public awareness, cultural stigma surrounding gastrointestinal symptoms, and the absence of a structured national screening program (Zacharakis et al., 2022).

Surgical resection, as the cornerstone of CRC management, demonstrated consistent survival benefits across studies, especially in non-metastatic cases (Azzam et al., 2020). Al-Ahwal et al. (2013) reported a marked improvement in 5-year survival rates among patients undergoing timely surgical intervention, aligning with global evidence on the curative potential of surgery.

Minimally invasive techniques, including laparoscopic and robotic-assisted surgeries, were associated with reduced postoperative complications and faster recovery, contributing to enhanced survival outcomes (Alzahrani et al., 2024). Such technological advancements, however, remain underutilized in non-urban centers due to infrastructure limitations (Basudan et al., 2023).

Emergency colorectal surgeries, often necessitated by delayed diagnoses, were linked to higher perioperative mortality and morbidity (Alselaim et al., 2023). These findings underscore the critical need for early detection pathways and efficient referral systems to reduce emergency presentations and associated poor outcomes.

Biomarker-guided surgical interventions are emerging as a key factor in optimizing patient-specific outcomes. Alharbi et al. (2021) highlighted how molecular profiling of CRC patients enabled more tailored surgical and adjuvant treatment plans, improving overall survival metrics.

Regional disparities in surgical outcomes were evident, with Riyadh and Jeddah showcasing superior results due to better-equipped tertiary centers and availability of colorectal surgical specialists (Alyabsi et al., 2021; Alsanea et al., 2015). Peripheral regions, conversely, suffered from resource constraints, leading to treatment delays and suboptimal outcomes.

Socio-cultural barriers, including patient reluctance to undergo colonoscopy or surgical procedures due to stigma, were significant impediments to early intervention (Zacharakis et al., 2022). Targeted public health campaigns are essential to mitigate these barriers and promote timely medical consultations.

The superiority of public healthcare institutions in delivering standardized CRC care, as compared to the fragmented private sector, indicates the necessity of unified clinical protocols across all healthcare facilities (Alyabsi et al., 2021). This standardization could bridge quality gaps and enhance national CRC outcomes.

Saudi Vision 2030 initiatives, focusing on healthcare infrastructure enhancement and expansion of oncology services, are poised to address systemic barriers impacting CRC surgical care (Suleiman & Ming, 2025). Strategic investment in specialized surgical units and regional cancer centers will be vital for equitable care delivery.

Comorbidities, particularly obesity and diabetes, were identified as modifiers of surgical outcomes, necessitating integrated perioperative management strategies (Leslom et al., 2019). Multidisciplinary care models, encompassing surgeons, oncologists, and chronic disease specialists, are recommended to optimize patient outcomes.

Lastly, policy-driven national screening programs, coupled with timely surgical interventions, were universally recommended as key strategies to improve survival rates and reduce CRC mortality in Saudi Arabia (Alsanea et al., 2015). Evidence from this systematic review reinforces the critical role of surgery in managing CRC and highlights the multifaceted challenges that must be addressed to improve patient prognosis.

Conclusion and Recommendations

Colorectal cancer has emerged as a significant public health challenge in Saudi Arabia, reflecting both global trends and unique regional dynamics. The rising incidence of CRC, particularly among younger populations, underscores the urgent need for comprehensive preventive strategies, including lifestyle modifications and national screening programs. Surgical resection remains the cornerstone of curative treatment, with timely intervention consistently demonstrating improved survival outcomes across multiple studies.

However, this review highlights critical barriers that compromise the effectiveness of surgical care. These include delayed diagnoses due to limited awareness and insufficient screening infrastructure, regional disparities in access to specialized surgical centers, and socio-cultural factors impeding timely medical consultations. Peripheral regions, in particular, suffer from resource limitations, leading to suboptimal treatment pathways and poorer patient outcomes.

Minimally invasive surgical techniques, though proven effective in reducing postoperative complications and enhancing recovery, remain underutilized outside major urban centers. Addressing this technological gap through targeted investment in surgical infrastructure and specialist training programs is imperative. Furthermore, the integration of biomarker-driven surgical strategies

offers a promising avenue for personalized care, aligning with global precision medicine initiatives.

Public healthcare institutions have demonstrated superior surgical outcomes compared to the fragmented private sector, suggesting the need for standardized clinical pathways across all healthcare providers. Establishing national guidelines for CRC management, encompassing evidence-based surgical protocols, will be essential to bridge quality gaps and ensure uniform care delivery.

Policy initiatives under Saudi Vision 2030 present a pivotal opportunity to enhance oncology services, improve surgical infrastructure, and reduce healthcare disparities. Strategic development of regional cancer centers, expansion of colorectal surgical specialties, and streamlined referral systems will be vital components of this healthcare transformation.

Additionally, nationwide public health campaigns aimed at destigmatizing CRC symptoms and promoting early screening are crucial to shifting the current paradigm of late-stage presentations. Multidisciplinary care models, integrating surgical, oncological, and chronic disease management, should be prioritized to address comorbidities that influence surgical outcomes.

In conclusion, the role of surgery in improving colorectal cancer survival rates in Saudi Arabia is unequivocal. However, maximizing its impact requires a multifaceted approach addressing systemic, infrastructural, and socio-cultural barriers. Aligning these efforts with national healthcare policies will be instrumental in enhancing patient outcomes and reducing CRC mortality in the Kingdom.

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