BOWEL CANCER OUTCOMES REGISTRY

2022 ANNUAL REPORT

This publication was produced on behalf of the Bowel Cancer Outcomes Registry (BCOR)

Data Period

The data contained in this report was extracted from the Bowel Cancer Outcomes Registry on 31st January 2023 and reports patient episodes and data from January 1st to December 31st 2022 unless otherwise stated.

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The 2022 Data Bowel Cancer Outcomes Registry Report 2023, pages xx.

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The Bowel Cancer Outcomes Registry is principally funded by:

The Colorectal Surgical Society of Australia and New Zealand (CSSANZ) is the professional body that represents Australian and New Zealand Colorectal Surgeons. CSSANZ members voluntarily fund the majority of costs associated with BCOR to advance the quality of colorectal cancer care in Australia and New Zealand.

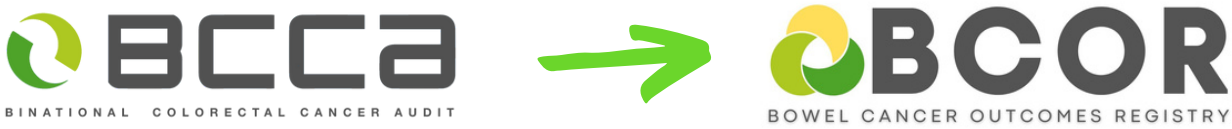
Partners:

Monash University through both the Cancer Research Program and Clinical Outcomes data Reporting and Research Program provide database hosting and a secure research environment as well as Academic and Clinical Research guidance, Advocacy and Registry Science expertise. Monash is a leader in multiple Cancer Outcomes Registries and a critical partner in ongoing development of the BCOR.

Endorsed by:

Supporters:

The BCCA transition to BCOR



In our discussions with all parties involved in bowel cancer care it became clear that there is confusion about cancer registries in general, and in particular the difference between *Incidence* registries and *Outcomes* registries.

In order to align with other national and international cancer outcomes registries and following member consultation it was clear that a name change to BCOR would better reflect the purpose of the registry.

Stated another way:

It is poorly understood that incidence registries do not measure outcomes of care, and indeed the health sector in general spends very little energy measuring the effect of care that is delivered.

This is the purpose of BCOR: to measure and report outcomes of treatment for bowel cancer across the entire disease spectrum, from screening and diagnosis to palliative care and everything in between, in a way that is meaningful to patients, clinicians and health services providers.

The initial goal of a developing health system is to capture the incidence of diseases with in the community. In Australia and New Zealand this problem was largely solved two generations ago by the emergence of cancer incidence registries. Following on from that the task was to implement effective treatment, and on this front much progress has been made.

The task of the current generation is then to measure the effectiveness and outcomes of that treatment to close the feedback loop, and it it **here that there is much work to be done.**

BCOR has been established as an independent entity, under the guidance of CSSANZ and partners as a public good, to deliver on the potential of aggregated data reported in a meaningful way, to both elevate the standards of care and guide patient, clinician and health service provider decision making.

ICORC Collaboration

BCOR is a founding member of the International Colorectal Cancer Outcomes Registry Collaboration and is working with ten partner countries to align data fields and develop collaborative research projects.

Argentina

Australia and New Zealand

Denmark

Norway

Sweden

Netherlands

United Kingdom

Italy

Contents

Foreword

In memory of Nicole Cooper 1984-2023

Nicole Cooper, beloved Wife of Tim, devoted Mother of Josh, BCCA/BCOR patient representative, BCOR founding Board Member and passionate and dedicated cancer patient advocate, passed away in January 2023 at the age of 38.

Nicole was diagnosed with metastatic colorectal cancer age 32 and devoted a phenomenal amount of time to advocacy and charitable work following that diagnosis. She placed her successful career in management consulting on hold to help drive improvements in cancer care in a myriad of ways. Nicole became one of the most well-known and respected cancer patient advocates in Australia.

Despite undergoing intensive treatment and facing multiple setbacks over six years of treatment, she continued her advocacy and charitable work while also mothering her son, Josh. Her energy, intellect and determination allowed her to drive connectivity across charitable organisations and government entities and raise awareness of the issues faced by patients with metastatic colorectal cancer through her substantial social media presence.

Nicole's advocacy and charitable contributions were numerous and impacted many lives. She served as an ambassador for Bowel Cancer Australia, and was a member of the Exercise and Cancer Advisory Committee of the Victorian Department of Health and Human Services. She was a consumer advocate for the Victorian Comprehensive Cancer Centre, the face of the Clinical Oncology Society of Australia's statement on Exercise and Cancer, and a director of the not-for-profit cancer and exercise charity, Ex-Med Cancer.

Her advocacy efforts extended to media appearances on Network 10's "Taboo" program and various interviews on ABC Breakfast, Channel 7, and Channel 9. Nicole was also the founder and host of the Impatient Podcast, where she interviewed guests covering various cancers and related topics.

Nicole's dedication and vision led to the integration and embedding of patient-centered care into the workflow of Yarra Oncology, which was awarded the annual Patient Central Award by Servier. She was also a member of the advisory committee for the Patient Voice Initiative and worked with Healthscope management to implement multidisciplinary cancer treatment in Knox Private Hospital.

But is with BCCA/BCOR that I best understood her capacity to effect change. The evolution of BCCA from a surgically focussed audit to a fully fledged disease based cancer outcomes registry (BCOR) would not have been possible if not for her efforts. The loss of her drive and expertise will be felt by all involved in BCOR.

Nicole will be deeply missed by her husband, Tim, and son, Josh, as well as by the countless lives she touched through her advocacy and charitable efforts.

May she rest in peace and continue to inspire future generations of clinicians, patients and healthcare providers to make a difference to bowel cancer outcomes through BCOR.

Phil Smart, BCOR Operations Committee Chair

From the President of the Colorectal Surgical Society of Australia and New Zealand

It is an important time in Australia and New Zealand as the Bi-National Colorectal Cancer Audit (BCCA) transitions to the Bowel Cancer Outcomes Registry (BCOR). The report remains an invaluable tool for clinicians to benchmark their practice to other surgeons and institutions in Australia and New Zealand and overseas. It has become increasingly apparent however, that the old format and governance of BCCA needs an update and a new model with governance and input beyond the CSSANZ and the Section of Colon and Rectal Surgery of RACS. This is necessary in order to make the Bowel Cancer Outcomes Registry a sustainable model which has relevance for all individuals caring for people with colorectal cancer but most importantly consumers themselves. Members of the Operations and Steering Committees for BCCA and the Council of CSSANZ have been working diligently to help create this report but also to finalise the BCOR governance structure which will enable effective fund raising. A new BCOR Board is due to commence imminently with diverse and effective representation. I would particularly like to thank Phil Smart, Sandy Heriot and Leticia Delmenico for their efforts in this area.

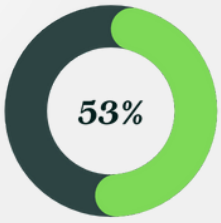
BCCA/BCOR continues to provide invaluable information and much work has been done recently in order to create data linkages internationally with other bowel cancer registries. The output of research projects using registry data continues to be impressive under the guidance of the Research Committee.

A lot of effort has gone into establishing the BCCA since 2007, and it is essential as we move forwards with BCOR, that we continue to improve catchment of colorectal cancer cases, refine data collection and improve the platform to ensure that this important source of information on colorectal cancer in Australia and New Zealand is increasingly complete and relevant to all involved.

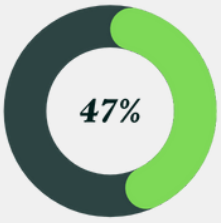
Dr Elizabeth Murphy
CSSANZ President

Overall

53,208 patients are in the registry



Male



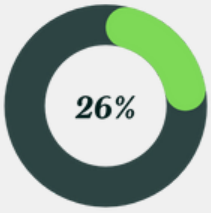
Female

1 in 10 under 50 yrs

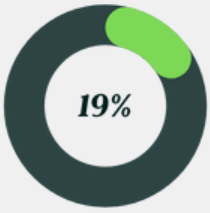
68 yrs Avg age

59% Stage II or III

10% Stage IV



<50yrs



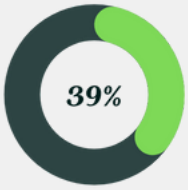
>50yrs

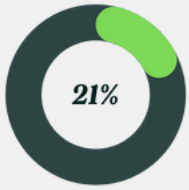
Younger patients more likely to present emergently

Bowel Cancer Screening

Screened patients more likely to have early stage cancer

Screened pts who have Stage I cancer





Non-screened pts who have Stage I cancer

Perioperative Care

7.8 days Avg LOS

5% Unplanned RTT

21% Surgical Complication

45% ASA >3

Rectal Cancer Treatment

40% patients had neoadjuvant therapy

Colon Cancer Treatment

72.5% Stage III pts given chemotherapy

Executive Summary

Audit Background

In 2022 further work was completed to build out the structure for the transition from BCCA to BCOR, via a new corporate entity, under the auspices of the CSSANZ.

This allows BCOR to function as a Deductible Gift Recipient (DGR) with the primary aim of progressing bowel cancer care and enabling tax deductibility for funding sources.

BCOR has established an in principle Board structure and is finalising updated governance and ethics documentation.

BCOR continues to broaden the parties involved in the registry to reflect the continuum of care, from diagnosis and screening to palliative care and end of life.

As the effect of COVID fades, there are promising developments in the Clinical Quality Registry (CQR) space both nationally and internationally. BCOR hopes to see a reduced regulatory burden for all CQRs. Acceptance of CQRs as a standardised aspect of clinical care rather than as 'research projects' with defined endpoints is required, along with sustainable ongoing funding and participation from all parties involved in bowel cancer care.

It would be fair to characterise the current BCOR database as out of date and this is reflected in reduced participation in the registry. Work continues on a upgraded platform with PROMs integration, with fields aligned with our international partners.

This foundational work, despite being labour intensive, aims to set BCOR up for automated data entry, real time reporting, and greatly enhanced value for patients, clinicians and health service payers and providers.

Key findings

Participation

- As of 31st December 2022 there were 53,208 patients registered representing an additional 4,140 patients since December 2021.
- The 4,102 patients represent 21.7% colorectal cancer diagnoses recorded binationally, lower than in previous year, due mainly to data entry being paused in Queensland by the Health Department.
- The majority of cases reported are from public hospitals (82%).

Demographics

- 53% of cases reported were males.
- The number of patients under age 50 at time of diagnosis was stable, representing 10% of the cohort in 2022.
- 44% of the cohort were classified as American Society of Anaesthesiologists (ASA) Classification 3 or greater. This is a small decrease from last year and opposing an ongoing trend within the audit. In 2012 this was 32%. These patients therefore present higher surgical risk.
- Stage distribution is similar to previous years, with stages II and III being present in the majority of patients at surgery. The number of patients with stage IV disease remains stable at 10%.
- The majority of cases were elective, with emergency cases and urgent cases numbers stable compared to last year. Patients with young-onset colorectal had a slightly higher rate of non-elective surgery (26%).

Screening

- Patients diagnosed following positive faecal occult blood test (FOBT) trended lower (15%) in the 2022 cohort compared to 2021 (16%) and 2019 (19%).
- FOBT screened patients had an earlier tumour stage.

Colorectal Cancer Management

- A minimally invasive surgical approach was utilised in almost 80% of colon cancer resections. This number is stable compared to prior years.
- The rate of open rectal cancers resection is stable 80% minimally invasive vs 20% open.
- Transanal total mesorectal excision (taTME) has dropped further in 2022, with less than 1% of cases utilising this technique.
- 81% of rectal cancer cases have a magnetic resonance imaging (MRI) but there is variability, with some volume centres using MRI in less than 50% of patients.
- 92% of patients were discussed in a multidisciplinary team meeting (MDT).
- More than half the patients with rectal cancer received neoadjuvant therapy, the majority receiving long course chemoradiotherapy. There was growth in the neoadjuvant treatment field 'Other.' BCOR currently does not capture total neoadjuvant therapy, though this field is to be added shortly.
- Utilisation of adjuvant therapy is high across stage III colon cancer patients of all ages, only reducing in patients aged over 80. Uptake is lower in stage II disease as expected; however, it is higher in patients under 50, reducing proportionately with increasing age.

Key findings

Colorectal Cancer Management (cont)

- The proportion of patients undergoing surgery for colon cancer experiencing one or more surgical complications was 17%. Fourteen percent of patients had one or more medical complication post-surgery.
- In rectal cancer the surgical complication rate was 26%.
- The anastomotic leak rate was 4% and would generally be considered consistent with good practice, albeit with caveats regarding reporting bias.

Clinical Quality Reporting

- For this 2022 data Annual Report, clinical quality indicators (CQIs) comprise the most recent 3 years of data only (2020-2022).
- Comparisons noted in this report are between 2019-2022 data and 2020-2022 data, unless otherwise stated.
- Inpatient mortality remains low at 1%. Inpatient mortality is lower in higher case volume hospitals.
- Return to theatre within 30 days is a broad indicator of significant complications related to surgery. The rate was 5% across the audit when risk adjusted, down from 6%.

Clinical Quality Reporting (cont)

- Length of stay (LOS) was 7.8 days. The mean LOS of patients undergoing colonic surgery was 7.4 days and rectal surgery 8.9 days. Factors that influence LOS include age, ASA, cancer type, operative urgency, age, overall stage and gender.
- The mean number of nodes retrieved per colonic resection was 21 for the period 2020-2022, and this number was stable.
- The permanent colostomy rate was 22%, similar to previously reported and consistent with international data.
- The rate of circumferential resection margin (CRM) involvement remains stable at 6%.
- The number of patients with an involved CRM was higher in the 2022 audit period 7% for those who received neoadjuvant therapy, and 6% for those who did not.

Introduction

Governance

BCOR is overseen by the BCOR (BCCA) Steering Committee in coordination with the Operations Committee.

Employment and financial management remain under the auspices of the CSSANZ Council. The Steering Committee is composed of senior clinicians and a consumer representative and is responsible for oversight of BCOR activities including that of the Operations Committee, providing ongoing review of objectives and effectiveness.

The Operations Committee is responsible for the day to day management of BCOR, developing quality measures and forming relevant subcommittees to address data access, research and quality issues.

The BCOR Research Committee was established in 2020 with the aim of guiding registry research, overseeing requests for data access and speeding research project approval.

BCOR (BCCA) has ethics approval in each jurisdiction in Australia and New Zealand, and governance approval from participating sites. Patients have the opportunity to opt out of the registry at any time. Governance documents are currently being transitioned across from BCCA to BCOR.

2022 Data analyses

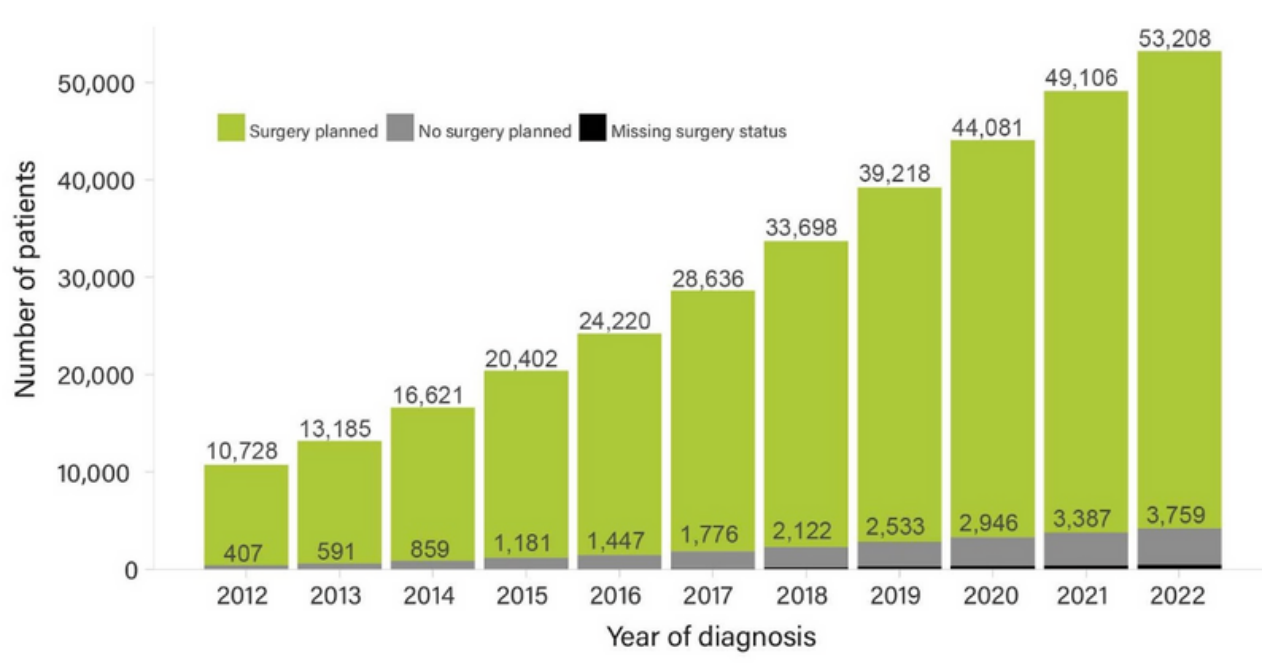
Unless stated otherwise, analyses were undertaken on patients diagnosed with colorectal cancer between 1 January 2022 and 31 December 2022. Throughout the report, analyses were undertaken where complete data was available unless otherwise stated. Where deemed relevant, sections include details about how many treatment episodes (TE) (as opposed to patients) were included in the analysis. Three-year (2020 - 2022) data was used to generate funnel plots to ensure statistical power and relevance. A funnel plot is a visual representation of individual units compared to their peers and the overall average; it also identifies those who are performing better or worse than the average. The funnel plot contours represent two standard deviations (95% control limits) and three standard deviations (99.8% control limits) from the mean. Those above and below these lines are considered outliers, with a 5% and 0.2% chance of a false positive. All units with <10 operations were grouped in a single group (labelled group ZZ). For the 120 units analysed, the median number of operations was 58 (mean 110, SD 133). Some funnel plots present unadjusted crude data, while others (where noted) are risk-adjusted. Risk-adjustment considers differences in patient-level risk-factors and enables adjustment for confounding variables which are beyond the control of the surgeon or healthcare system. The risk-adjustment models were revised in January 2023. Variables used in the risk adjustment model are noted under each graph. Statistical modelling including the likelihood ratio test was used to identify multivariate and independently significant risk factors. A separate category for missing data was created and included in the model. Units with less than 20% of complete data on endpoint and/or risk factors were not included in the risk adjusted funnel plots.

1. Participation

Cumulative participation (2011-2022)

In 2022, 4,102 new patients were added, accounting for 21.7% of patients diagnosed with bowel cancer in Australia and New Zealand (1-2). These include patients undergoing surgery and some who have been treated non-operatively. This is a similar number of patients compared to the numbers reported in the 2021 report (3). Whilst over 4000 patients' details are being entered on the registry each year, this accounts for a smaller percentage of the total number of patients with colorectal cancer than in previous years. The reasons for this are multifactorial, with a slight reduction in the total number of colorectal cancers being diagnosed, the impact of COVID on presentations and reductions in numbers of cases registered from some institutions all contributing. Increasing case registration is one of the most pressing challenges facing the registry and BCOR will be looking to automate these processes wherever possible going forward.

Figure 1. Cumulative BCOR patient entry



Annual participation (2011-2022)

Figure 2. Proportion of patients captured

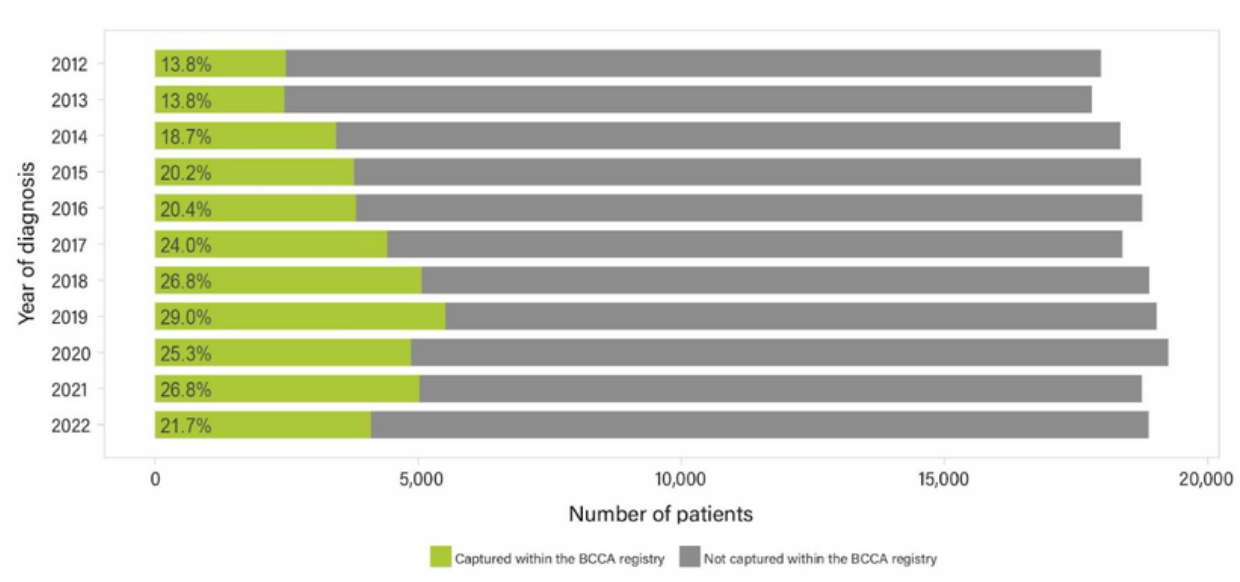


Figure 3. Patients added per year (due to ongoing retrospective data entry at some sites, current year is always lower at census date)

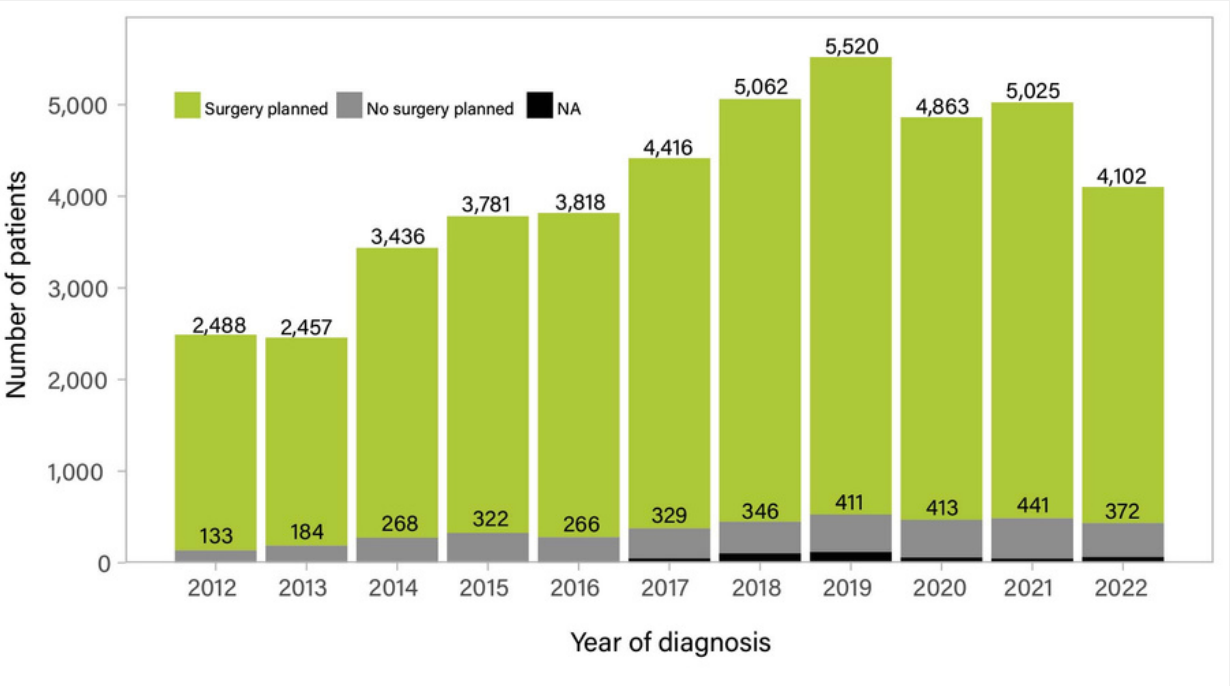


Table 1. Reasons for non-operative management

Reason for no surgery	Count	Percentage
Stage IV	119	31%
Other	78	21%
Medically unfit	55	15%
Polypectomy	52	14%
Watch and wait	26	7%
Patient declined	24	6%
Advanced age	10	3%
Unknown	7	2%
Unresectable	6	2%
Doctor's discretion	1	0%
Total	378	101%

Reason for no surgery total exceeds 100% due to rounding error.

Three hundred and seventy-eight patients (9%) of the patients diagnosed in 2022 did not have surgery planned (Table 1). Reasons included patients having stage IV cancer (n=119, 31%), patients deemed medically unfit for surgery (n=55, 15%), and polypectomy (n=52, 14%). Twenty-four (6%) patients declined surgery. Twenty-six (7%) were entered into a 'watch and wait' approach.

Participation by jurisdiction (2022)

Victoria and New Zealand reported the highest volume participation in 2022 followed by New South Wales, South Australia, Queensland and Western Australia (Table 2). Across both countries, 82% of participating cases were from public hospitals (98% for New Zealand, and 74% for Australia). This is a much greater proportion of public sector participation than occurs in practice, reflecting mandatory CSSANZ trainee input to the registry. A future focus of BCCA is identification and recruitment of private sector health services, though funding data entry at these sites remains a challenge.

Table 2. BCOR participation by jurisdiction and public/private hospital (2022)

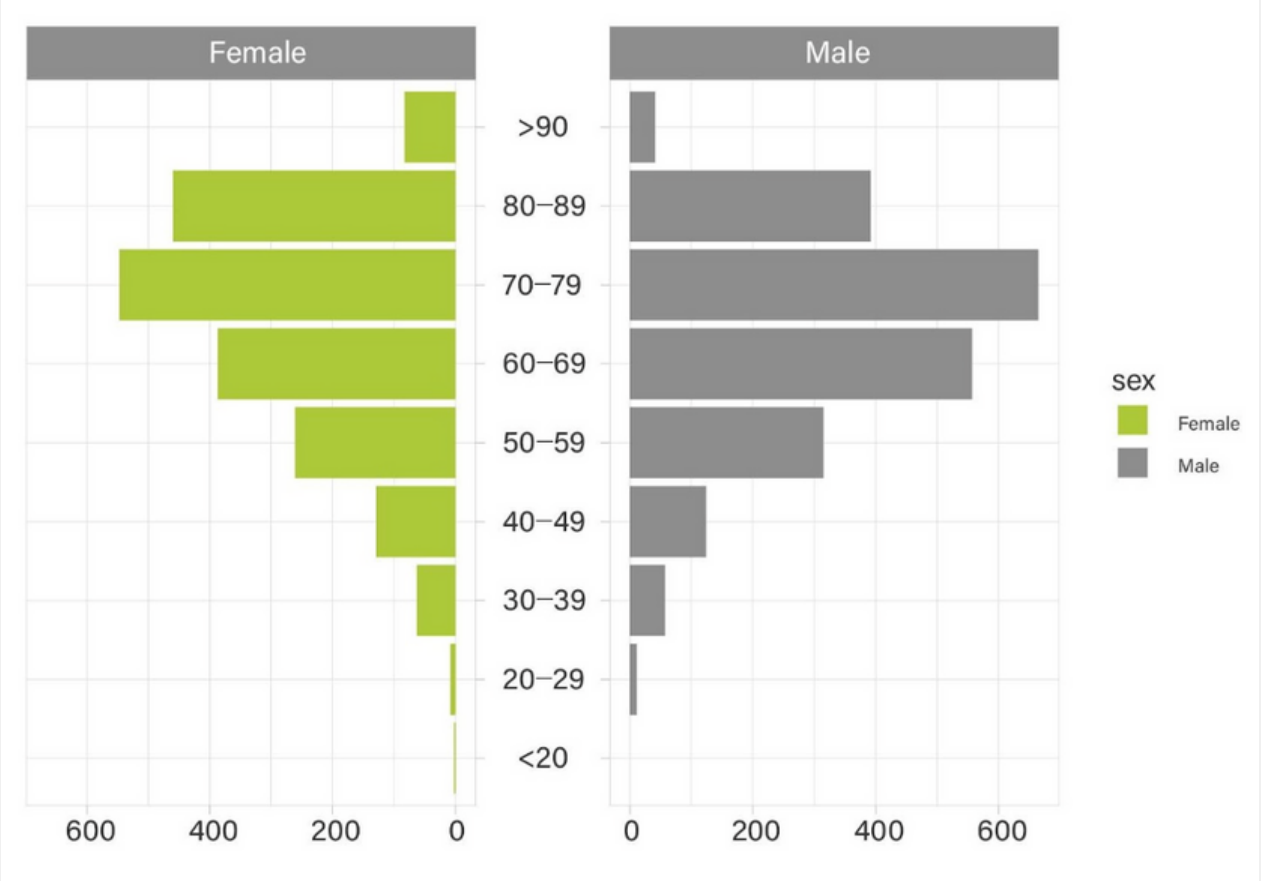
	Hospital	Count	Percentage
NSW	Private	119	16%
	Public	606	84%
NZ	Private	24	2%
	Public	1272	98%
QLD	Private	143	42%
	Public	200	58%
SA	Private	110	19%
	Public	471	81%
TAS	Private	22	56%
	Public	17	44%
VIC	Private	275	30%
	Public	633	70%
WA	Private	48	23%
	Public	162	77%

2. Demographics

Age and gender characteristics

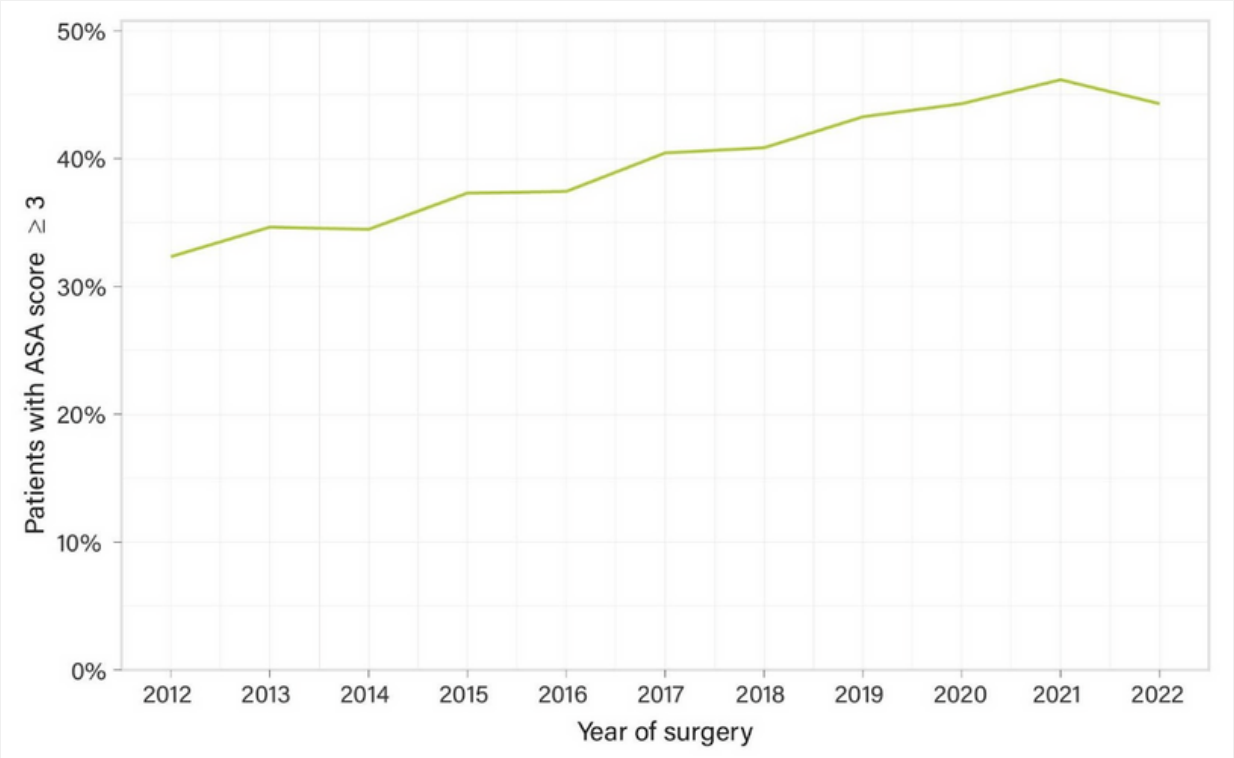
Figure 4 shows the number of patients across various age categories diagnosed with colorectal cancer according to gender in 2022. The majority of patients were diagnosed between the ages 60-89 years old. The distribution of colorectal cancer according to gender remains about equal with 47% females. The mean age of diagnosis was also about the same for both genders (69.4 years female, 67.9 years male).

Figure 4. Age and gender of patients at the time of colorectal cancer diagnosis



ASA status

Figure 5. Patients with ASA ≥3 at the time of surgery



The American Society of Anaesthesiologist (ASA) classification system defines ASA 3 as a patient with 'severe systemic disease'. Examples of ASA 3 include 1 or more diseases such as obesity (BMI >=40), poorly controlled hypertension, diabetes and ischaemic heart disease (4).

Figure 5 shows that over the last 10 years the proportion of patients with at least ASA 3 has increased. 44.2% of patients who had surgery were classified as ASA 3 or greater in 2022. An aging population and increasing incidence of co-morbidities specifically obesity probably accounts for this finding.

Figure 6. Patients under 50 years old at the time of colorectal cancer diagnosis

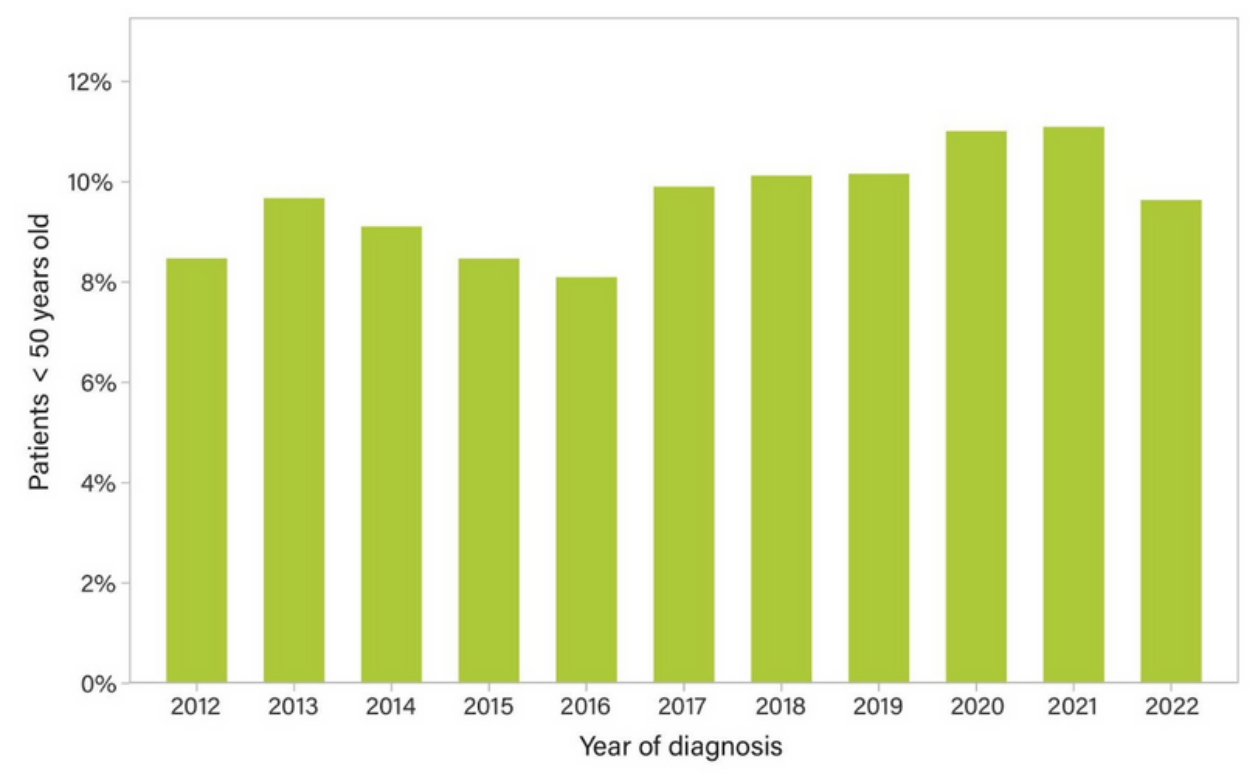


Figure 6 shows the incidence of young-onset colorectal cancer defined as patients diagnosed aged under 50 years old. In 2022, 9.6% of patients were younger than 50 years compared to 11.1% in 2021. This small decrease may be due to lack of access to medical care during the COVID pandemic and an increase in incidence with potentially advanced disease may be seen in subsequent reports.

Primary tumour location

The distribution of primary tumour location is shown in Table 3. The percentages are similar to previous reports. Around 30% of patients have tumours in the rectum or rectosigmoid.

Table 3. Primary tumour location of colorectal cancer patients who received surgical treatment in 2022

Tumour site	Count	Percentage
Ascending colon	629	15%
Caecum	539	13%
Descending colon	148	4%
Hepatic flexure	233	6%
Rectosigmoid	254	6%
Rectum lower third	485	12%
Rectum mid third	323	8%
Rectum upper third	182	4%
Sigmoid colon	809	20%
Splenic flexure	117	3%
Transverse colon	366	9%
Unknown	27	1%
Total	4,112	100%

Colon and rectal cancer profiles

The incidence of rectal cancer was higher amongst patients aged 64 years and younger compared to older patients. Similar to last year, 64.5% of patients with rectal cancer were females. The rates of colon cancer were similar between genders. In the very elderly (aged 85+ years) the majority of surgery was for colon cancer (86.5%). Table 4 also details the incidence of cancer staging. The rates are similar to 2021. Of note the incidence of metastatic disease for colon cancer was slightly higher than for rectal cancer (11.1% vs 6.6%).

Table 4. Demographic and tumour stage information for colon and rectal cancers

	Colon, N=3,095	Rectal, N=990	Overall, N=4,085
Sex			
Female	1,539 (49.7%)	639 (64.5%)	2,178 (53.3%)
Male	1,556 (50.3%)	351 (35.5%)	1,907 (46.7%)
Age at diagnosis			
<50 yrs	275 (8.9%)	123 (12.4%)	398 (9.7%)
50-64 yrs	707 (22.8%)	336 (33.9%)	1,043 (25.5%)
65-74 yrs	862 (27.9%)	305 (30.8%)	1,167 (28.6%)
75-84 yrs	900 (29.1%)	171 (17.3%)	1,071 (26.2%)
85+ yrs	351 (11.3%)	55 (5.6%)	406 (9.9%)
T stage			
T0	59 (2.0%)	74 (7.7%)	133 (3.3%)
Tis	339 (11.2%)	154 (16.0%)	493 (12.4%)
T1	387 (12.8%)	223 (23.2%)	610 (15.3%)
T2	1,329 (44.0%)	357 (37.2%)	1,686 (42.4%)
T3	764 (25.3%)	73 (7.6%)	837 (21.0%)
T4	127 (4.2%)	76 (7.9%)	203 (5.1%)
TX	14 (0.5%)	3 (0.3%)	17 (0.4%)
Unknown	76	30	106
N stage			
N0	1,737 (57.6%)	561 (59.2%)	2,298 (58.0%)
N1	760 (25.2%)	217 (22.9%)	977 (24.7%)
N2	405 (13.4%)	69 (7.3%)	474 (12.0%)
NX	112 (3.7%)	100 (10.6%)	212 (5.4%)
Unknown	81	43	124

Table 4 (cont). Demographic and tumour stage information for colon and rectal cancers

	Colon, N=3,095	Rectal, N=990	Overall, N=4,085
M stage			
M0	2,078 (69.1%)	694 (72.5%)	2,772 (69.9%)
M1	334 (11.1%)	63 (6.6%)	397 (10.0%)
MX	594 (19.8%)	200 (20.9%)	794 (20.0%)
Unknown	89	33	122
Overall stage*			
0	70 (2.3%)	68 (7.1%)	138 (3.5%)
I	602 (20.0%)	299 (31.2%)	901 (22.7%)
II	991 (33.0%)	208 (21.7%)	1,199 (30.3%)
III	899 (29.9%)	250 (26.1%)	1,149 (29.0%)
IV	334 (11.1%)	63 (6.6%)	397 (10.0%)
X	109 (3.6%)	69 (7.2%)	178 (4.5%)
Unknown	90	33	123
ASA score			
1	171 (5.7%)	60 (6.2%)	231 (5.8%)
2	1,396 (46.4%)	523 (53.8%)	1,919 (48.2%)
3	1,304 (43.3%)	359 (36.9%)	1,663 (41.8%)
4	133 (4.4%)	30 (3.1%)	163 (4.1%)
5	5 (0.2%)	0 (0.0%)	5 (0.1%)
Unknown	86	18	104
80 patients excluded due to missing cancer type			

*Stage according to the American Joint Committee on Cancer (AJCC) staging system (5).

Urgency of hospital admission

In 2022, the majority of colorectal surgery (80%) was performed electively and although this is similar to 2021 the overall rate is decreasing over time. Patients with young-onset colorectal had a slightly higher rate of non-elective surgery (26%). Other factors associated with higher rates of non-elective surgery include right sided colon cancer and metastatic cancer. Further details on urgency of hospital admission are shown in Table 5.

Table 5. Description by urgency of hospital admission

	Elective N=3,337	Urgent N=347	Emergency N=472	Overall N=4,156)
Sex				
Female	1,776 (53.2%)	181 (52.2%)	255 (54.0%)	2,212 (53.2%)
Male	1,561 (46.8%)	166 (47.8%)	217 (46.0%)	1,944 (46.8%)
Age at diagnosis				
<50 yrs	303 (9.1%)	44 (12.7%)	60 (12.7%)	407 (9.8%)
50-64 yrs	867 (26.0%)	78 (22.5%)	118 (25.0%)	1,063 (25.6%)
65-74 yrs	986 (29.5%)	94 (27.1%)	112 (23.7%)	1,192 (28.7%)
75-84 yrs	883 (26.5%)	84 (24.2%)	117 (24.8%)	1,084 (26.1%)
85+ yrs	298 (8.9%)	47 (13.5%)	65 (13.8%)	410 (9.9%)
Cancer site				
Caecum/ascending colon	931 (34.8%)	101 (38.0%)	128 (41.0%)	1,160 (35.6%)
Hepatic flexure	182 (6.8%)	16 (6.0%)	33 (10.6%)	231 (7.1%)
Transverse colon	274 (10.2%)	54 (20.3%)	36 (11.5%)	364 (11.2%)
Splenic flexure/descending colon	171 (6.4%)	38 (14.3%)	55 (17.6%)	264 (8.1%)
Rectosigmoid	195 (7.3%)	26 (9.8%)	32 (10.3%)	253 (7.8%)
Rectal	926 (34.6%)	31 (11.7%)	28 (9.0%)	985 (30.2%)
Unknown	658	81	160	899
T stage				
T0	132 (4.1%)	4 (1.2%)	1 (0.2%)	137 (3.4%)
Tis	464 (14.4%)	19 (5.6%)	9 (1.9%)	492 (12.2%)
T1	567 (17.6%)	32 (9.4%)	9 (1.9%)	608 (15.1%)
T2	1,397 (43.3%)	132 (38.7%)	168 (36.3%)	1,697 (42.1%)
T3	482 (14.9%)	143 (41.9%)	234 (50.5%)	859 (21.3%)
T4	167 (5.2%)	11 (3.2%)	42 (9.1%)	220 (5.5%)
TX	17 (0.5%)	0 (0.0%)	0 (0.0%)	17 (0.4%)
Unknown	111	6	9	126

Table 5 (cont). Description by urgency of hospital admission

	Elective N=3,337	Urgent N=347	Emergency N=472	Overall N=4,156)
N stage				
N0	1,976 (61.6%)	163 (47.8%)	182 (39.5%)	2,321 (57.9%)
N1	741 (23.1%)	98 (28.7%)	141 (30.6%)	980 (24.4%)
N2	317 (9.9%)	66 (19.4%)	94 (20.4%)	477 (11.9%)
NX	174 (5.4%)	14 (4.1%)	44 (9.5%)	232 (5.8%)
Unknown	129	6	11	146
M stage				
M0	2,386 (74.2%)	210 (61.8%)	195 (42.4%)	2,791 (69.5%)
M1	240 (7.5%)	65 (19.1%)	104 (22.6%)	409 (10.2%)
MX	588 (18.3%)	65 (19.1%)	161 (35.0%)	814 (20.3%)
Unknown	123	7	12	142
Overall stage*				
0	136 (4.2%)	5 (1.5%)	2 (0.4%)	143 (3.6%)
I	845 (26.3%)	41 (12.1%)	16 (3.5%)	902 (22.5%)
II	957 (29.8%)	115 (33.8%)	148 (32.2%)	1,220 (30.4%)
III	887 (27.6%)	107 (31.5%)	155 (33.7%)	1,149 (28.6%)
IV	240 (7.5%)	65 (19.1%)	104 (22.6%)	409 (10.2%)
X	148 (4.6%)	7 (2.1%)	35 (7.6%)	190 (4.7%)
Unknown	124	7	12	143
ASA score				
1	194 (5.9%)	21 (6.8%)	17 (3.7%)	232 (5.7%)
2	1,673 (50.9%)	126 (40.5%)	162 (35.3%)	1,961 (48.3%)
3	1,334 (40.6%)	139 (44.7%)	220 (47.9%)	1,693 (41.7%)
4	85 (2.6%)	24 (7.7%)	56 (12.2%)	165 (4.1%)
5	0 (0.0%)	1 (0.3%)	4 (0.9%)	5 (0.1%)
Unknown	51	36	13	100
49 patients excluded due to missing operative urgency				

3. Screened vs. non-NBCSP screened cancers

Screening (testing of asymptomatic persons) for colorectal cancer using the Faecal Occult Blood Test (FOBT) was introduced in Australia in 2006, after an initial pilot study between 2002 and 2004. There has been an incremental rollout of the National Bowel Cancer Screening program (NBCSP) which is now complete, and invites all Australians aged 50-74 to complete screening biannually. Australians between 50 and 74 years of age at average risk and without symptoms are mailed an immunological FOBT every 2 years, equating to approximately 5 million Australians screened per year.

The latest Australian National Bowel Cancer Screening Program Monitoring report was published in October 2022. Since the program began in August 2006, around 9.2 million NBCSP screening tests have been completed. Of the 5.8 million people invited to screen between January 2019 and December 2020, 43.8% participated, which has improved marginally from the previous two years (1). For this reporting period, of those assessed after a positive screen, 1 in 95 were diagnosed with a confirmed or suspected cancer and 1 in 20 were diagnosed with an adenoma (1).

In New Zealand, a pilot program was carried out by the Waitemata District Health Board between 2011 and 2017. Now completed, the new National Bowel Screening Programme (NBSP), commenced a staged rollout across all health boards for eligible New Zealanders aged 60 to 74 in January 2018. The New Zealand National program is in its infancy, but predictions based on the pilot program are estimating a 7% positivity rate at full rolled out with initial detection of about 500-700 cancers each year. The program currently invites about 835,000 people for FOBT screening every 2 years (6).

A subset of patients from each national screening program are submitted to BCOR thus the data presented below includes patients from bowel cancer screening programs in both Australia and New Zealand. It includes patients who have had screening tests outside of the screening programs, and patients who were diagnosed without screening.

The proportion of patients diagnosed following FOBT has increased from 12% in 2012 to 19% in 2019 (Table 6). However, this has been falling in the last two years with only 15% of patients diagnosed with cancer following an FOBT in 2022. It is hoped this percentage will increase as the screening programs in both countries mature, and efforts to improve screening compliance remain important.

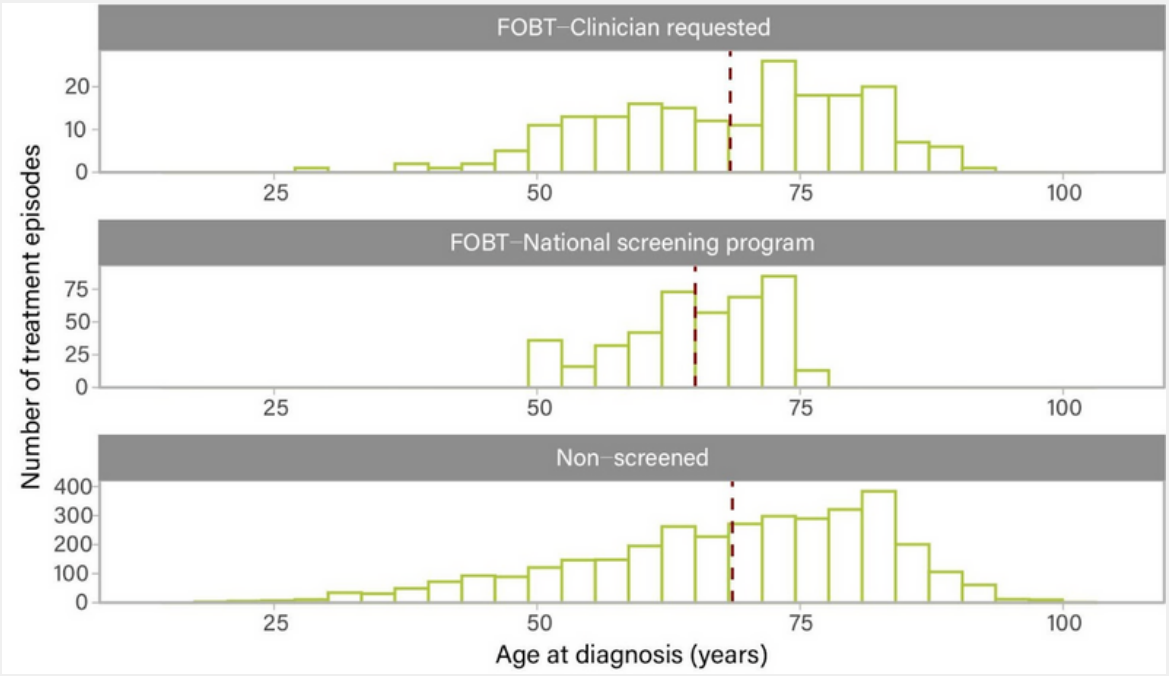
Table 6. Cumulative incidence and proportion of patients diagnosed by FOBT

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Diagnosed following FOBT	12%	11%	12%	11%	15%	15%	18%	19%	17%	16%	15%
Count	1,445	1,897	2,733	3,155	3,204	3,745	4,339	4,742	4,279	4,412	3,501

Characteristics of patients diagnosed by screening vs symptoms

Mean age at diagnosis is earlier for patients participating in the NBCSP (65.0 years), than for those screened outside of the program (68.4 years) or for those diagnosed without screening (68.6 years) (Figure 7).

Figure 7. Age distribution of screened vs non FOBT-screened patients



(Vertical dashed line represents average)

Efficacy of FOBT screening

Differences between proportion of tumour stages across two screening categories (national FOBT screening program versus non-national FOBT-screened colorectal cancer) was tested using the Chi-square goodness of fit (Table 7).

Further analyses showed that there were statistically significant differences in the tumour stage proportions when comparing "FOBT-national screening program" group with "non-screened" group, "FOBT-national screening program" group with "FOBT-clinician requested" group, and "FOBT-clinician requested" with "non-screened" group.

The data here once again shows earlier stage cancers when patients are diagnosed via the National Bowel Cancer screening programs (Stage I – FOBT (NBCSP) 35.7% vs Non-screened 18.8%). This is compared to a higher rate of late stage cancers in non-screened patients (Stage IV - FOBT (NBCSP) 4.7% vs Non-screened 11.0%).

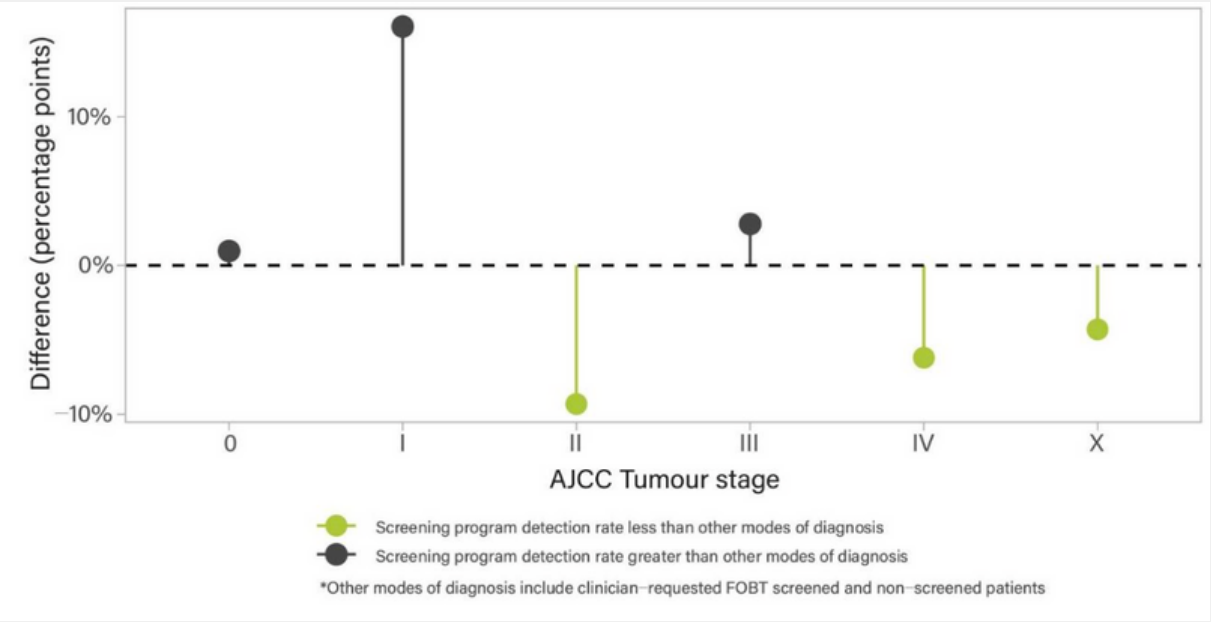
Table 7. Tumour stage of patients diagnosed with colorectal cancer by the national FOBT screening program vs non-screened (2022)

	FOBT-Clinician requested	FOBT-National screening program	Non-screened	Unknown	Total	p value*
AJCC tumour stage						< 0.001
0	9 (4.5%)	18 (4.3%)	110 (3.2%)	6 (4.5%)	143 (3.4%)	
I	70 (35.4%)	151 (35.7%)	650 (18.8%)	36 (27.3%)	907 (21.6%)	
II	59 (29.8%)	91 (21.5%)	1,042 (30.2%)	33 (25.0%)	1,225 (29.1%)	
III	42 (21.2%)	129 (30.5%)	957 (27.7%)	29 (22.0%)	1,157 (27.5%)	
IV	10 (5.1%)	20 (4.7%)	378 (11.0%)	3 (2.3%)	411 (9.8%)	
X	4 (2.0%)	4 (0.9%)	181 (5.2%)	1 (0.8%)	190 (4.5%)	
Unknown	4 (2.0%)	10 (2.4%)	134 (3.9%)	24 (18.2%)	172 (4.1%)	
	198 (4.7%)	423 (10.1%)	3,452 (82.1%)	132 (3.1%)	4,205 (100%)	

*Pearson's Chi-squared test

Figure 8 illustrates the differences between the proportion of patients in the two screening categories (national FOBT screening program versus non-national FOBT-screened colorectal cancers) across different tumour stages. A positive value represents a higher proportion of patients in the national FOBT screening program compared with the other. Cancers diagnosed at the stage I were more than 15% higher in the national FOBT screening program.

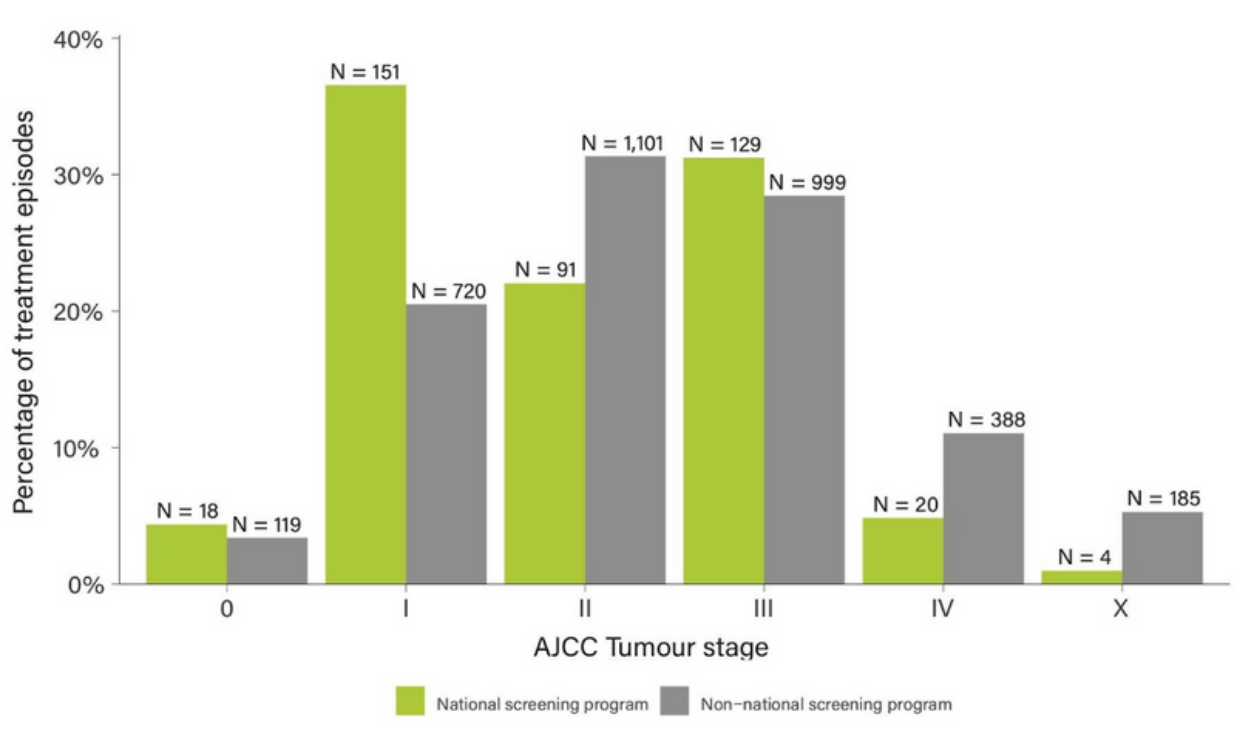
Figure 8. Difference in proportion of colorectal cancer patients diagnosed in the national FOBT screening program and outside the national FOBT screening programs (2022)



Cancer stage

Patients diagnosed via the NBCSP are at an earlier stage than non-screened patients (Figure 9). Diagnosis at an earlier stage has been shown to be associated with reduced colorectal cancer related mortality (7,8). This is highlights the significant value of the NBCSP and its role in improving survival from colorectal cancer.

Figure 9. NBCSP patients vs unscreened patients by cancer stage. Early stage diagnosis is strongly linked to improved survival



4. Management

Surgery is the primary treatment modality for most patients treated for colorectal cancer treated with curative intent, however, a significant proportion of rectal cancer patients also require preoperative neoadjuvant treatment. This section is divided into the following headings.

4.1. Colon cancer

- Primary procedure
- Operative approach
- Adjuvant therapy

4.2. Rectal cancer

- MRI utilisation
- MDT discussion
- Neoadjuvant therapy
- Primary procedure
- Operative approach

4.1 Colon cancer

Primary procedures for colon cancer

Right hemicolectomy remains the most commonly performed surgical procedure for colon cancer, accounting for 49% of operations (Table 8). The majority of sigmoid colon cancers are managed with a high anterior resection with a small number of sigmoid colectomies reported.

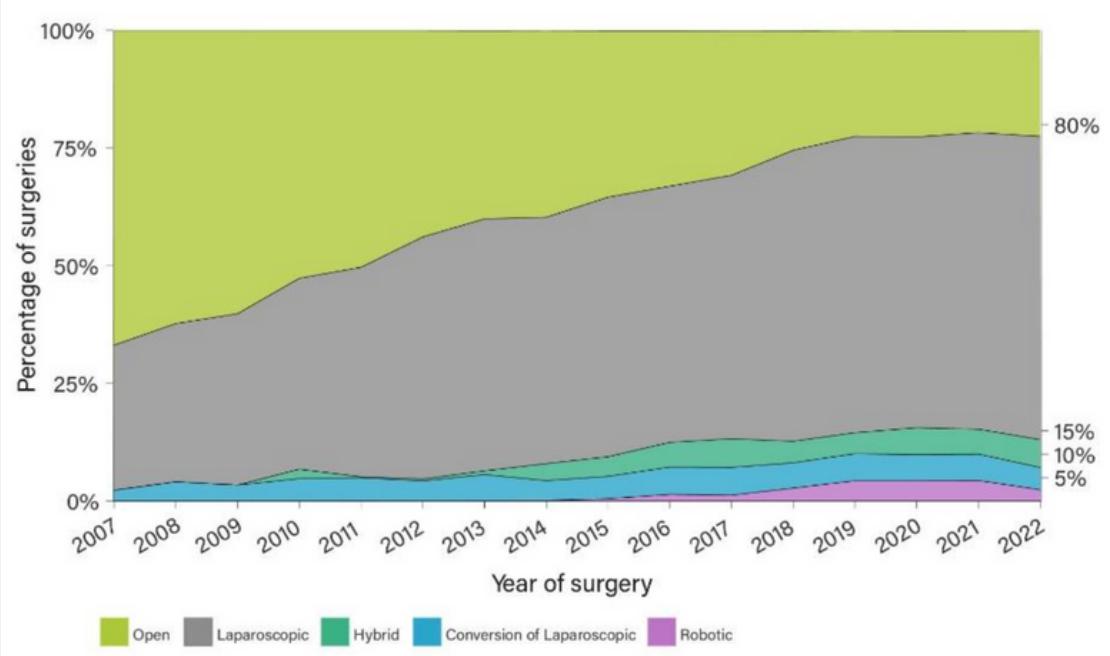
Table 8. Primary procedure for colon cancer patients who received surgical treatment in 2022

Operation	Count	Percentage
Right hemicolectomy	1,350	49%
Extended right hemicolectomy	235	9%
Left hemicolectomy	173	6%
Sigmoid colectomy	42	2%
Total colectomy	29	1%
Sub total colectomy	103	4%
Proctocolectomy	14	1%
High anterior resection (10.1-15 cm)	694	25%
Transverse colectomy	47	2%
Laparotomy	1	<1%
Other	47	2%
Total	2,735	100%

Operative approach for colon cancer

The adoption of minimally invasive surgery (MIS) for colon cancer has stabilised after several years of progressive increases in adoption (Figure 10). This is likely due to MIS techniques reaching maturity, and increased recognition that technique selection should be targeted and tailored to patient and disease presentation.

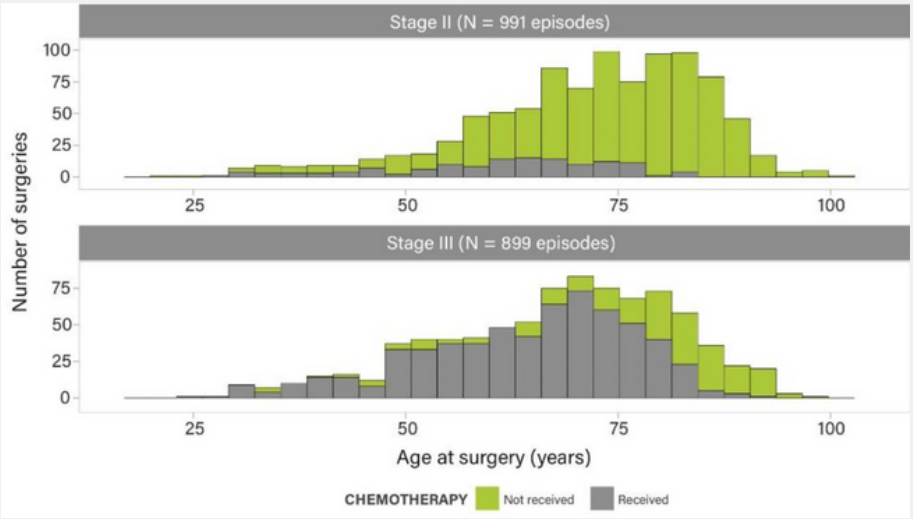
Figure 10. Operative approach for colon cancer patients who received surgical treatment



Adjuvant therapy for colon cancer

Adjuvant therapy with chemotherapy is an important component of the management of patients with advanced colorectal cancer. It is not required in all patients but is often recommended in colon cancer patients with stage III disease and in selected patients with high-risk stage II disease. The decision is usually made following resection of the primary tumour when the histology is available. Figure 11 demonstrates adjuvant therapy utilisation in colon cancer patients with stage II and stage III disease.

Figure 11. Age distribution of stage II and stage III colon cancer patients who received surgical treatment in 2022, stratified by chemotherapy treatment status



4.2 Rectal cancer

Management of rectal cancer is frequently multimodal and requires multidisciplinary input, including preoperative chemoradiation in a significant percentage of patients. Quality indicators for treatment of rectal cancer include preoperative imaging with MRI to allow preoperative assessment of patients for neoadjuvant treatment, and discussion at multidisciplinary team (MDT) meetings. With complexity of rectal cancer treatment increasing, it is now reasonable to expect the standard of care is for all rectal cancers to have an MRI and MDT discussion.

Figures 12 - 14 and Table 9 demonstrates that most patients are appropriately preoperatively staged using either MRI and are discussed at MDT, however there is still room for improvement, with some low volume centres still having MDT discussion rates of 50% or less (Figure 14).

MRI utilisation

Figure 12. Proportion of patients with rectal cancer staged with MRI

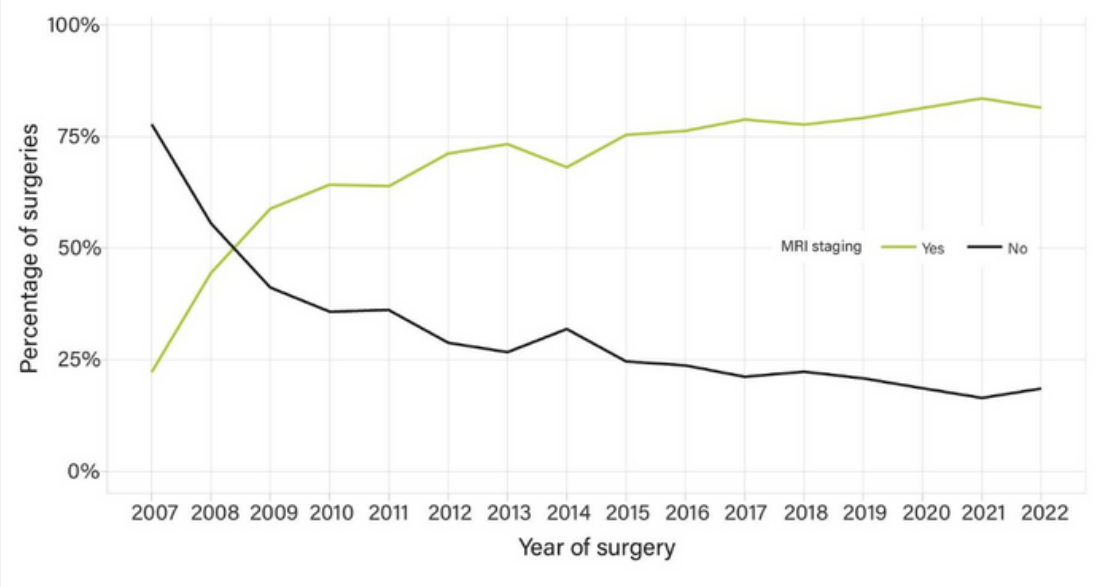
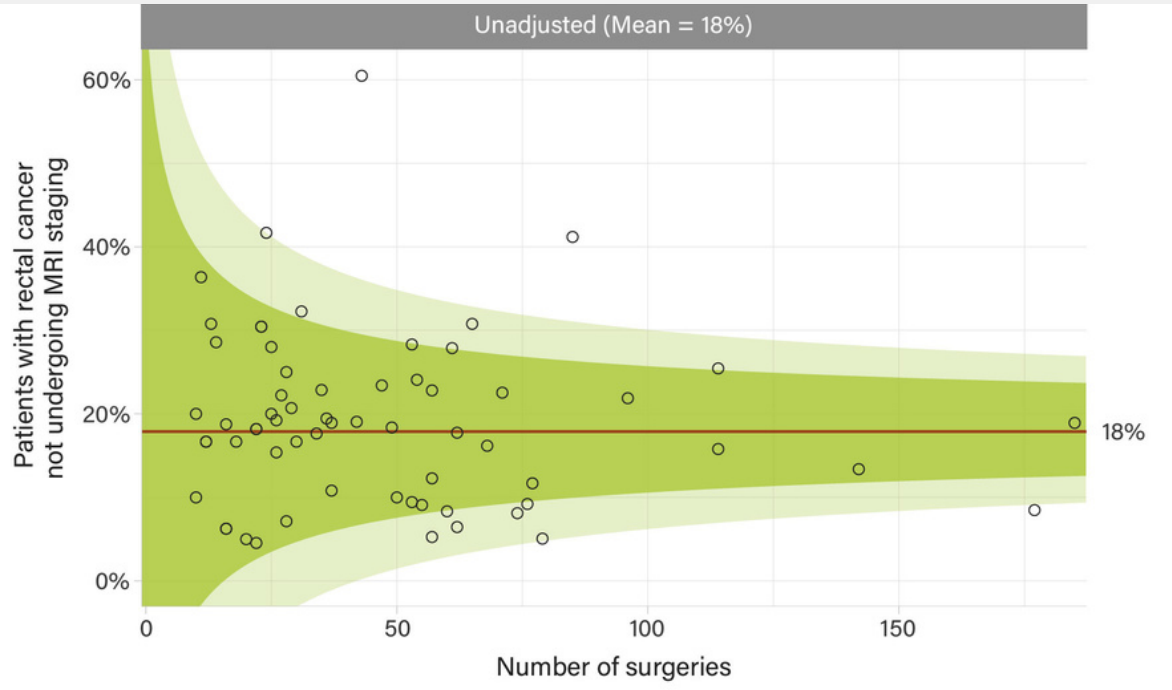


Figure 13. Proportion of rectal cancer patients who received surgical treatment, but were not staged using MRI (2020 - 2022, by site)



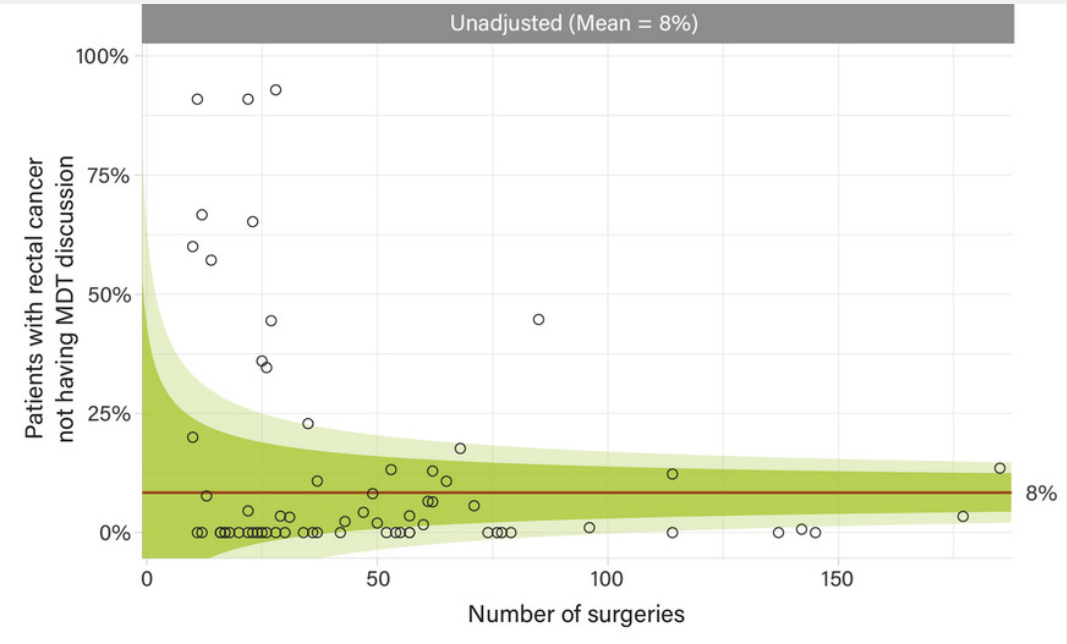
Shaded areas represent 95 and 99.8% control limits.

MDT discussion

Table 9. Patients with rectal cancer discussed at MDT

Discussed at MDT	Count	Percentage
Yes	901	92%
No	75	8%
N/A	5	1%
Total	981	100%

Figure 14. Rate of rectal cancer patients who received surgical treatment not discussed at MDT (2020 - 2022, by site)

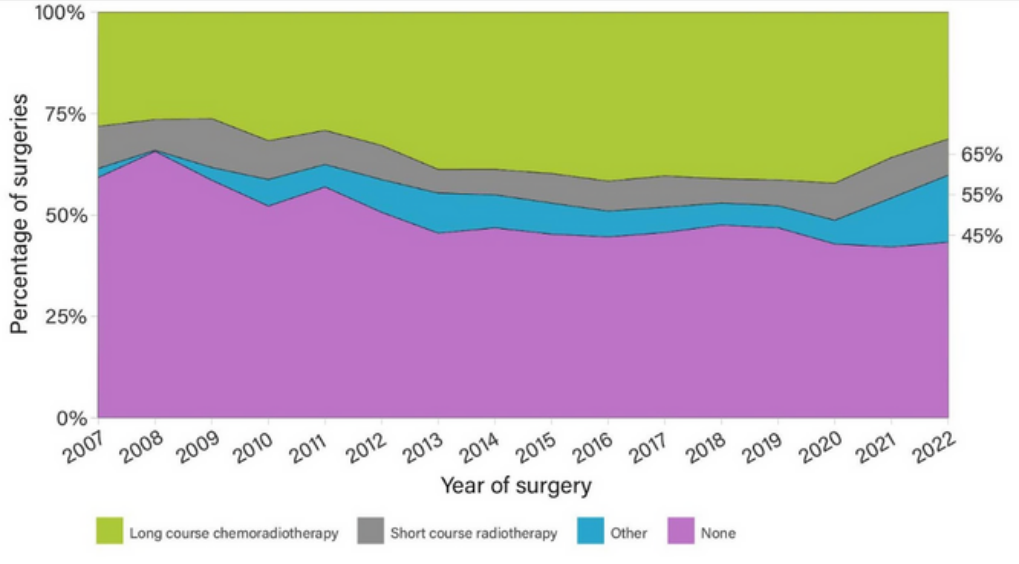


Shaded areas represent 95 and 99.8% control limits.

Neoadjuvant therapy

Figure 15 demonstrates that the number of patients with rectal cancer receiving neoadjuvant therapy is steadily increasing. This graph includes all patients presenting with rectal cancer, even those with high rectal cancer and patients with early-stage disease, for whom neoadjuvant treatment is not typically indicated. The most common regimen remains long course chemoradiotherapy. There is increasing use of total neoadjuvant chemo radiotherapy (TNT), captured in the blue in figure 15. TNT is often used for more advanced tumours, and tumours that would require an abdominoperineal resection with permanent stoma. This is resulting in up to 20% not needing surgery after a complete response. This registry however primarily captures cases with a surgical event.

Figure 15. Neoadjuvant therapy in rectal cancer



Primary procedures for rectal cancer

Ultra low anterior resection remains the most commonly performed surgical procedure for rectal cancer, accounting for 39% of all operations (Table 10).

Table 10. Primary procedure for rectal cancer patients who received surgical treatment in 2022

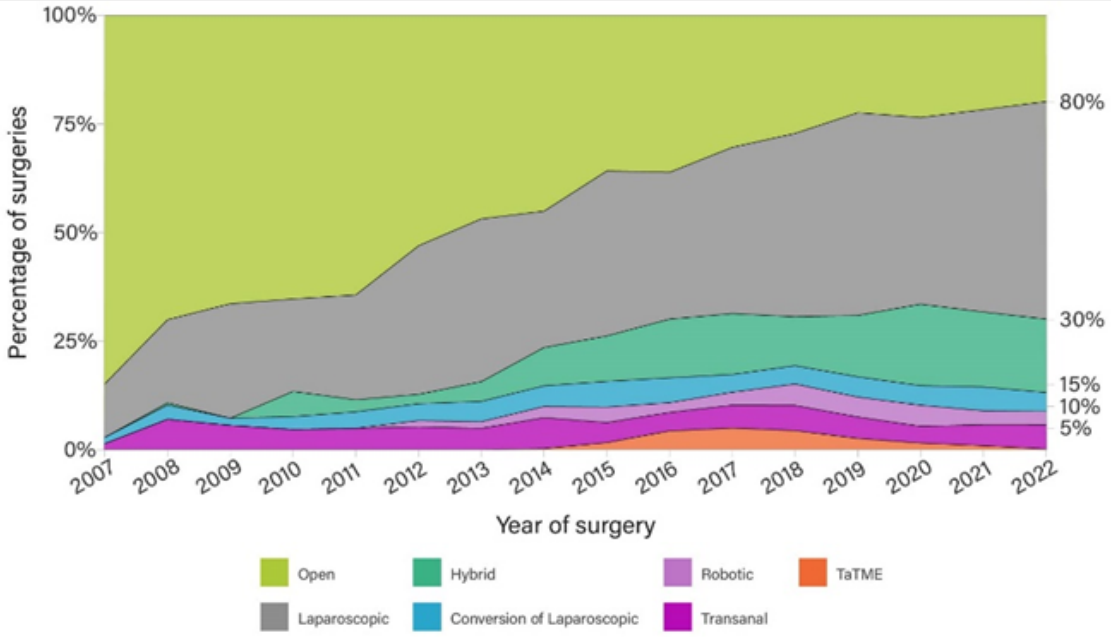
Operation	Count	Percentage
Ultra low anterior resection (0-6 cm)	342	35%
APR	205	21%
Low anterior resection (6.1-10 cm)	199	20%
High anterior resection (10.1-15 cm)	76	8%
Other	42	4%
Hartmanns	38	4%
TEMS/TAMIS	38	4%
Local excision	18	2%
Proctocolectomy	10	1%
Colo-anal anastomosis	8	1%
Laparotomy	1	<1%
Total	977	100%

*APR (abdominoperineal resection); TEMS (transanal endoscopic microsurgery); TAMIS (transanal minimally invasive surgery)

Operative approach for rectal cancer

The adoption of minimally invasive surgery (MIS) for rectal cancer has stabilised, after several years of progressive increases in adoption(Figure 16). Robotic resection remains stable but the use of transanal total mesorectal excision (taTME) is falling off with no cases recorded in 2022. MIS techniques are reaching maturity, with an increased recognition that technique selection should be targeted and tailored to patient and disease presentation.

Figure 16. Operative approach for rectal cancer patients who received surgical treatment



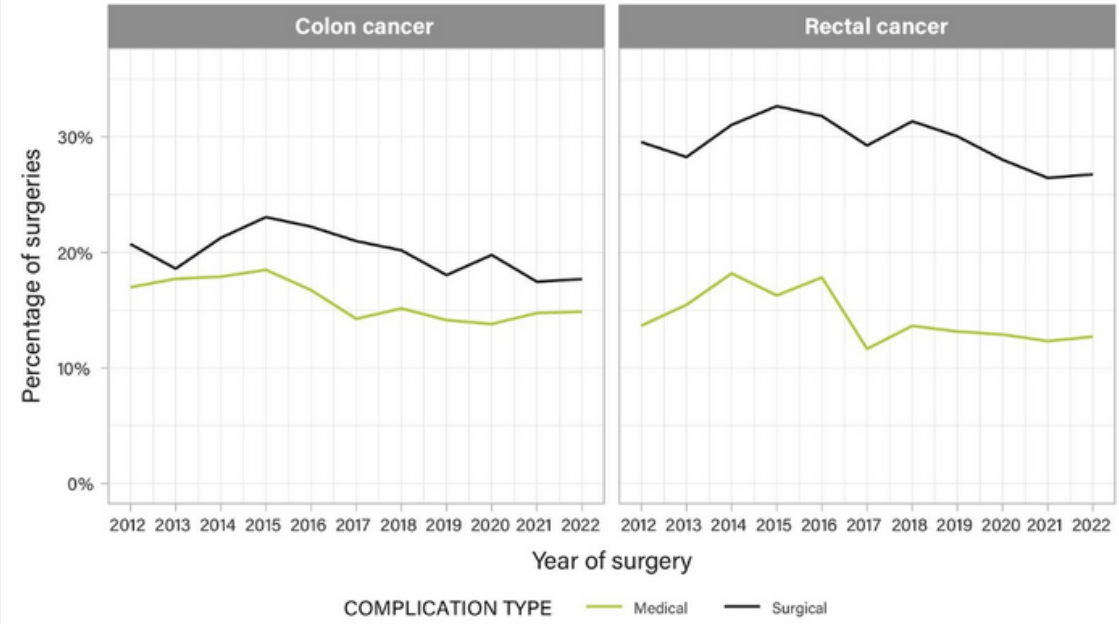
5. Complications

All complications excluding death (Clavien-Dindo grade 1-4) are presented here; inpatient mortality is presented in section 6 (Clinical Quality Indicators). Due to the different complication profiles of colon and rectal surgery, post-operative complications for colon and rectal cancer are presented separately (Table 11 and Table 12).

The complication rates are broadly comparable with international literature, with an overall surgical complication rate of 17% for colon cancer surgery and 26% for rectal cancer surgery. The increased complication rate for rectal surgery occurred across most surgical complications, but a notable difference was seen in abdomino-pelvic collections (2% colon surgery vs. 7% rectal surgery). Anastomotic leak rates remain low, in line with previous years, but it must be noted this data is self-reported.

Medical complication rates were very similar following colon and rectal cancer surgery. A slight downward trend is seen in complication rates reported from 2012 to 2022 (Figure 17).

Figure 17. Complications over time in colorectal cancer patients who received surgical treatment



Colon cancer

Table 11. Summary of surgical and medical complications of colon cancer patients who received surgical treatment in 2022

Complication	Count	Percentage
Surgical complications	**535**	**17%**
Abdominal pelvic collection	68	2%
Anastomotic leak	79	3%
Enterocutaneous fistula	4	<1%
Superficial wound dehiscence	44	1%
Deep wound dehiscence	15	<1%
Wound infection	76	2%
Sepsis	49	2%
Prolonged ileus	242	8%
Small bowel obstruction	19	1%
Urinary retention	13	<1%
Ureteric injury	8	<1%
Splenectomy	2	<1%
Postoperative haemorrhage	41	1%
Other surgical complications	76	2%
Medical complications	**447**	**14%**
DVT / PE	26	1%
Chest infection	111	4%
Cardiac	135	4%
Other medical complications	267	9%

n = 3,095 treatment episodes
*Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE)

Rectal Cancer

Table 12. Summary of surgical and medical complications of rectal cancer patients who received surgical treatment in 2022

Complication	Count	Percentage
Surgical complications	**259**	**26%**
Prolonged ileus	99	10%
Abdominal pelvic collection	65	7%
Urinary retention	17	2%
Wound infection	39	4%
Anastomotic leak	40	4%
Superficial wound dehiscence	34	3%
Sepsis	28	3%
Small bowel obstruction	22	2%
Postoperative haemorrhage	13	1%
Deep wound dehiscence	6	1%
Ureteric injury	7	1%
Other surgical complications	50	5%
Enterocutaneous fistula	2	<1%
Medical complications	**122**	**12%**
Cardiac	26	3%
Chest infection	29	3%
DVT / PE	9	1%
Other medical complications	86	9%

n = 990 treatment episodes
*Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE)

6. Clinical Quality Indicators

Indicators for performance and outcome measurement allow the quality of care and services to be measured. Quality indicators describe the performance that should occur (based on evidence-based standards of care) and then evaluate whether patients' care is consistent with this (9).

The clinical indicators used in BCOR are process and outcome measures and are generally rate or mean based, providing a quantitative basis for quality improvement. In most cases, clinical measures must be adjusted for factors outside the health system when benchmarking care, such as patient and disease-related factors.

BCOR has reported against a number of clinical quality indicators (or CQIs) since 2017.

These include:
Primary CQIs:
• Inpatient mortality
• Return to theatre
• Anastomotic leak rate
• Number of lymph nodes examined (colon)
• Circumferential margins (rectal)

Secondary CQIs:
• Adjuvant chemotherapy
• Length of stay
• Surgical complication rate (complications analysed include abdominal pelvic collection, anastomotic leak, enterocutaneous fistula, superficial wound dehiscence, deep wound dehiscence, wound infection, temperature > 38.5 °C with haemodynamic features of sepsis, prolonged ileus, small bowel obstruction, urinary retention, ureteric injury, splenectomy, postoperative haemorrhage, other)
• Discussed at MDT (rectal)
• MRI staging (rectal)
• Permanent stoma rate (rectal)

These CQIs are reported in this chapter and chapters 4 and 5. Health service performance in relation to these are reported to individually participating sites where a sufficient volume of patients is managed. In order to account for contemporaneous data and smaller volume sites with which to benchmark sometimes rare events, from 2018 the CQIs comprise the most recent 3 years of data only (unless otherwise indicated). Prior to 2018, these CQIs included cumulative data from 2007, but as the annual number of episodes has increased in recent years, the registry is now able to meaningfully compare data over a rolling 3-year period.

CQIs in this chapter are primarily presented as funnel plots, which are a snapshot at a point in time of comparative performance of centres in relation to an individual measure. The outer lines of the funnel plot provide the statistical limits that define whether the performance of a centre is a statistical outlier or not, with greater uncertainty available to smaller numbers of episodes per centre. Additionally, this variation in site performance is relative to the performance of the sites within the data set and is not measured against an independently agreed target.

6. Clinical Quality Indicators (cont.)

Data completeness in registries typically varies for many data items that comprise the clinical indicators, and the items that have been used for risk adjustment. This is because sites enter their own data and factors that affect data entry, such as availability of staff will affect the validity of the data. Also, while most funnel plots have had risk-adjustment models developed, where this is not the case, the limitation of this lack of risk adjustment should be considered in their interpretation.

It is important to note that the BCOR dataset is only representative of those who participate in BCOR; outliers may be identified who may be within the common bounds if all colorectal cancer operations in Australia and New Zealand were entered into BCOR. Data and initial reports must be interpreted with this in mind.

Inpatient mortality

Inpatient mortality remains low at 1% of reported cases (Table 13). Urgency of admission is a factor in hospital mortality. Mortality for elective surgery is usually lower than 1% compared to about a 2% mortality noted in urgent or emergency cases (Figure 18). In the 2020 to 2022 cohort, the volume of surgery performed by a hospital is associated with reduced inpatient mortality (Figure 19). When adjusted for ASA score, patient age, operative urgency, sex and overall stage, the majority above the 99.8% control limit were low volume sites.

Table 13. Hospital mortality in colorectal cancer patients who received surgical treatment, by year of surgery (unadjusted)

	Treatment episodes	Inpatient death	Inpatient mortality rate (%)
2007	497	10	2
2008	1,237	16	1
2009	1,484	19	1
2010	2,030	24	1
2011	2,284	38	2
2012	2,189	35	2
2013	2,125	21	1
2014	3,028	41	1
2015	3,298	44	1
2016	3,387	28	1
2017	3,735	44	1
2018	4,326	45	1
2019	4,720	47	1
2020	4,368	48	1
2021	4,378	44	1
2022	4,031	40	1
Total	47,117	544	1

Figure 18. Mortality rate over time of colorectal cancer patients who received surgical treatment, by hospital admission category

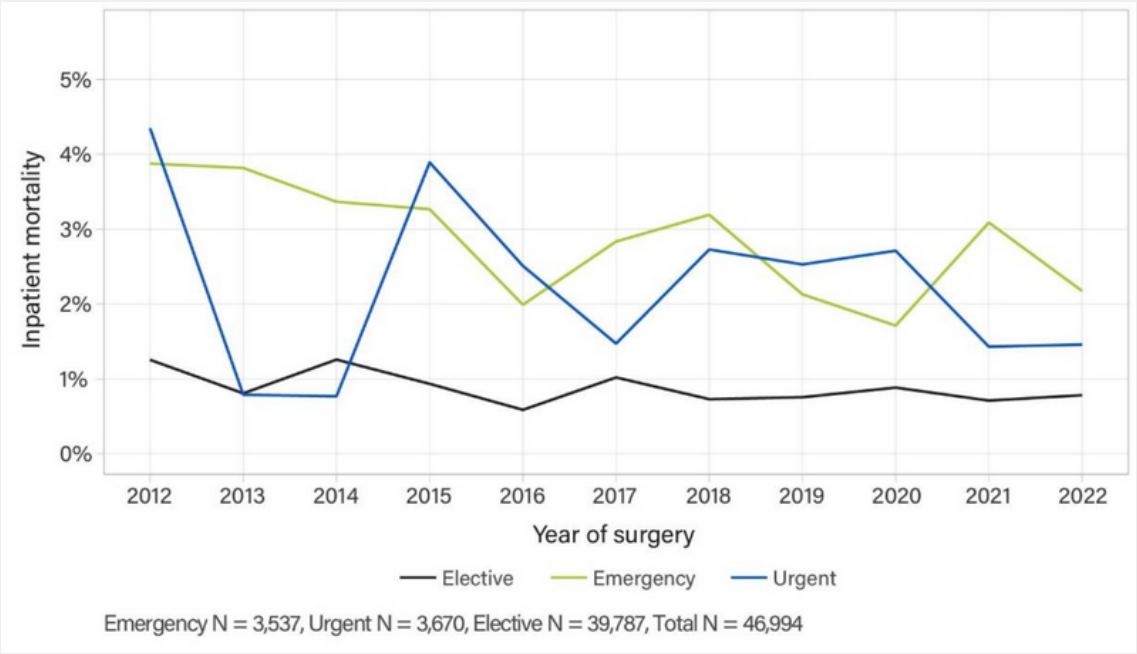
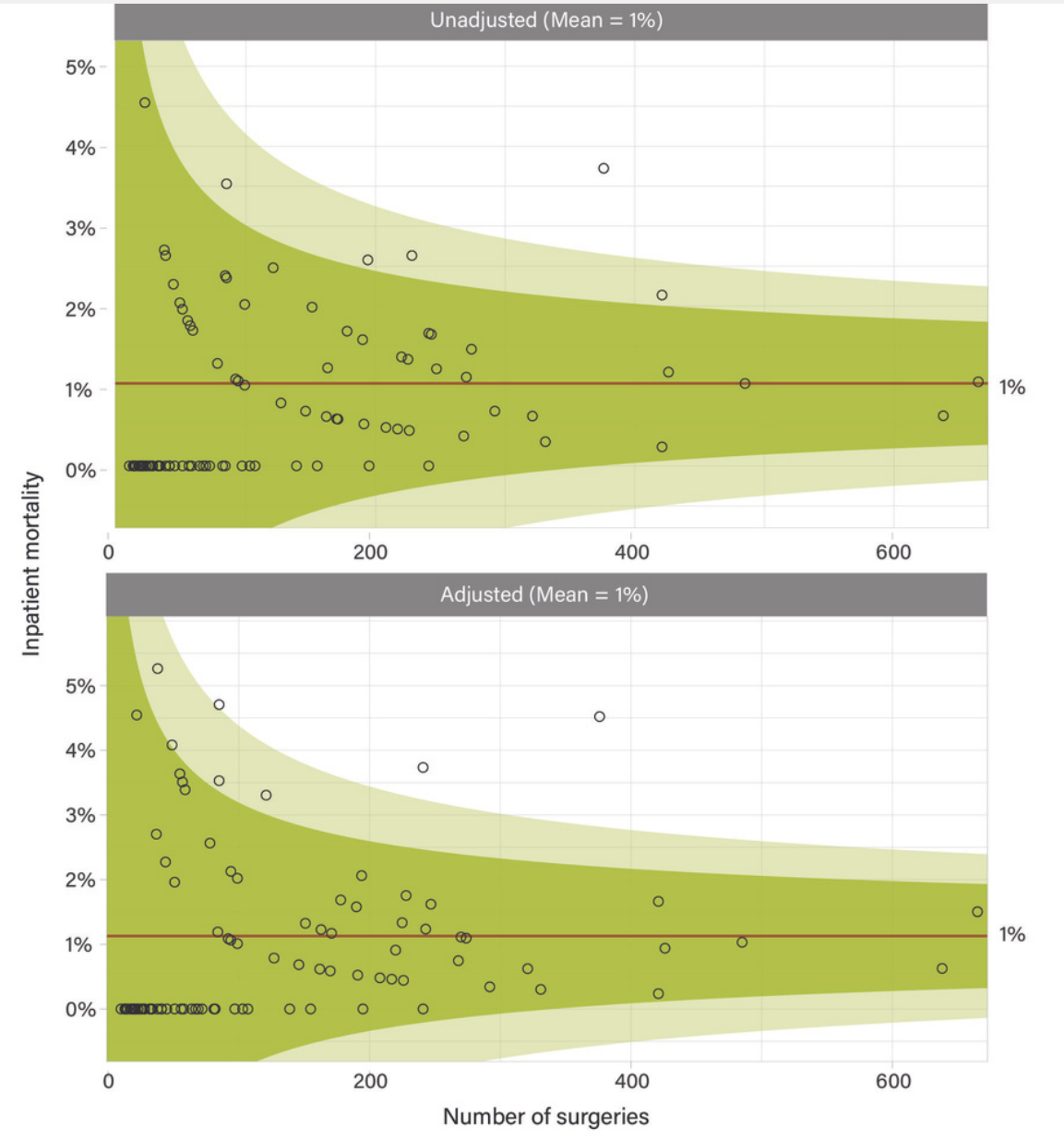


Figure 19. Inpatient mortality rate in colorectal cancer patients who received surgical treatment (2020 - 2022, by site)

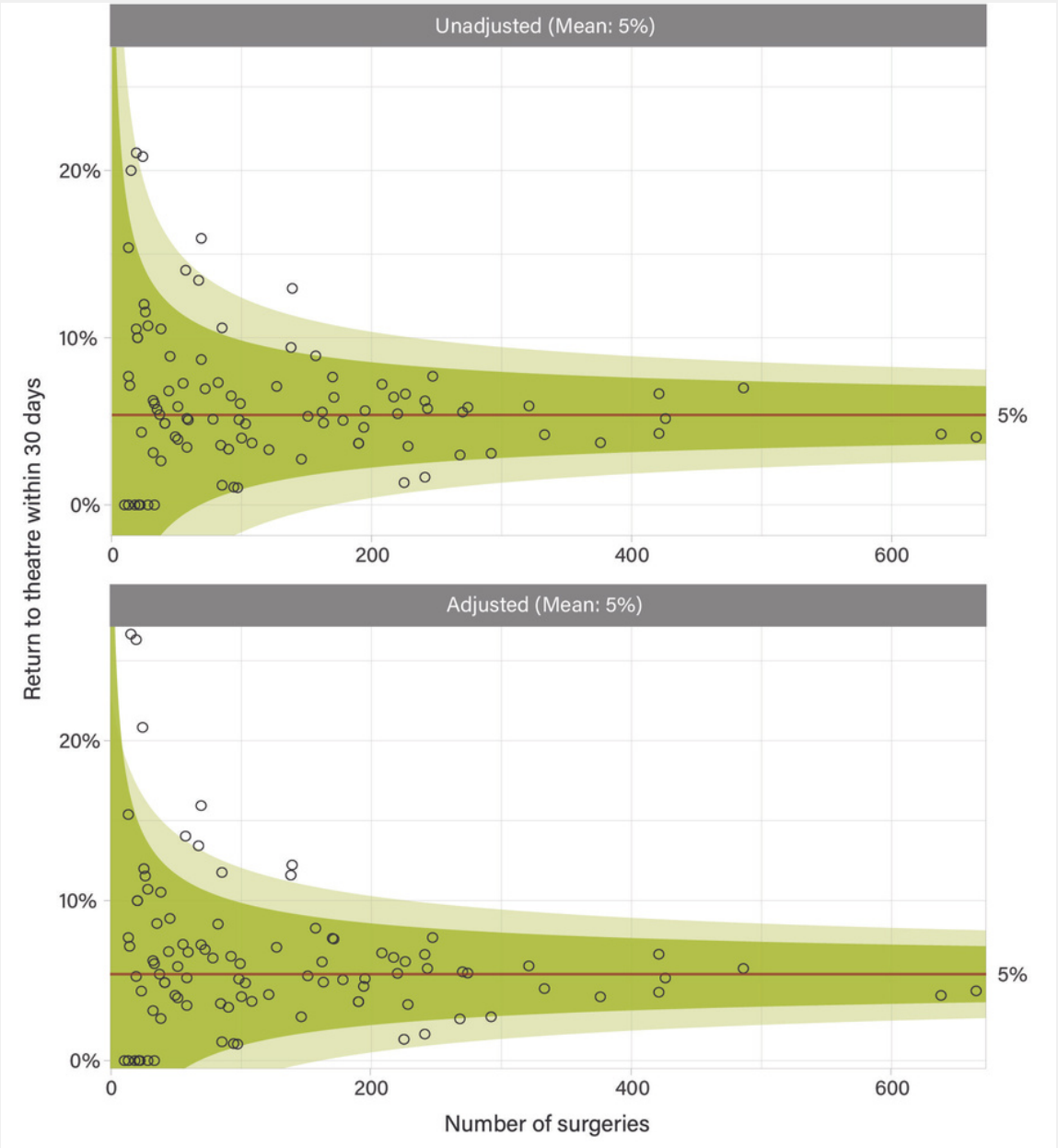


Adjusted for ASA score, patient age at diagnosis, operative urgency, overall stage and gender.
Shaded areas represent 95 and 99.8% control limits.
Four sites were excluded due to low completeness of the adjusting covariates and/or outcome.

Return to theatre

The mean adjusted return to theatre rate was 5%, compared to 6% in previous years (Figure 20). There were less outliers in higher volume centres. The most common cause for return to theatre was anastomotic leak and abdominal pelvic collection, the same as previous years.

Figure 20. Return to theatre rate in colorectal cancer patients who received surgical treatment (2020 - 2022, by site)

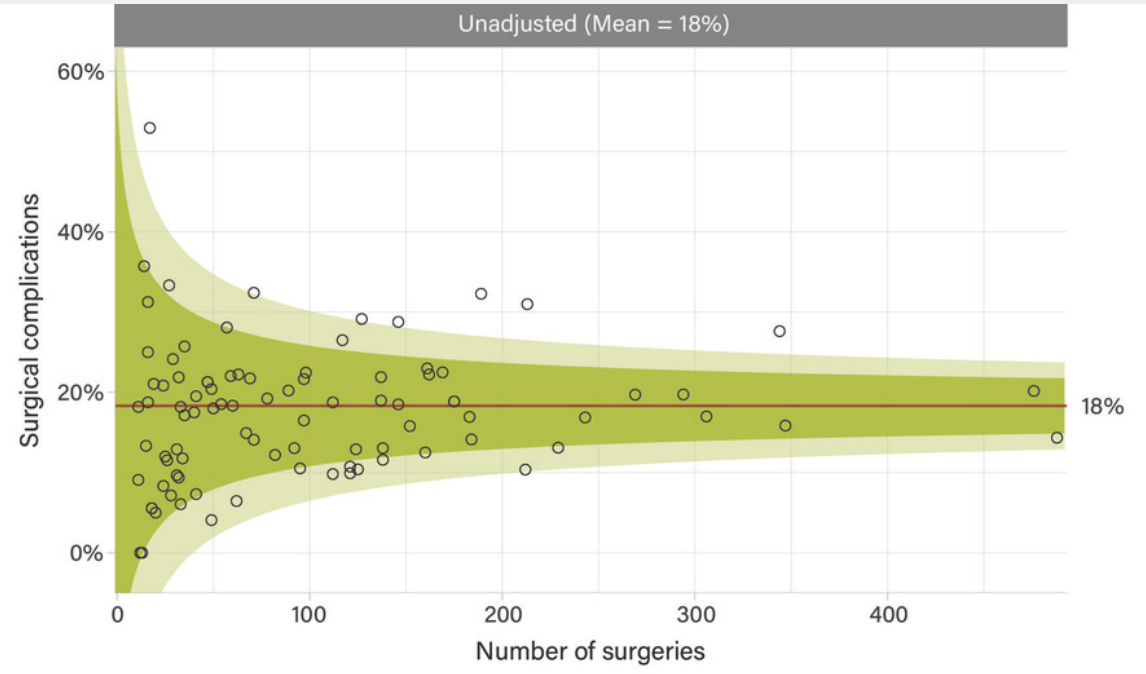


Adjusted for cancer type, ASA score, gender and operative urgency.
Shaded areas represent 95 and 99.8% control limits.
One site was excluded due to low completeness of the adjusting covariates and/or outcome.

Surgical complications

Approximately 1 in 5 patients who underwent colorectal resection between 2020 and 2022 were reported to experience a surgical complication. Unadjusted Funnel plots showing surgical complications by site for the period 2020-2022 are presented below for colon (Figure 21) and rectal (Figure 22) cancer surgery. Overall surgical complication rates were higher for rectal cancer surgery than colon cancer surgery (27% rectal vs. 18% colon). Adjusted funnel plots for surgical complications resulting from surgery for colon and rectal cancer combined are shown in Figure 23.

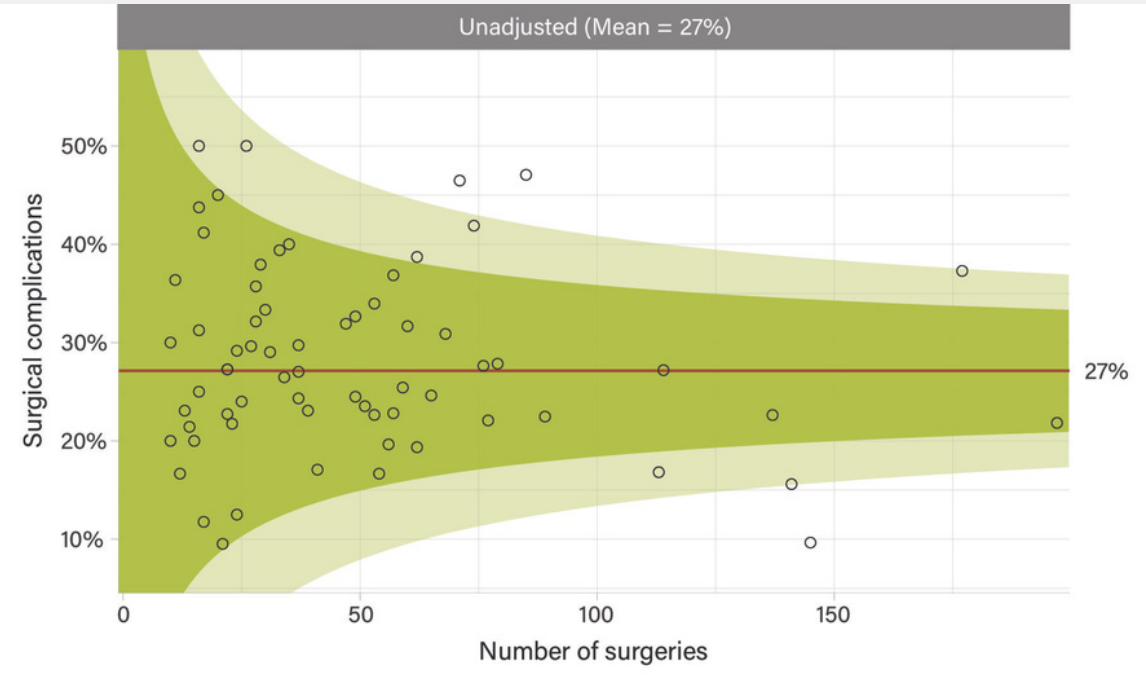
Figure 21. Surgical complication rate in colon cancer patients who received surgical treatment (2020 - 2022, by site)



Shaded areas represent 95 and 99.8% control limits.

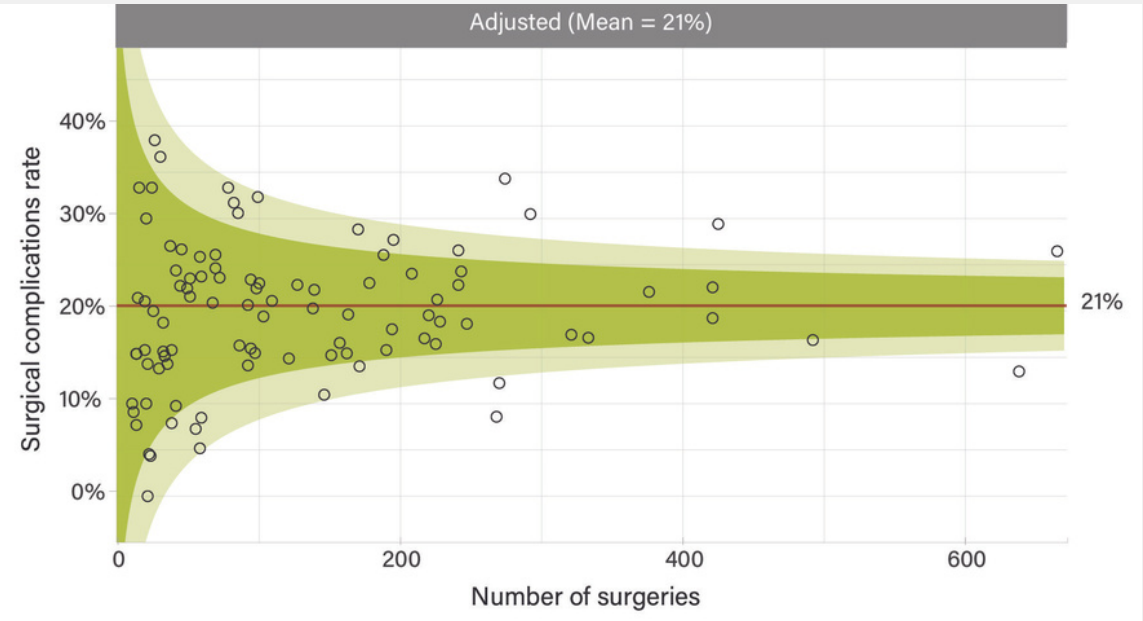
Surgical complications (cont.)

Figure 22. Surgical complication rate in rectal cancer patients who received surgical treatment (2020 - 2022, by site)



Shaded areas represent 95 and 99.8% control limits.

Figure 23. Surgical complication rate in colorectal cancer patients who received surgical treatment (2020 - 2022, by site)

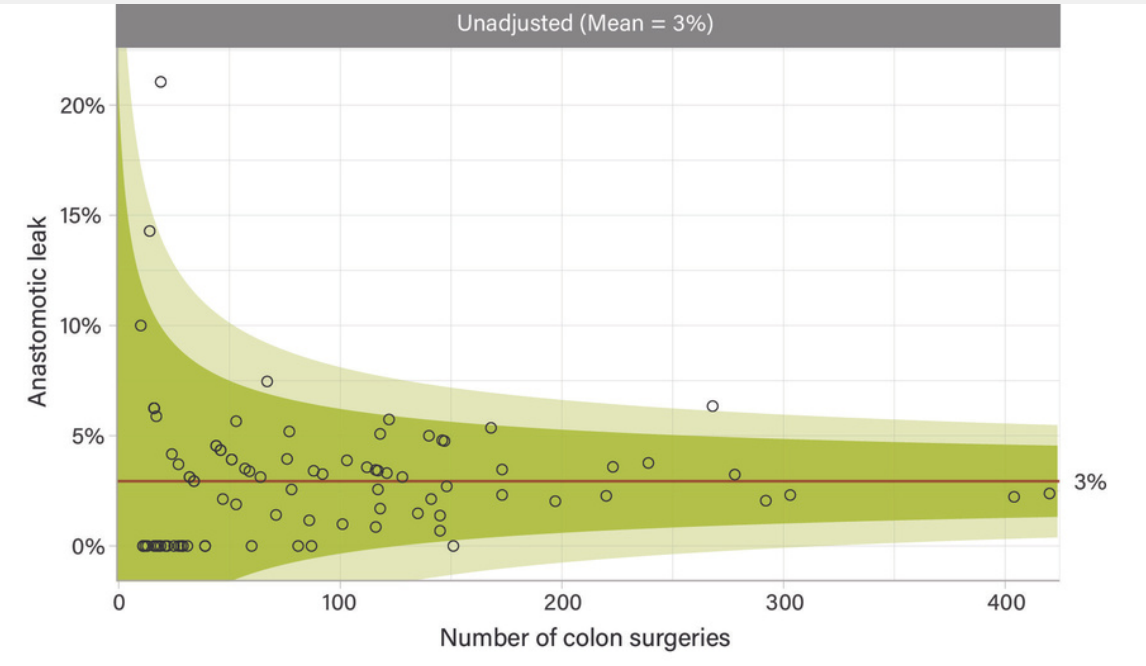


Adjusted for cancer type, ASA score, gender, operative urgency and overall stage.
Shaded areas represent 95 and 99.8% control limits.
One site was excluded due to low completeness of the adjusting covariates and/or outcome.

Anastomotic leak

Rates of anastomotic leak remain within appropriate international standards, with an adjusted mean of 3% across all surgeries. The rate of anastomotic leak in patients with colon cancer is lower than those with rectal cancer (unadjusted mean 3% vs 6%, Figures 24 and 25). The overall rate of anastomotic leak remains low with an adjusted mean of 3% (Figure 26). Risk adjustments were made for cancer type and age. There is a trend towards lower leak rates in higher volume centres. Anastomotic leak rates in this audit are subject to reporting bias, and may be underreported in some centres.

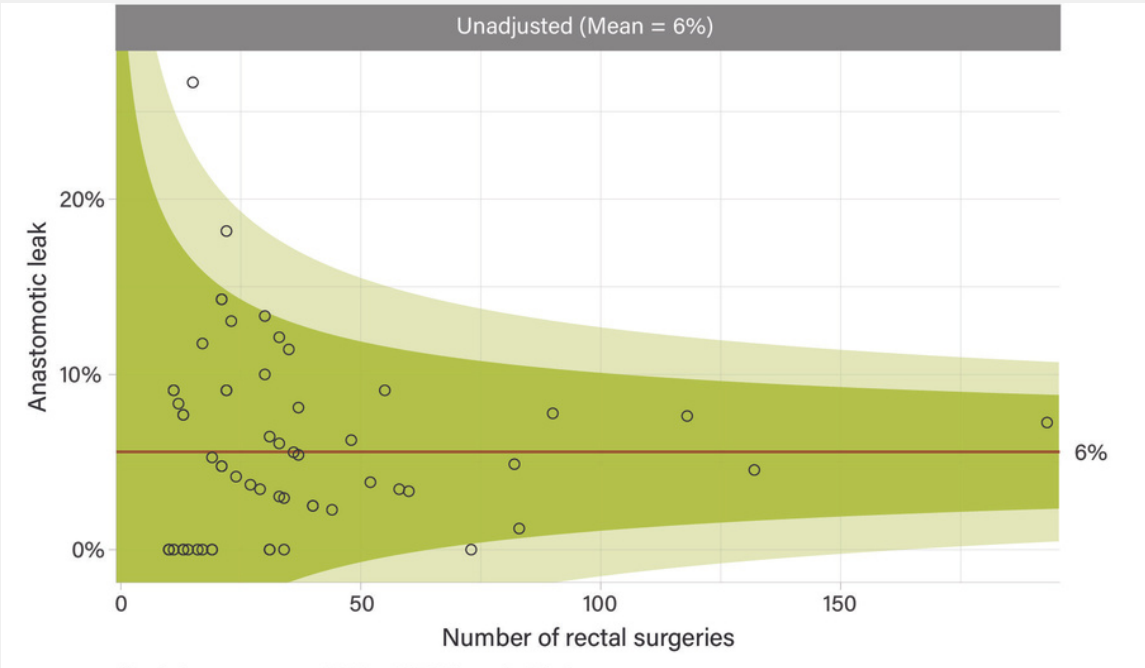
Figure 24. Anastomotic leak rate in colon cancer patients who received surgical treatment (2020 - 2022, by site)



Shaded areas represent 95 and 99.8% control limits.

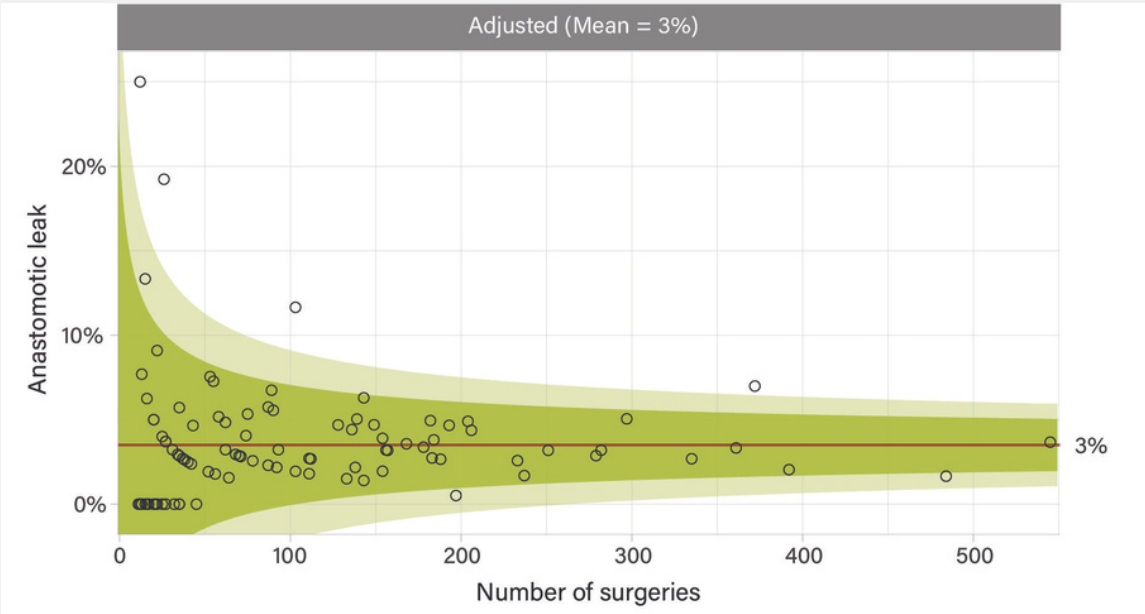
Anastomotic leak (cont.)

Figure 25. Anastomotic leak rate in rectal cancer patients who received surgical treatment (2020 - 2022, by site)



Shaded areas represent 95 and 99.8% control limits.

Figure 26. Anastomotic leak rate in colorectal cancer patients who underwent surgery with anastomosis (2020 - 2022, by site)



Adjusted for cancer type, ASA score, gender and patient age at diagnosis.
Shaded areas represent 95 and 99.8% control limits.
One site was excluded due to low completeness of the adjusting covariates and/or outcome.

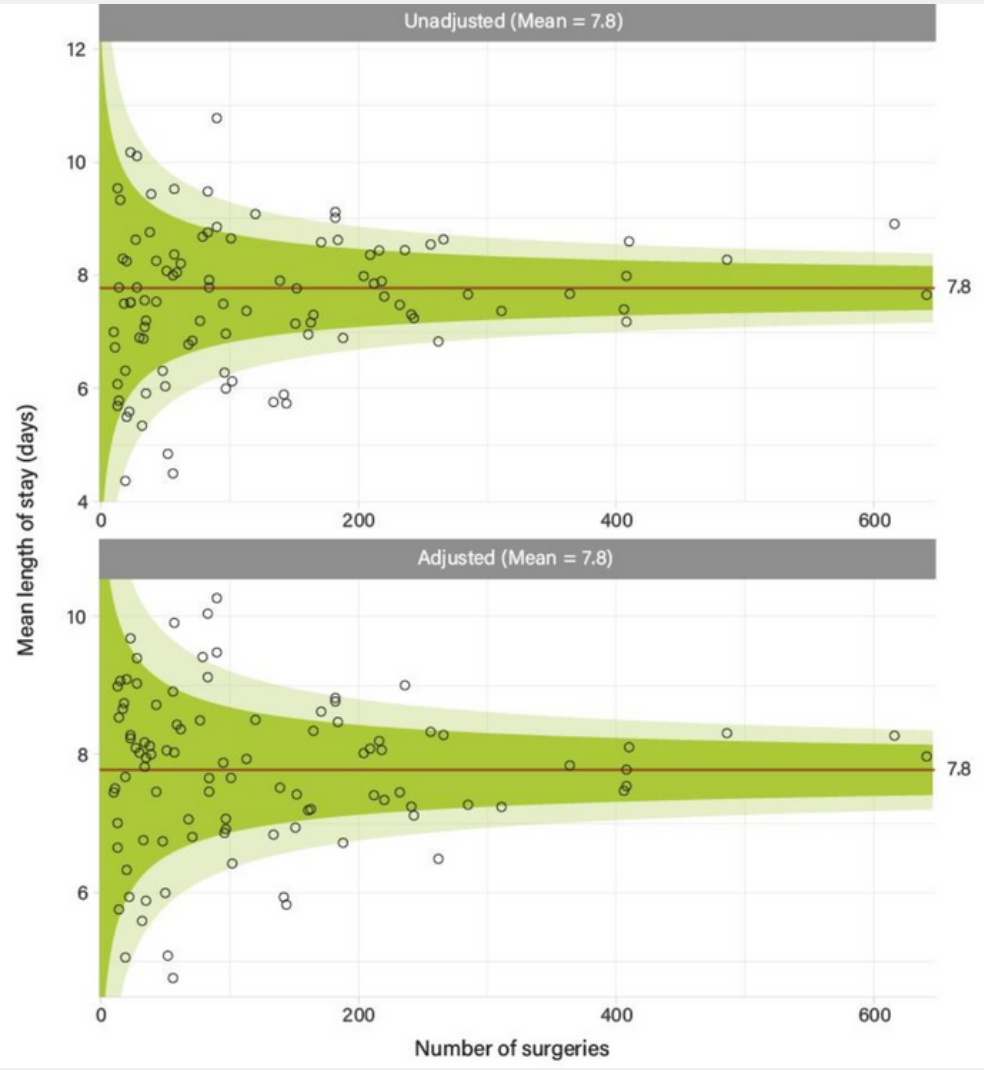
Length of stay

Since the last reporting period, the overall adjusted mean length of stay (LOS) has remained mostly consistent with a slight overall improvement. The overall LOS (Figure 27) is 7.8 days (vs 7.7 in 2021). The mean LOS of patients undergoing colonic surgery was 7.4 days (vs 7.2 in 2021) and rectal surgery was 8.9 days (vs 9 in 2021).

Urgency of admission, patient characteristics, stage of disease are factors that can contribute to LOS. When adjusted for these covariates, regardless of case volume, most units have similar LOS likely due to comparable enhanced recovery programs.

LOS above the 95% control limit could be due to factors not adjusted for, such as case complexity and patient discharge logistics (eg. 'out of area' patients or patients with higher needs requiring increased social support organisation prior to discharge).

Figure 27. Mean length of post-surgical hospital stay in colorectal cancer patients who received surgical treatment (2020 - 2022, by site)



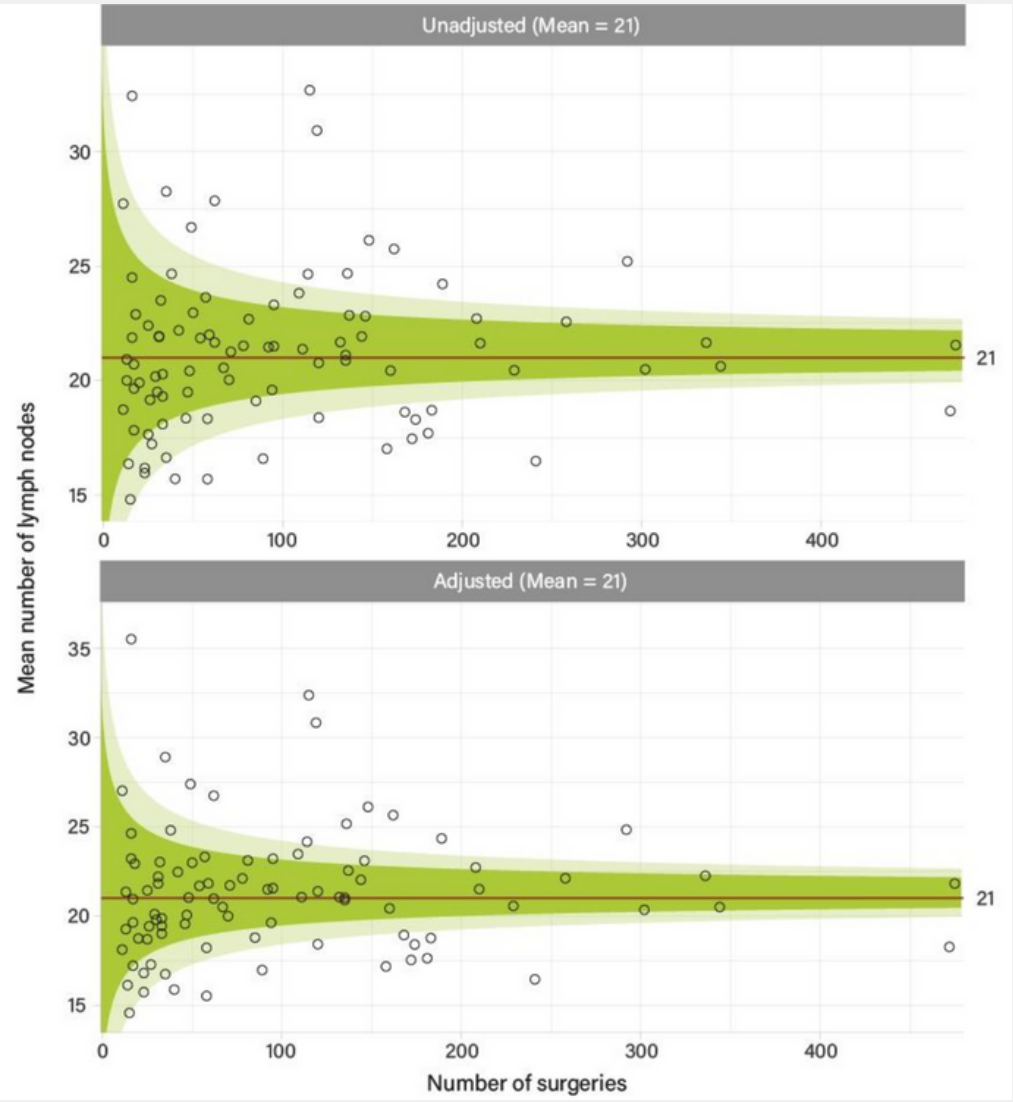
Adjusted for ASA score, cancer type, operative urgency, patient age at diagnosis, overall stage and gender. Shaded areas represent 95 and 99.8% control limits.
No site was excluded due to low completeness of the adjusting covariates and/or outcome.

Lymph node examination

Lymph node (LN) metastases are a recognised and important prognostic marker in colorectal cancer. The LN status identifies those patients who may benefit from adjuvant chemotherapy and determines their surveillance follow up, therefore the nodal harvest during colorectal resection has been shown to be closely related to survival. Current literature suggests that those patients with a reduced LN harvest have a poorer prognosis. Although the optimal number of LNs required for accurate staging is debated several international bodies, and many clinical guidelines, recommend a minimum of 12 LNs (10-12).

The funnel plots below represent the mean LN yield for colorectal cancer patients per site. The mean number of LNs harvested during colorectal resection, per patient, between 2020 and 2022 when unadjusted was 21 (Figure 28). When adjusted for overall stage, sex, age at diagnosis, emergency versus elective surgery, and the patient's ASA score the mean number of LNs was also 21. Most centres obtain a mean above the recommended 12 LNs.

Figure 28. Mean number of lymph nodes harvested in colorectal cancer patients who received surgical treatment (2020 - 2022, by site)

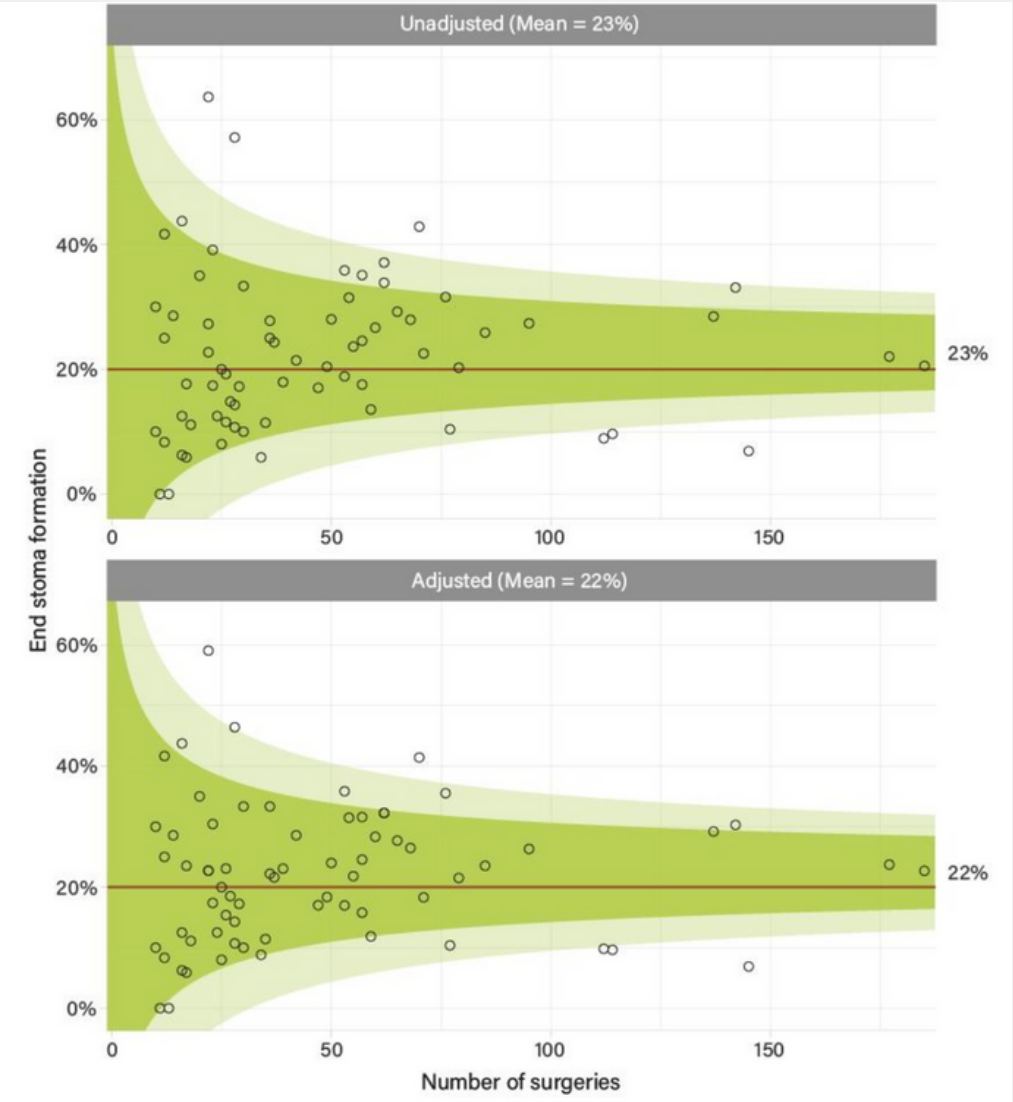


Adjusted for ASA score, operative urgency, patient age at diagnosis, overall stage and gender.
Shaded areas represent 95 and 99.8% control limits.
One site was excluded due to low completeness of the adjusting covariates and/or outcome.

End stoma

Stoma-free survival is an important outcome and quality-of-life measure. In the 2020-2022 cohort, the mean end stoma formation rate was 22% (Figures 29). Similar to previously reported, this rate has stayed stable over the last 3 years and remains consistent with international data (13). Most patients who have a permanent end stoma have had an abdominoperineal resection (APR). The APR rate is simple to measure, but evidence supporting the APR rate as a quality marker is weak (14).

Figure 29. End stoma rate in rectal cancer patients who received surgical treatment (2020 - 2022, by site)



Adjusted for ASA score, overall stage, patient age at diagnosis, and operative urgency.
Shaded areas represent 95 and 99.8% control limits.
No sites were excluded due to low completeness of the adjusting covariates and/or outcome.

Circumferential margin involvement

The CRM may be one of the most important quality indicators in rectal cancer surgery. The rate of positive CRM has been relatively stable in the BCCA dataset over the past 10 years (between 4 and 6%). With the increasing adoption of non-operative management strategies, the percentage rate of positive margins may increase as the denominator will reduce and include only non-responders.
Following risk adjustment models revision in January 2023, this year CRM was risk adjusted for overall stage, operative urgency and neoadjuvant therapy and separately for pre-operative T stage and sex (rather than just overall stage and operative urgency as in the 2021 report).

Figure 30. CRM involvement rate over time in rectal cancer patients who received surgical treatment

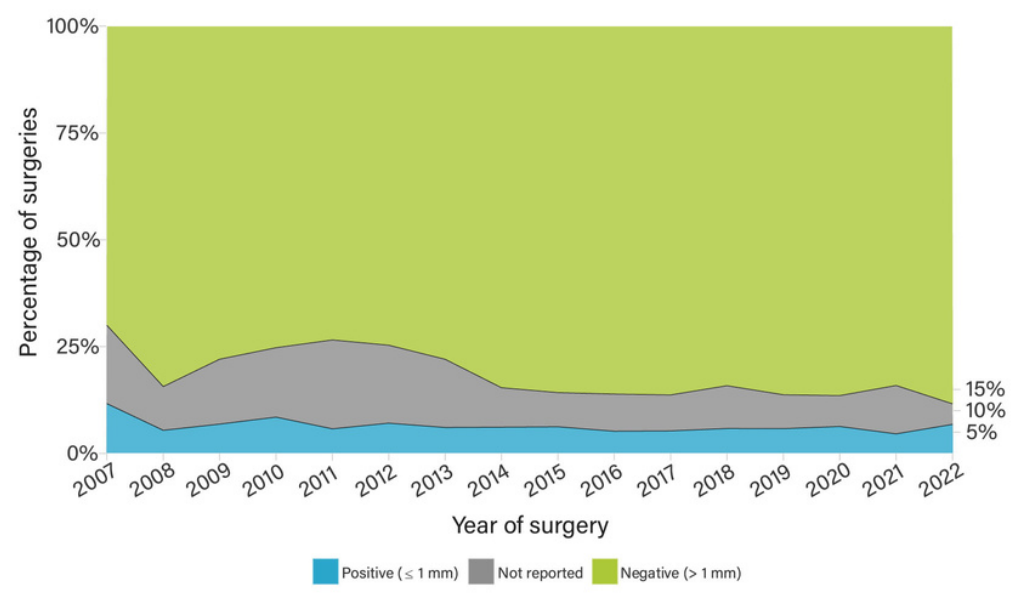
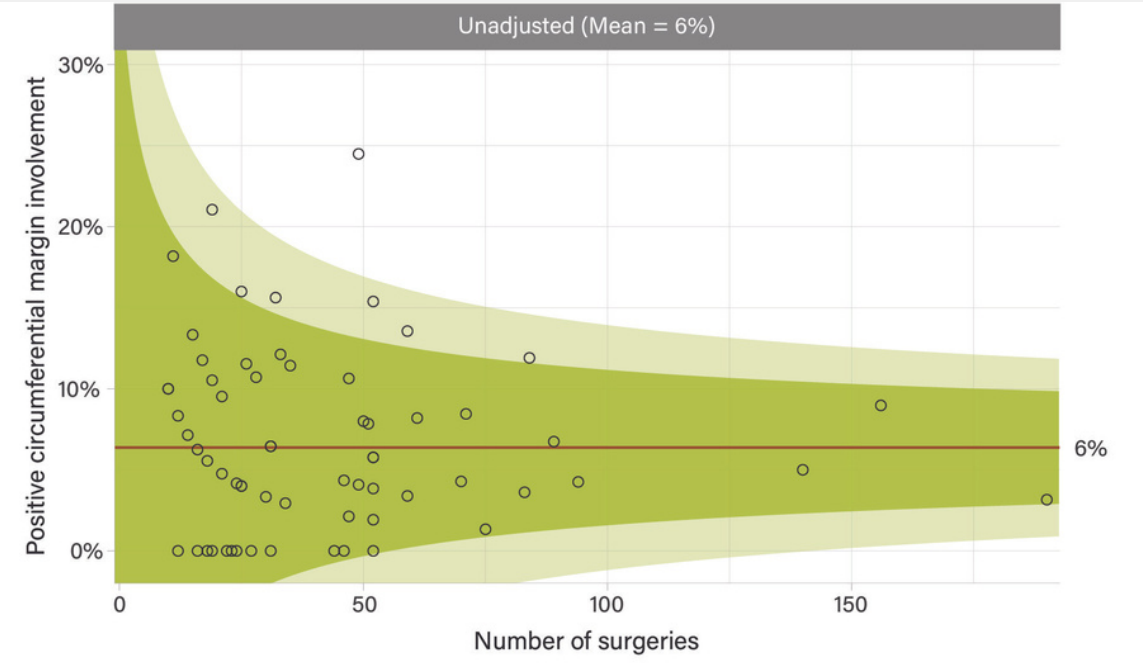


Table 14. Use of neoadjuvant therapy and CRM involvement in rectal cancer patients who received surgical treatment in 2022

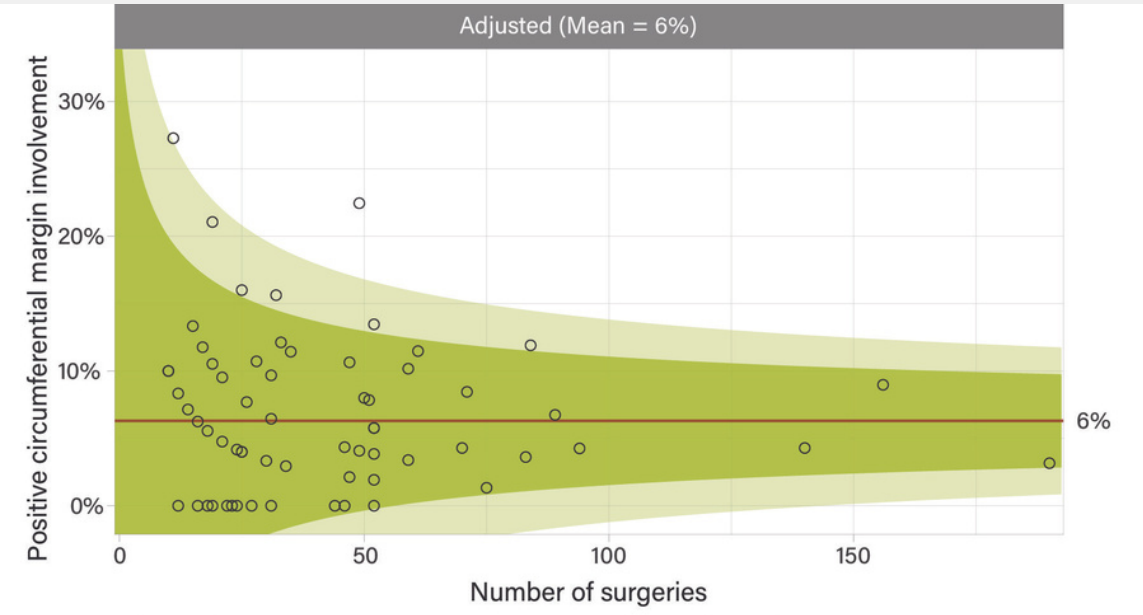
	Neoadjuvant therapy not received		Neoadjuvant therapy received	
	Count	Percentage	Count	Percentage
Negative (> 1mm)	312	88%	426	89%
Not reported	22	6%	18	4%
Positive (<= 1mm)	22	6%	36	7%
Total	356	100%	480	100%

Figure 31. Positive CRM involvement rate in rectal cancer patients who received surgical treatment (2020 - 2022, by site, unadjusted)



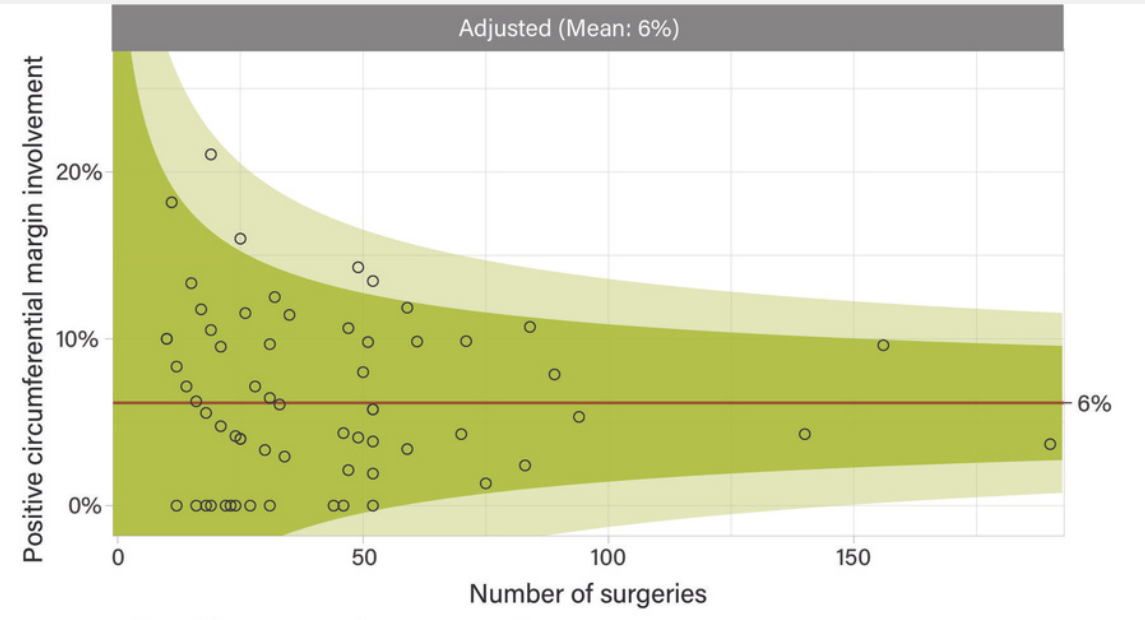
Shaded areas represent 95 and 99.8% control limits.

Figure 32. Positive CRM rate (2020 - 2022, adjusted for overall stage, operative urgency, and neoadjuvant therapy)



Adjusted for overall stage, operative urgency and neoadjuvant therapy.
Shaded areas represent 95 and 99.8% control limits.
Four sites were excluded due to low completeness of the adjusting covariates and/or outcome.

Figure 33. Positive CRM rate (2020 - 2022, adjusted for pre-operative T stage and sex)



Adjusted for pre-operative T stage and gender.
Shaded areas represent 95 and 99.8% control limits.
Four sites were excluded due to low completeness of the adjusting covariates and/or outcome.

7. Research (2022)

Publications

- Dinger TL, Kroon HM, Traeger L, Bedrikovetski S, Hunter A, Sammour T. (2022). Regional variance in treatment and outcomes of locally invasive (T4) rectal cancer in Australia and New Zealand: analysis of the Bi-National Colorectal Cancer Audit. **ANZ J Surg** 92(7-8): 1772-1780. DOI: 10.1111/ans.17699

- Thungathurthi K, Antoniou E, Arachchi A, Tay Y, Nguyen TC, Lim J, Chouhan H, Narasimhan V, Teoh W. (2023). Surgical management of splenic flexure cancer: is there an optimal technique? A bi-national registry analysis. **ANZ J Surg** doi.org/10.1111/ans.18469

- Kong JC, Prabhakaran S, Fraser A, Warrier S, Heriot AG. (2021). Predictors of Surgical Difficulty in Laparoscopic Total Mesorectal Excision. **Pol Przegl Chir** 93 (6): 33-9. DOI: 10.5604/01.3001.0014.9721

- Prabhakaran S, Prabhakaran S, Lim WM, Guerra G, Heriot AG, Kong JC (2022). Predictive Factors for Anastomotic Leak in Colorectal Surgery: A Bi-National Database Study. **Pol Przegl Chir**. 2022 Dec 20;95(4):1-5. DOI: 10.5604/01.3001.0016.1602.

Presentations

- Rajagopalan A, Centauri S, Antoniou E, Arachchi A, Tay YK, Chouhan H, Lim JT-H, Nguyen TC, Narasimhan V, Teoh WMK. (RACS, ASC 2023, May). Right hemicolectomy for colon cancer: does the anastomotic configuration affect short-term outcomes? ANZ J Surg 93 (S1); CR074P, 42.

- Dinger T; Kroon H, Traeger L, Bedrikovetski S, Sammour T. (Tripartite Colorectal Meeting 2022, February). Regional variance in treatment and outcomes for T4 rectal cancer in Australia and New Zealand: Analysis of the BiNational Colorectal Cancer Audit (BCCA). Colorectal Dis 24 (S1) P089, 93.

- Liu J, Lee J, Bedrikovetski S, Traeger L, Moore J, Kroon H, Sammour T. (Tripartite Colorectal Meeting 2022, February). Clinical predictors of rectal cancer response after neoadjuvant (chemo)radiotherapy in Australasia: Analysis of the Bi-National Colorectal Cancer Audit (BCCA). Colorectal Dis 24 (S1) P129, 106.

- Proud D, Yeoh A. (Tripartite Colorectal Meeting 2022, February). The utility of CT derived markers of visceral obesity in predicting operative difficulty and outcomes in laparoscopic right hemicolectomy. Colorectal Dis 24 (S1) P153, 117.

- Thungathurthi K, Narasimhan V, Antoniou E, Arachchi A, Chouhan H, Teoh W. (Tripartite Colorectal Meeting 2022, February). Comparison of outcomes between different surgical techniques for splenic flexure cancers. Colorectal Dis 24 (S1) P176, 126.

- Wang J, Prabhakaran S, Casey L, Warrier S, Heriot A, Kong J. (Tripartite Colorectal Meeting 2022, February). Long-term outcomes of colorectal cancer in young adults: A retrospective observational study of the BCCA registry. Colorectal Dis 24 (S1) P181, 128.

- Williams E, Kong J, Prabhakaran S, Singh P, Warrier S, Bell S. (Tripartite Colorectal Meeting 2022, February). The impact of the COVID-19 pandemic on colorectal cancer diagnosis and management: A binational colorectal cancer audit study. Colorectal Dis 24 (S1) P191, 133.

7. Research(2022)

Currently Approved Projects

Chemotherapy in stage II colorectal cancer - trends in use and survival outcomes in Australia and New Zealand.
Investigator: Dr Adele Burgess, Austin Health
Status: Approved
The objective of this project is to determine trends in chemotherapy use in stage II colorectal cancer and whether chemotherapy improves survival in stage II colorectal cancer.

Treatment pathways and outcomes in octogenarians/nonagenarians with rectal cancer.
Investigator: Bushra Othman, Epworth Eastern Hospital
Status: Approved
The objective of this project is to analyse treatment modalities of patients over 80 years with rectal cancer and report on the associated morbidity and mortality outcomes.

Evaluation of the impact of stenting in colorectal cancer on survival.
Investigator: David Proud, Epworth Freemasons Hospital.
Status: Approved
The objective of this project is to evaluate the use of stenting in colorectal cancer in Australia and New Zealand and the impact of stenting on survival in colorectal cancer in Australia and New Zealand.

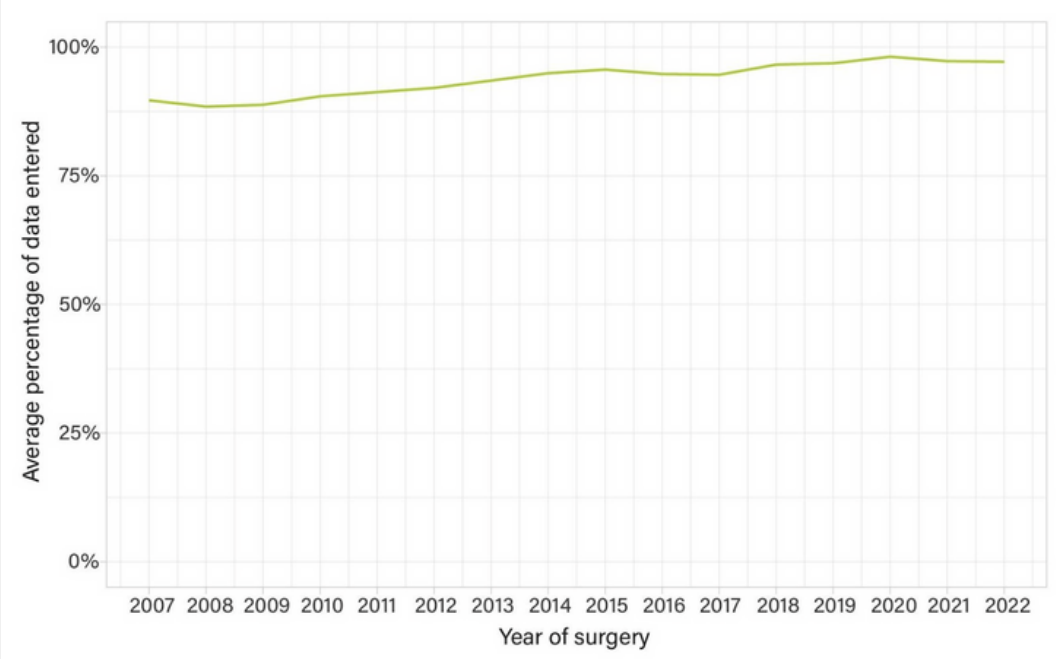
For further information about these projects please contact the investigators. A complete list of approved, published or presented projects can be found at bowelcanceraudit.com

8. Quality assurance

Data completion

BCOR is analysed for data completeness based on 29 elements (Patient ID, date of birth, hospital code, consultant code, tumour diagnosis screening FOBT, rectal cancer, discussed at MDT, surgery planned, surgery date, operative urgency, ASA score, surgical entry, tumour site, procedure type, stoma formed, discharge date, surgical complications, medical complications, returned to theatre, inpatient death, 30 day mortality, primary tumour stage, regional lymph nodes stage and distant metastasis, lymph nodes harvested, adjuvant therapy, circumferential margins, and neoadjuvant therapy). Figure 34 shows that data completeness was 97%.

Figure 34. Mean percentage of data completion over time across 29 key BCOR items



Appendix A - Registry Personnel 2022

Steering Committee Membership

Professor Alexander Heriot (Victoria)(Chair)
Dr Philip Smart (Chair BCCA Operations Committee)
Dr Rowan Collinson (CSSANZ) until November 2022
Dr Elizabeth Murphy (CSSANZ) since November 2022
Dr Raymond Yap (Colon and Rectal Surgery Section, RACS)
Dr Andrew Hughes (GSA)
Dr Jasen Ly (NZAGS)
Professor John Zalcberg (Interested Clinician)
John Stubbs (Consumer Representative)

The Steering Committee membership is made up of the Chair, one member of the CSSANZ Council, one member of RACS Colon and Rectal Surgery Section Executive, one representative recommended by GSA Council, one representative recommended NZAGS, a clinician with an interest in colorectal cancer, one consumer representative and the Chair of the Operations Committee.

Operations Committee Membership

Dr Philip Smart (Victoria) (Australian Co-Chair)
Dr Sze-Lin Peng (New Zealand Co-Chair)
Professor Paul McMurrick (Victoria) (CRC Audit)
Associate Professor Chris Byrne (New South Wales)
Dr Elizabeth Murphy (South Australia) until November 2022
Associate Professor Mark Thompson-Fawcett (New Zealand)
Dr Anthony Ciccocioppo (South Australia)
Dr Greg Nolan (Queensland)
Dr Aymen Al-Timimi (Queensland)
Associate Professor Tarik Sammour (South Australia)
Dr Jesse Fischer (New Zealand)
Dr Su Mei Hoh (Victoria)
Dr Thomas Arthur (Colorectal Fellow)
Dr Ankur Sidhu (Fellow representative) until November 2022
Dr Cameron Law (Fellow representative) since November 2022
Angela Brennan (DEPM)
Professor Susannah Ahern (DEPM)
Dr Farhad Salimi (DEPM) until July 2022
Nicole Cooper (Management Consultant and Bowel Cancer Patient)
Awenna Williams (Bowel Cancer New Zealand) since March 2022
Liam Crank (IT Specialist) since March 2022
Victoria Thompson (Bowel Cancer Patient) since July 2022
Professor Nik Zeps (registry governance specialist) since July 2022
Associate Professor Hidde Kroon (South Australia; Research Fellow) since July 2022
Associate Professor Christophe Rosty (RCPA representative)
Professor Eva Segelov (Medical Oncologist), Monash Health until September 2022
Professor Katherine Clark (Palliative Care Australia Representative)
Dr Helen Mohan (International Registry Collaboration Representative)
Dr Stephen Chin (Radiation Oncologist)

The BCCA Operations Committee membership is made up of the Chair, Representatives of the Department of Epidemiology & Preventive Medicine, Monash University (DEPM), a representative of CRC Audit (the extended dataset), representatives of ANZTBCRS Training Fellows, surgeons who regularly undertake surgery for colorectal cancer providing a broad geographic binational representation and other co-opted members as required.

Appendix A - Registry Personnel 2022

Research Committee membership

Professor Alexander Heriot (Chair)
Associate Professor Tarik Sammour
Angela Brennan (DEPM)
Dr Farhad Salimi (DEPM)
Dr Ankur Sidhu (Fellow representative) until November 2022
Dr Cameron Law (Fellow representative) since November 2022
Dr Helen Mohan (International Registry Collaboration Representative) since September 2022
Associate Professor Hidde Kroon (South Australia; Research Fellow) since September 2022

The Research Committee membership is made up of the Chair, Representatives of the Department of Epidemiology & Preventive Medicine, Monash University (DEPM), and representatives of ANZTBCRS Training Fellows and other co-opted members as required.

Appendix B - Glossary

AJCC – American Joint Committee on Cancer
ANZTBCRS – Australia and New Zealand Training Board in Colon and Rectal Surgery
APR – Abdominoperineal Resection
ASA – American Society of Anaesthesiologists Classification
ASC – Annual Scientific Congress
ASCRS – The American Society of Colon and Rectal Surgeons
BCCA – Binational Colorectal Cancer Audit
COVID-19 – Coronavirus
CQRs – Clinical Quality Registries
CQIs – Clinical Quality Indicators
CRM – Circumferential Resection Margin
CRC Audit – Colorectal Cancer Audit (Extended dataset managed by Professor Paul McMurrick via Cabrini Institute)
CSSANZ – Colorectal Surgical Society of Australia and New Zealand
DEPM – Department of Epidemiology and Preventative Medicine, Monash University
DVT – Deep Vein Thrombosis
FOBT – Faecal Occult Blood Test
GSA – General Surgeons Australia
LN – Lymph Nodes
LOS – Length of Stay
MDT – Multidisciplinary Team Meeting
MIS – Minimally Invasive Surgery
MRI – Magnetic Resonance Imaging
NBCSP – National Bowel Cancer Screening Program
NBSP – National Bowel Screening Programme
NZAGS – New Zealand Association of General Surgeons
PE – Pulmonary Embolism
PHA – Public Health Act
RACS – Royal Australasian College of Surgeons
RCPA – The Royal College of Pathologists of Australasia
SD – Standard Deviation
TAMIS – Transanal Minimally Invasive Surgery
taTME – Transanal Total Mesorectal Excision
TE – Treatment Episodes
TEMS – Transanal Endoscopic Microsurgery
TME – Total Mesorectal Excision
TNM – Tumour staging system (tumour, node, metastasis)
UK – United Kingdom
US – United States

Appendix C - Participating Health Services

State	Hospital
NSW	Bankstown Hospital
NSW	Blacktown Hospital
NSW	Calvary Riverina
NSW	Chris O'Brien Lifehouse
NSW	Concord Repatriation General Hospital
NSW	Gosford Private Hospital
NSW	Gosford Public Hospital
NSW	John Hunter Hospital
NSW	Lismore Base Hospital
NSW	Liverpool Hospital
NSW	Macquarie University Hospital
NSW	Maitland Hospital
NSW	Maitland Private Hospital
NSW	Nepean Hospital
NSW	Norwest Private Hospital
NSW	Orange Health Service
NSW	Port Macquarie Base Hospital
NSW	Prince of Wales Private Hospital
NSW	Prince of Wales Public Hospital
NSW	Royal Prince Alfred Hospital
NSW	St George Hospital
NSW	St Vincent's Hospital Lismore
NSW	Sydney Adventist Hospital
NSW	The Tweed Hospital
NSW	Wagga Wagga Base Hospital
NSW	Westmead Public Hospital
NZ	Auckland City Hospital
NZ	Christchurch Hospital
NZ	Dunedin Hospital
NZ	Grace Hospital
NZ	Hawkes Bay Regional Hospital
NZ	Mercy Ascot Hospital
NZ	Middlemore Hospital
NZ	Nelson Hospital
NZ	North Shore Hospital
NZ	Southern Cross Wellington
NZ	Southland Hospital
NZ	St George's Hospital
NZ	Taranaki Base Hospital
NZ	Tauranga Hospital
NZ	Timaru Hospital
NZ	Waikato Hospital
NZ	Wellington Regional Hospital
QLD	Cairns Base Hospital
QLD	Gold Coast University Hospital
QLD	Holy Spirit Northside Private Hospital
QLD	Ipswich Hospital
QLD	John Flynn Private Hospital
QLD	Logan Hospital
QLD	Mater Hospital Brisbane
QLD	Pindara Private Hospital
QLD	QEII Jubilee Hospital
QLD	Sunnybank Private Hospital
QLD	Sunshine Coast University Hospital
QLD	Sunshine Coast University Private Hospital
QLD	The Sunshine Coast Private Hospital
SA	Ashford Hospital
SA	Calvary North Adelaide
SA	Calvary Wakefield Hospital
SA	Flinders Medical Centre
SA	Flinders Private Hospital
SA	Lyell McEwin Hospital
SA	Royal Adelaide Hospital
SA	St Andrew's Hospital
SA	The Queen Elizabeth Hospital
SA	Western Community Hospital
TAS	Calvary Lenah Valley
TAS	Hobart Private Hospital
TAS	Launceston General Hospital
VIC	Alfred Hospital
VIC	Austin Hospital
VIC	Bairnsdale Regional Health Service
VIC	Ballarat Base Hospital
VIC	Bendigo Health
VIC	Box Hill Hospital
VIC	Cabrini Hospital
VIC	Dandenong Hospital
VIC	Epworth Eastern Hospital
VIC	Epworth Geelong Hospital
VIC	Epworth Richmond Hospital
VIC	Footscray Hospital
VIC	Frankston Hospital
VIC	Peter MacCallum Cancer Centre
VIC	The Royal Melbourne Hospital
VIC	St John of God Bendigo Hospital
VIC	St John of God Ballarat Hospital
VIC	St Vincent's Hospital
VIC	Sunshine Hospital
VIC	The Northern Hospital
WA	Fiona Stanley Hospital
WA	Hollywood Private Hospital
WA	Joondalup Health Campus
WA	St John of God Murdoch Hospital

Appendix D - Participating clinicians

Sarah Abbott
Nima Ahmadi
Sinan Albayati
Imad Aljanabi
Nagham AlMozany
Aymen Al-timimi
Mohammad Amer
Vinna An
Nabila Ansari
Janet Ansell
Asiri Arachchi
Andrew Audeau
Kirk Austin
Vikram Balakrishnan
Hasitha Balasuriya
Wal Baraza
Jon Barnard
Walid Barto
Nigel Barwood
Corina Behrenbruch
Stephen Bell
Tilan Beneragama
Pia Bernardi
Madhu Bhamidipaty
Daniel Bills
Ian Bloomfield
Les Bokey
Vlad Bolshinsky
Ian Bradford
Katherine Broughton
Richard Brouwer
Andrew Bui
Adele Burgess
Chris Byrne
Amy Cao
Peter Carne
John Cartmill
Raaj Chandra
Frank Chen
Michelle Chen
Henry Cheung
Carolyn Chew
Simon Chew
Heng-Chin Chiam
Martin Chin
Tim Chittleborough
Jin Hee Cho
Hanumant Chouhan
Terence Chua
Anthony Ciccocioppo

David Clark
Louise Clarke
David Colledge
Rowan Collinson
Edward Cooper
Gary Cooper
Grant Coulter
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Appendix E - List of Figures

Appendix F - List of Tables

Appendix G - References

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Thank You.

To the clinicians, health care providers and patients who contribute time, expertise and data that helps improve the care of bowel cancer sufferes in Australia and New Zealand

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