



BINATIONAL COLORECTAL CANCER AUDIT

2021

DATA AUDIT REPORT

This publication was produced on behalf of the Binational Colorectal Cancer Audit (BCCA).

Data period

The data contained in this report was extracted from the Binational Colorectal Cancer Audit on 31st January 2022 and reports patient episodes and data from January 1st to December 31st 2021 unless otherwise stated.

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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 BCCA 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 BCCA.

Supporters:



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The BCCA in its current format is a well-established tool that assists surgeons in benchmarking their performance, contributing to improved safety and quality of care. But it is the BCCA's potential that is truly compelling: an opportunity to use real world evidence to drive care continuity, health-service co-design and regular and meaningful measurement of agreed performance indicators across the bowel cancer care continuum.

Nicole Cooper



FOREWORD

From the Operations Committee

While the emergence of COVID-19 has impacted every aspect of modern Australian society, it is unlikely that any industry felt the swift and permanent change of the pandemic more so than healthcare. Australian patients have been the beneficiaries of unyielding efforts by our front-line health professionals who have continued to deliver high quality care despite the weight of immense daily challenges.

Moving forward, health industry participants are capitalising on a now well-entrenched strategic observation that “one must never let a good crisis go to waste”. Colossal innovation and investment in health have produced a period of maximum stakeholder collaboration, little friction and profound technological progress. There are many wonderful examples of this: the immediate uptake of telehealth, the adoption of e-scripts and the emerging use of cloud-based practice management systems are all examples of innovations that place patients at the centre of their care coordination.

However, the rate of technological change in care coordination has disappointingly not been matched by a digital evolution in the delivery, review and improvement of clinical care. Smarter, digitally enabled, evidence-based decision making is now overdue. Over the past two years, there has been a broad-based deterioration of cancer care. Diagnostic pathways have been disrupted. Screening tools are backlogged. Referrals have plummeted. Australia’s bowel cancer patients will increasingly present with more advanced disease, require more complex treatments and experience poorer outcomes, against an existing national backdrop of one of the highest rates of bowel cancer globally.

The BCCA in its current format is a well-established tool that assists surgeons in benchmarking their performance, contributing to improved safety and quality of care. But it is the BCCA’s potential that is truly compelling; an opportunity to use real world evidence to drive care continuity, health-service co-design and regular and meaningful measurement of agreed performance indicators across the bowel cancer care continuum. Indicators that are important to outcomes, and important to patients.

This year the BCCA has made a deliberate effort to recognise patients as partners in their healthcare. These steps include appointing bowel cancer patients to the BCCA governance committees, consultation with patient advocacy groups including Bowel Cancer Australia, and the commencement of a data co-design project to evolve the BCCA to include a combination of clinical and patient-derived data, including patient reported experience and outcomes measures.

Our efforts must continue to champion the paradigm shift that acknowledges the patient as an advocate for their own care and informs and empowers them accordingly.

Nicole Cooper
Operations Committee Member
Management Consultant and Bowel Cancer Patient

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

The 2021 BCCA data audit report is an important overview of an unusual period in our practice. COVID-19 has interrupted our usual work streams, and this may explain some of the trends seen in this year's report. FOBT screen-detected cancers have declined. Medical comorbidity in patients undergoing surgery has increased. These factors may be COVID-related effects. Total BCCA cases are approaching 50,000, with steady growth continuing, although a slight decrease is noted in the proportion of ANZ cancer incidents captured by the BCCA in the 2020-2021 period.

Surgical quality metrics in this report again demonstrate acceptably low morbidity and inpatient mortality rates, not only when bench-marked against previous years, but also against accepted international standards. This should reinforce to the public of Australia and New Zealand and our relevant health authorities, our commitment to the highest standards of patient care.

Dr Andrew Hunter stepped down in 2021 as Chair of the Steering Committee, after nearly twenty years associated with the BCCA and its predecessors. Andrew has been Chair of the BCCA Steering Committee since the new governance model was implemented in 2015 to conform to the new ACSQHC operating principles. The BCCA would not be what it is today without his unwavering commitment and expertise in his roles. He is congratulated and thanked for a job well done. Professor Sandy Heriot has taken over this role, and I am sure the BCCA will benefit from his invaluable skills and experience. The Steering and Operations committees remain vital and committed groups, comprised predominantly of volunteers who have a desire to see colorectal cancer care done as well as possible. Thanks especially to Dr Philip Smart and Dr Sze-Lin Peng, co-Chairs of the Operations Committee

The on-going challenge is to maximise our data capture. This involves more individuals and better systems. CSSANZ members and our GSA and NZAGS partners are strongly encouraged to explore ways to participate, and to seek the advice and support of the BCCA staff to this end. They are there to help and do a fantastic job. A special thanks must go to Dr Hayat Dagher in particular.

Again, I congratulate the hard work and commitment of the staff of the BCCA, its governing committees and contributing surgeons.

Rowan Collinson
President, CSSANZ

From the Chair of the Steering Committee

The Steering Committee is responsible for overseeing the day to day running of the BCCA by the Operations Committee. The Steering Committee provides valuable advice and support to the Operations Committee and is well represented by experienced clinicians from different interest groups with expertise and involvement in the management of colorectal cancer.

The Steering Committee conducted two Meetings both by Zoom in May and November.

At each meeting the Chairman of the Operations Committee provides a summary report of the activities of the BCCA Operations Committee over the last six months. Another excellent Annual Report was produced in 2021. The members of the Operations Committee should be congratulated. In addition, the Monash Master Service Agreement has been finalised and the Strategic Plan has been updated. The accountants have developed specific BCCA Management Reports which provide a more transparent financial summary of the Audit's Income and Expenses. The Operations Committee have been tireless in their efforts in exploring new and sustainable funding opportunities, and along with Alexander Heriot, have developed links with Dutch and UK Audits. The Audit is progressing to a Clinical Registry with subsequent Incorporation. John Zalcborg submitted a detailed proposal to Telstra Health to link BCCA with the National Bowel Cancer Screening Program (NBCSP) which unfortunately was rejected but ongoing discussions continue. Linkage to the National Death Index was finalised to provide valuable long term mortality data. Numerous important research projects have been undertaken and published, under the guidance of the Research Committee.

The Steering Committee congratulates all members of the Operations Committee for their hard work and ongoing success. I am now stepping down as Chair of the Steering Committee and have asked Alexander Heriot to take over this position but plan to stay on the Committee for another three years.

Andrew Hunter
Chair, Steering Committee

From Monash University Partners

The BCCA continues to mature as a key measure of quality of care for newly diagnosed patients with bowel cancer. It does so because of the enormous commitment of so many dedicated colorectal and general surgeons, their trainees and other key staff who remain committed to the goals of the registry – to improve outcomes from colorectal cancer, one of the most frequent causes of cancer death in our community.


The growth of the BCCA is occurring at a critical time given the increasing awareness of the growing incidence of colorectal cancer in young people (under the age of 50 years) who are not eligible for the current national bowel cancer screening programs.

Indeed, the US National Preventive Services Task Force recommends that screening tests for bowel cancer in the US should commence from age 45 years. In Australia and New Zealand, data from the BCCA may help inform analyses on the cost-effectiveness of screening for early bowel cancer, which if confirmed, may ultimately lead to a change in the screening guidelines in Australia and New Zealand.

Whilst we are hopeful that Federal funding may ultimately provide long term support for the BCCA I'd like to thank the Colorectal Surgical Society of Australia and New Zealand, the Royal Australasian College of Surgeons and Medtronic for their ongoing support of this important initiative. I'd also like to thank members of the Steering Committee, Operations Committee, and the Research Committee of the BCCA for their ongoing commitment to this important work. Finally, but not least, a huge thanks to Dr Hayat Dagher, the BCCA Program Manager as well as the staff in the Clinical Outcomes Data Reporting and Research Program in the School of Public Health at Monash for their high quality data analysis and reporting.

John Zalcborg OAM
Head Cancer Research Program, Monash University

As of 31st December 2021
there were 47,611 patients
registered representing
an additional 4,140 patients
since December 2020.



EXECUTIVE SUMMARY

Audit background

2021 has proven to be a difficult year for all involved in bowel cancer care, and BCCA has also faced challenges. Though linkage to the National Death Index is a key step for the registry in filling out long term causes of death for the more than 47,000 patients over 15 years, and international collaboration with the UK, Dutch, Swedish, Danish and US registries has been productive and promising, there have been setbacks.

BCCA Data entry in Queensland has been paused since October 2020, as under the Public Health Act of that State, clinical quality registries must renew approval for data entry every five years. As of writing, this approval is still pending. At a governance level, clinical quality registries (CQRs) are often treated as research projects, with defined investigators and end points. Though BCCA and other CQRs have a research function, they also have broader long term aims. BCCA has engaged with the Queensland Health Department to reform the process and reduce regulatory burden.

Key findings

Participation

- As of 31st December 2021 there were 47,611 patients registered representing an additional 4,140 patients since December 2020.
- The 4,140 patients represent 25.5% 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 (81%).

Demographics

- 54% of cases reported were males.
- The number of patients under age 50 at time of diagnosis was stable, representing 11% of the cohort in 2021.
- 46% of the cohort were classified as American Society of Anaesthesiologists (ASA) Classification 3 or greater. This is a small increase from last year and reflects 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.

The 4,140 patients represent 25.5% colorectal cancer diagnoses recorded binationally, lower than in previous year, due mainly to data entry being paused in Queensland by the Health Department.

Transanal total mesorectal excision (taTME) has dropped further in 2021, with less than 1% of cases utilising this technique.

46% of the cohort were classified as ASA ≥ 3 . This is a small increase from last year and reflects an ongoing trend within the audit. In 2012 this was 32%. These patients therefore present higher surgical risk.

Screening

- Patients diagnosed following positive faecal occult blood test (FOBT) trended lower (16%) in the 2021 cohort compared to 2020 (17%) 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 78% minimally invasive vs 22% open.
- Transanal total mesorectal excision (taTME) has dropped further in 2021, with less than 1% of cases utilising this technique.
- 80% 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
- 90% 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.' BCCA 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 years. The uptake is lower in stage II disease as would be expected; however, it is higher in patients under 50 years, reducing proportionately with increasing age.
- 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 3% and would generally be considered consistent with good practice, albeit with caveats regarding reporting bias.

Clinical Quality Indicators

- For this 2021 data Annual Report, key performance indicators (KPIs) comprise the most recent 3 years of data only (2019-2021).
- Comparisons noted in this report are between 2018-2020 data and 2019-2021 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 6% across the audit when risk adjusted and this number was stable.
- Length of stay (LOS) was 7.7 days, a slight improvement. The mean LOS of patients undergoing colonic surgery was 7.2 days and rectal surgery 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 2019-2021, up from 20.
- 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 who received neoadjuvant therapy was similar in the 2021 audit period (5%) when compared to those who did not (4%).

The Binational Colorectal Cancer Audit (BCCA) is a clinical outcomes registry for clinicians involved in the care of patients with bowel cancer. It is led by those committed to excellence in the prevention, diagnosis and treatment of patients with colorectal cancer. The BCCA aims to create a large integrated dataset to be used for quality improvement and research.

INTRODUCTION

The Binational Colorectal Cancer Audit (BCCA) is a clinical outcomes registry for clinicians involved in the care of patients with bowel cancer. It is led by those committed to excellence in the prevention, diagnosis and treatment of patients with colorectal cancer. The BCCA aims to create a large integrated dataset to be used for quality improvement and research.

Governance

The BCCA is overseen by the BCCA Steering Committee in coordination with the BCCA 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 BCCA 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 BCCA, developing quality measures and forming relevant subcommittees to address data access, research and quality issues. The BCCA Research Committee was established in 2020 with the aim of guiding BCCA research, overseeing requests for data access and speeding research project approval.

The 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.

2021 Data analyses

Unless stated otherwise, analyses were undertaken on the 2021 dataset. For participation, incidence capture and screening, patients diagnosed with colorectal cancer between 1 January 2021 and 31 December 2021 were analysed. For sections pertaining to pre-surgery demographics, treatment and clinical quality indicators, patients who had surgery between 1 January 2021 and 31 December 2021 were analysed. 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 (2019 - 2021) 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 118 units analysed, the median number of surgeries was 69 (mean 115, SD 130). 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 December 2018. Variables used in the risk adjustment model are noted under each graph. Clinical input identified the following risk factors: age, sex, ASA grade, urgency of surgery, cancer type and tumour stage. 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.

Colorectal cancer is the second most common cause of cancer death in Australia, resulting in a significant burden of care in the Australian and New Zealand communities.



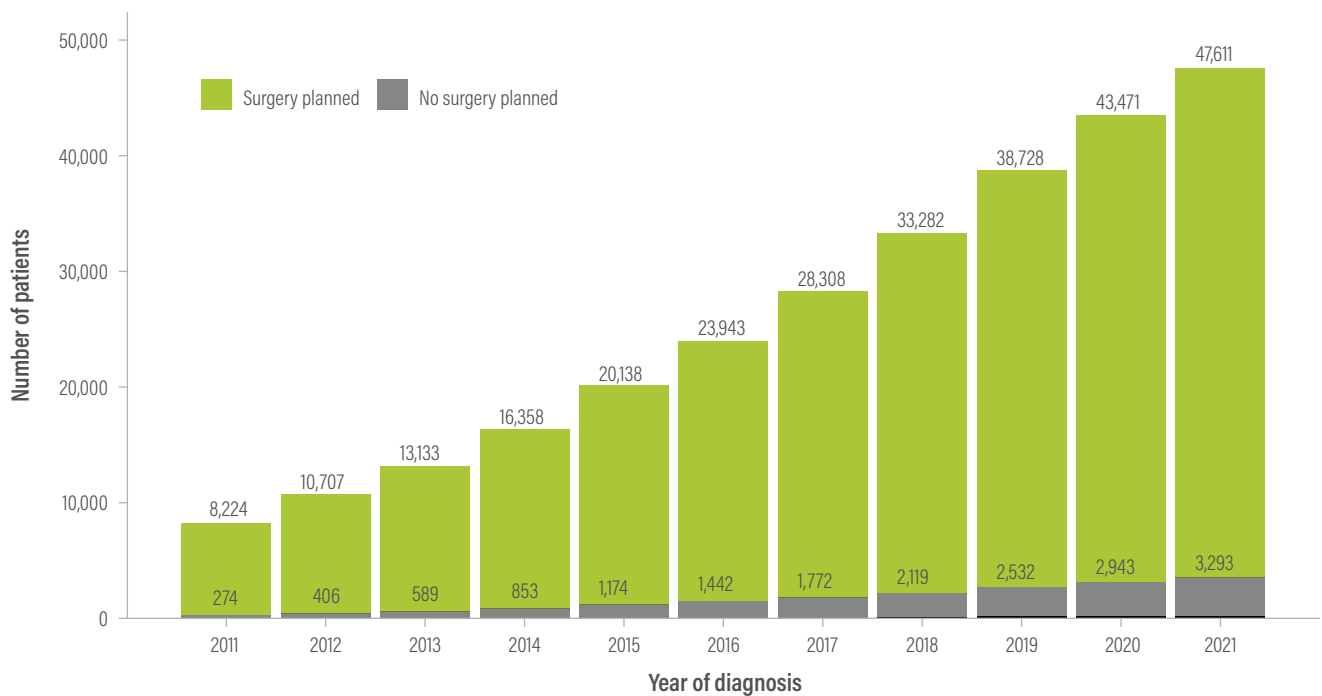
1. PARTICIPATION

Cumulative participation (2011-2021)

Colorectal cancer is the second most common cancer in Australia, resulting in a significant burden of care in the Australian and New Zealand communities. BCCA records information about people newly diagnosed with colorectal cancer, with the aim of improving clinical outcomes.

Participation in the BCCA by clinicians continues to grow. As of 31st December 2021, there were 47,611 patients registered (Figure 1), an increase of 4,140 patients (an approximately 10% increase on 2020 patient numbers). Participation is identified as year of diagnosis (not necessarily year of surgery). This means that both surgically as well as non-surgically managed patients recorded in the database are included, providing a more accurate comparison of BCCA uptake compared with annual colorectal cancer cases diagnosed in Australia and New Zealand¹⁻² (Figure 2).

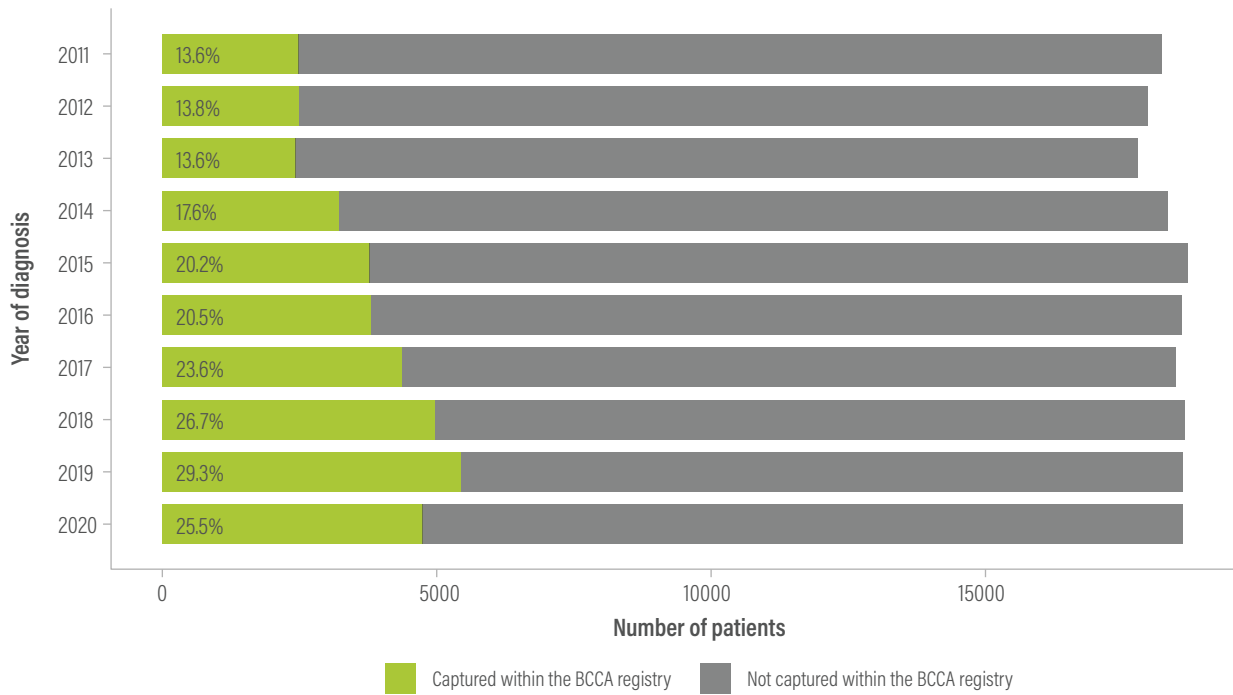
Figure 1. Cumulative participation of colorectal cancer patients with the BCCA registry



Of the 47,611 patients recorded in the BCCA as of 31st December 2021, 3,293 (or 7%) did not have surgery planned.

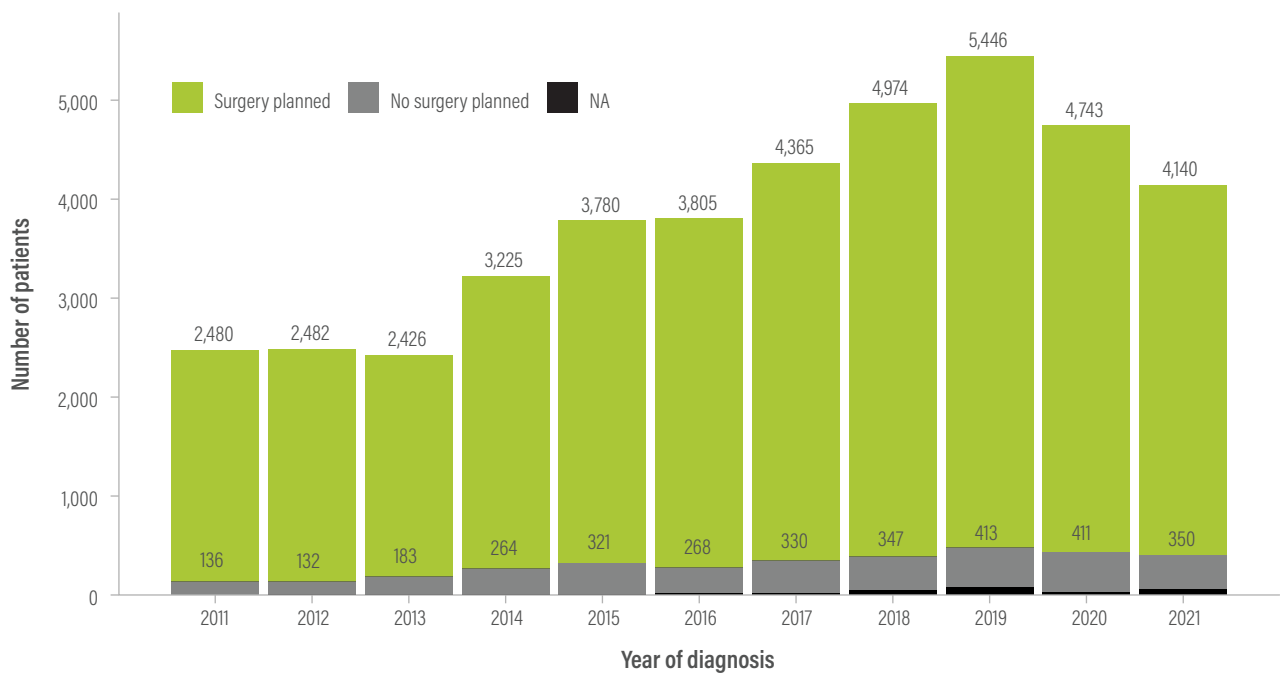
Annual participation

Figure 2. Proportion of Australia and New Zealand colorectal cancer incidents captured by the BCCA registry over time



Data for Figure 2 are delayed by one year so that the comparison of the BCCA case ascertainment to national incidence data can be accurately assessed. For 2020, the proportion of colorectal cancer cases recorded in the BCCA was 25.5% of the total incidence of Australian and New Zealand colorectal cancer cases for that year¹⁻². This is a slight decline compared with 2019 data.

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



4,140 new patients were added to BCCA in 2021 (Figure 3), lower than 2020. This may be due to lower presentation of cases due to the impact of COVID-19 during 2021, as well as cessation of data entry from public sites in Queensland due to expiration of the Queensland Public Health Act (PHA) approval (see below). Nevertheless, the annual number of cases registered has been steadily increasing with over 3,000 patients registered per annum since 2014, and over 4,000 patients registered since 2017.

Table 1. Reasons for non-operative management in patients diagnosed with colorectal cancer (2021)

Reason for no surgery	Count	Percentage
Stage IV	112	32%
Other	60	17%
Medically unfit	54	15%
Polypectomy	53	15%
Patient declined	25	7%
Watch and wait	25	7%
Unresectable	9	3%
Advanced age	6	2%
Unknown	4	1%
Stent	2	1%
Total	350	100%

Three hundred and fifty patients (8%) of the patients diagnosed in 2021 did not have surgery planned (Table 1). Reasons included patients having stage IV cancer (n=112, 32%), patients deemed medically unfit for surgery (n=54, 15%), and polypectomies (n=53, 15%). Twenty five (7%) patients declined surgery.

Participation by jurisdiction (2021)

Victoria and New Zealand reported the highest volume participation in 2021 followed by New South Wales, South Australia and Western Australia (Table 2). Across both countries, 81% of participating cases were from public hospitals (96% for New Zealand, and 75% 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.

Data entry has ceased in 2021 in Queensland as the BCCA's PHA approval from Queensland Health has expired, and has not yet been renewed to enable recollection of data. This is a potential loss of over 400 patients to the BCCA (based on 2020 BCCA data collected).

Table 2. BCCA participation by jurisdiction and public/private hospital (2021)

	Hospital	Count	Percentage
ACT	Private	2	50%
	Public	2	50%
NSW	Private	139	17%
	Public	674	83%
NZ	Private	41	4%
	Public	1,113	96%
QLD	Private	119	100%
	Public	0	0%
SA	Private	71	14%
	Public	425	86%
TAS	Private	35	100%
	Public	0	0%
VIC	Private	255	21%
	Public	977	79%
WA	Private	120	42%
	Public	167	58%

... the annual number of cases registered has been steadily increasing with over 3,000 patients registered per annum since 2014, and over 4,000 patients registered since 2017.

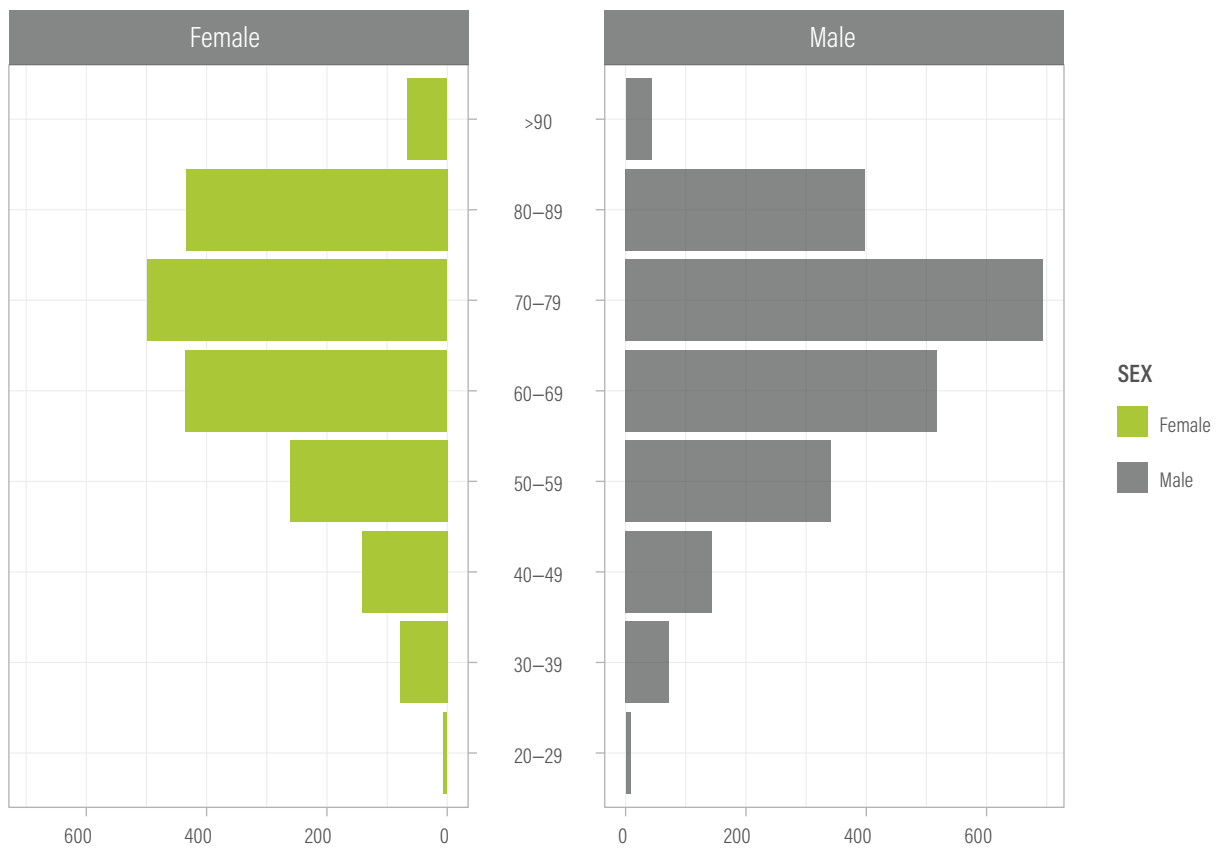


2. DEMOGRAPHICS

Age and gender characteristics

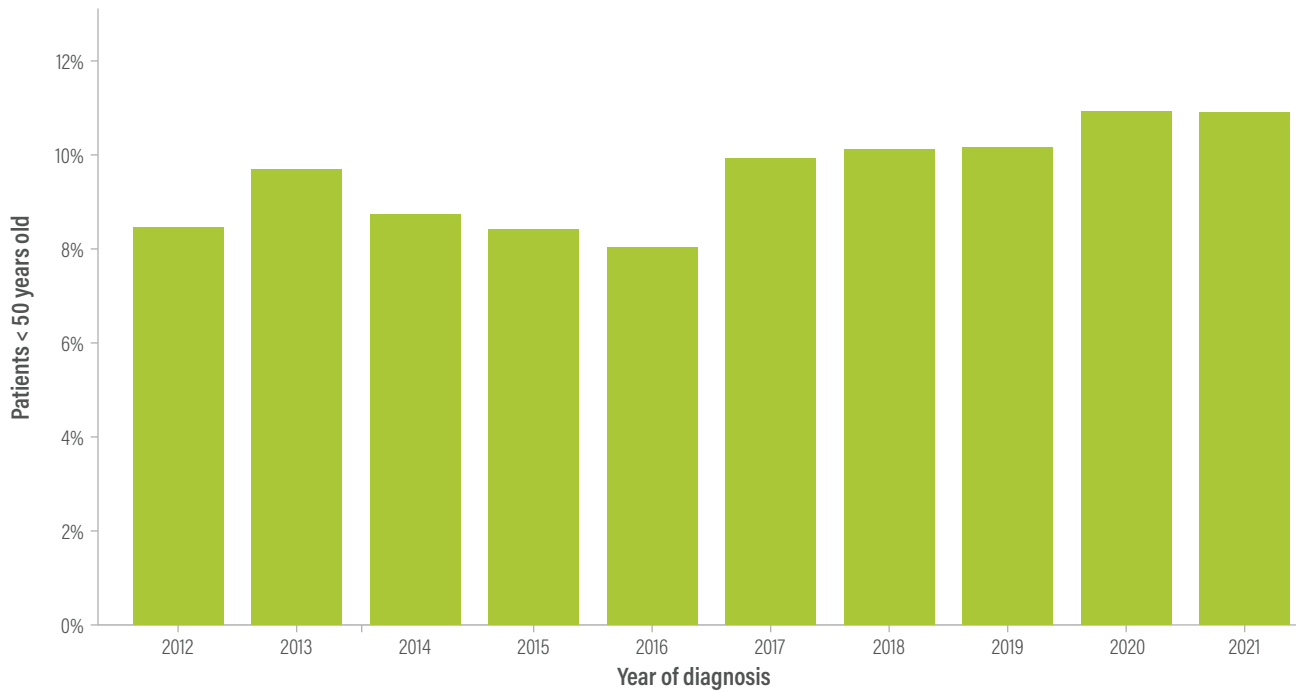
Figure 4 shows the proportion of males and females across various age categories who were diagnosed with colorectal cancer in 2021. The split between the genders remains the same as previously reported (54% males). Also as seen in previous reporting there were more elderly females (80 years or older) who were diagnosed compared to males (26% vs 20%). The mean age was very similar for both genders. Females were on average just slightly older at 68.8 years compared to males at 68.3 years of age at diagnosis.

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



Patients who were under 50 years of age at time of diagnosis are shown in Figure 5. There was a very slight decline in this cohort of patients compared to the previous report, however, overall the proportion of younger patients has steadily increased over the last five years. From 2016 to 2021, there has been a 3% increase observed in the proportion of younger patients being diagnosed with colorectal cancer.

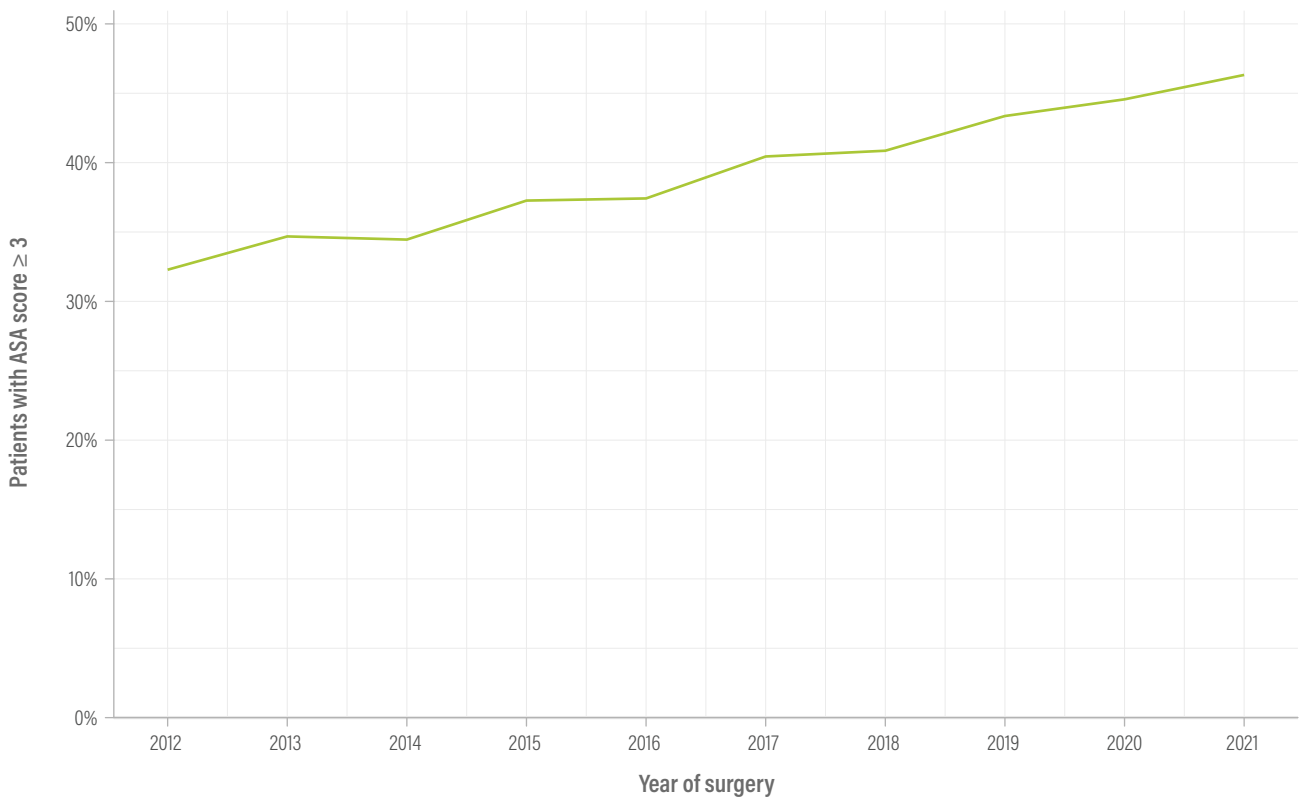
Figure 5. Patients under 50 years old at the time of colorectal cancer diagnosis



ASA status

The American Society of Anaesthesiologists (ASA) Physical Classification system is a tool used to assess the fitness of patients for surgery and can be utilised to understand their perioperative risks³. Since 2012, the proportion of patients with colorectal cancer undergoing surgery with an ASA ≥ 3 has steadily climbed from 32% in 2012 to 46% in 2021 (Figure 6). An ASA ≥ 3 represents “a patient with severe systemic disease” and includes comorbidities such as a history of previous cardiac bypass surgery, stroke and diabetes.

Figure 6. Patients with ASA ≥ 3 at the time of surgery



Primary tumour location

The location of the primary colorectal cancer is detailed in Table 3. In contrast to the previous year's reporting, the proportion of tumours in the mid and lower third of rectum has decreased (absolute reduction of 1.9% and 1.7% respectively). Conversely, the proportion of sigmoid colon primary tumours has increased by 1.3% compared to the previous reporting period. Overall, all other tumour locations are similar to previous reporting.

Table 3. Primary tumour location of colorectal cancer patients who received surgical treatment in 2021

Tumour site	Count	Percentage
Ascending colon	580	14.1%
Caecum	526	12.8%
Descending colon	148	3.6%
Hepatic flexure	247	6%
Rectosigmoid	286	6.9%
Rectum lower third	547	13.3%
Rectum mid third	326	7.9%
Rectum upper third	192	4.7%
Sigmoid colon	756	18.4%
Splenic flexure	129	3.1%
Transverse colon	343	8.3%
Unknown	36	0.9%
Total	4,116	100%

Colon and rectal cancer profiles

With regards to surgery for rectal cancer, females had significantly more rectal cancer than males (64% vs 36%). Overall, half of patients with rectal cancer were 64 years or younger, with 14.9% being under 50 years of age at the time of surgery. This is similar to the previous year's report. The rates of colon cancer were similar between the genders. Patients with colon cancer were older with 67.5% being 65 years or older at surgery. Further, in the cohort of very elderly (patients 85 years or older), 10.9% of surgery was for colon cancer compared with 3.8% for rectal cancer. Information related to cancer staging is shown in Table 4.

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

	Colon, N=3,015	Rectal, N=1,065	Overall, N=4,080
Sex			
Female	1,528 (50.7%)	680 (63.8%)	2,208 (54.1%)
Male	1,486 (49.3%)	385 (36.2%)	1,871 (45.9%)
Unknown	1	0	1
Age at diagnosis			
<50 yrs	291 (9.7%)	159 (14.9%)	450 (11.0%)
50-64 yrs	689 (22.9%)	387 (36.3%)	1,076 (26.4%)
65-74 yrs	843 (28.0%)	301 (28.3%)	1,144 (28.0%)
75-84 yrs	863 (28.6%)	177 (16.6%)	1,040 (25.5%)
85+ yrs	329 (10.9%)	41 (3.8%)	370 (9.1%)
T stage			
T0	58 (2.0%)	65 (6.3%)	123 (3.1%)
Tis	314 (10.7%)	147 (14.1%)	461 (11.6%)
T1	399 (13.6%)	264 (25.4%)	663 (16.7%)
T2	1,434 (49.0%)	440 (42.3%)	1,874 (47.3%)
T3	668 (22.8%)	83 (8.0%)	751 (19.0%)
T4	33 (1.1%)	34 (3.3%)	67 (1.7%)
TX	18 (0.6%)	6 (0.6%)	24 (0.6%)
Unknown	91	26	117
N stage			
N0	1,738 (59.6%)	675 (65.9%)	2,413 (61.2%)
N1	770 (26.4%)	238 (23.2%)	1,008 (25.6%)
N2	390 (13.4%)	71 (6.9%)	461 (11.7%)
NX	19 (0.7%)	40 (3.9%)	59 (1.5%)
Unknown	98	41	139

	Colon, N=3,015	Rectal, N=1,065	Overall, N=4,080
M stage			
M0	2,084 (71.4%)	782 (75.4%)	2,866 (72.4%)
M1	295 (10.1%)	73 (7.0%)	368 (9.3%)
MX	541 (18.5%)	182 (17.6%)	723 (18.3%)
Unknown	95	28	123
Overall stage*			
0	66 (2.3%)	67 (6.5%)	133 (3.4%)
I	600 (20.5%)	335 (32.3%)	935 (23.6%)
II	1,016 (34.8%)	280 (27.0%)	1,296 (32.8%)
III	924 (31.6%)	261 (25.2%)	1,185 (29.9%)
IV	295 (10.1%)	73 (7.0%)	368 (9.3%)
X	19 (0.7%)	21 (2.0%)	40 (1.0%)
Unknown	95	28	123
ASA score			
1	234 (7.9%)	115 (10.9%)	349 (8.7%)
2	1,193 (40.4%)	542 (51.4%)	1,735 (43.3%)
3	1,354 (45.9%)	375 (35.6%)	1,729 (43.2%)
4	169 (5.7%)	22 (2.1%)	191 (4.8%)
5	1 (0.0%)	0 (0.0%)	1 (0.0%)
Unknown	64	11	75

81 patients excluded due to missing cancer type

*The AJCC staging system is a classification system developed by the American Joint Committee on Cancer (AJCC) for describing the extent of disease progression in cancer patients. It utilises the TNM scoring system to calculate an overall stage value, where T is Tumour size, N is Lymph nodes affected, and M is Metastases. Tumour stages: Stage 0 (cancer in situ), Stage I, II (local disease), Stage III (nodal spread) Stage IV (metastatic disease) and Stage X (tumour stage cannot be identified)⁴.

Urgency of hospital admission

Overall, the majority of patients presented electively in 2021, however this has decreased compared to the previous two years (81% in 2021 vs 83% in 2020 vs 85% in 2019). Similar to previous reporting, female patients presented more frequently as an emergency case than did males (53.5% vs 46.5%). Refer to Table 5 for further information by urgency of hospital admission including cancer site and stage and ASA score.


Table 5. Description by urgency of hospital admission

	Elective N=3,365	Urgent N=406	Emergency N=383	Overall N=4,154
Sex				
Female	1,832 (54.5%)	205 (50.5%)	205 (53.5%)	2,242 (54.0%)
Male	1,531 (45.5%)	201 (49.5%)	178 (46.5%)	1,910 (46.0%)
Unknown	2	0	0	2
Age at diagnosis				
<50 yrs	358 (10.6%)	50 (12.3%)	51 (13.3%)	459 (11.0%)
50-64 yrs	920 (27.3%)	101 (24.9%)	95 (24.8%)	1,116 (26.9%)
65-74 yrs	960 (28.5%)	100 (24.6%)	103 (26.9%)	1,163 (28.0%)
75-84 yrs	852 (25.3%)	110 (27.1%)	85 (22.2%)	1,047 (25.2%)
85+ yrs	275 (8.2%)	45 (11.1%)	49 (12.8%)	369 (8.9%)
Cancer site				
Caecum/ascending colon	880 (32.0%)	124 (42.3%)	100 (36.2%)	1,104 (33.3%)
Hepatic flexure	195 (7.1%)	23 (7.8%)	29 (10.5%)	247 (7.4%)
Transverse colon	252 (9.2%)	42 (14.3%)	45 (16.3%)	339 (10.2%)
Splenic flexure/descending colon	212 (7.7%)	21 (7.2%)	43 (15.6%)	276 (8.3%)
Rectosigmoid	221 (8.0%)	33 (11.3%)	32 (11.6%)	286 (8.6%)
Rectal	988 (36.0%)	50 (17.1%)	27 (9.8%)	1,065 (32.1%)
Unknown	617	113	107	837
T stage				
T0	123 (3.8%)	2 (0.5%)	2 (0.5%)	127 (3.2%)
Tis	439 (13.5%)	16 (4.1%)	8 (2.1%)	463 (11.5%)
T1	611 (18.8%)	45 (11.7%)	9 (2.4%)	665 (16.6%)
T2	1,554 (47.8%)	174 (45.1%)	155 (41.1%)	1,883 (46.9%)
T3	444 (13.7%)	141 (36.5%)	188 (49.9%)	773 (19.3%)
T4	57 (1.8%)	6 (1.6%)	13 (3.4%)	76 (1.9%)
TX	23 (0.7%)	2 (0.5%)	2 (0.5%)	27 (0.7%)
Unknown	114	20	6	140

	Elective N=3,365	Urgent N=406	Emergency N=383	Overall N=4,154
N stage				
N0	2,103 (65.1%)	199 (51.6%)	142 (38.0%)	2,444 (61.3%)
N1	777 (24.1%)	112 (29.0%)	125 (33.4%)	1,014 (25.4%)
N2	299 (9.3%)	67 (17.4%)	96 (25.7%)	462 (11.6%)
NX	51 (1.6%)	8 (2.1%)	11 (2.9%)	70 (1.8%)
Unknown	135	20	9	164
M stage				
M0	2,456 (75.7%)	275 (71.2%)	165 (43.9%)	2,896 (72.3%)
M1	229 (7.1%)	72 (18.7%)	82 (21.8%)	383 (9.6%)
MX	561 (17.3%)	39 (10.1%)	129 (34.3%)	729 (18.2%)
Unknown	119	20	7	146
Overall stage				
0	131 (4.0%)	4 (1.0%)	4 (1.1%)	139 (3.5%)
I	866 (26.7%)	54 (14.0%)	17 (4.5%)	937 (23.4%)
II	1,075 (33.1%)	129 (33.4%)	112 (29.8%)	1,316 (32.8%)
III	912 (28.1%)	125 (32.4%)	152 (40.4%)	1,189 (29.7%)
IV	229 (7.1%)	72 (18.7%)	82 (21.8%)	383 (9.6%)
X	33 (1.0%)	2 (0.5%)	9 (2.4%)	44 (1.1%)
Unknown	119	20	7	146
ASA score				
1	311 (9.5%)	28 (7.0%)	18 (4.7%)	357 (8.8%)
2	1,504 (45.7%)	162 (40.7%)	99 (26.1%)	1,765 (43.4%)
3	1,356 (41.2%)	186 (46.7%)	209 (55.1%)	1,751 (43.1%)
4	119 (3.6%)	22 (5.5%)	52 (13.7%)	1,93 (4.7%)
5	0 (0.0%)	0 (0.0%)	1 (0.3%)	1 (0.0%)
Unknown	75	8	4	87

46 patients excluded due to missing operative urgency

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.



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 in this age group are at average risk and without symptoms, are mailed an immunological FOBT every 2 years, equating to approximately 5 million Australians screened per year.

The National Bowel Cancer Screening Program Monitoring report was published in July 2020. Since the program began in August 2006, around 6.8 million NBCSP screening tests have been completed. Of the 5 million people invited to screen between January 2018 and December 2019, 44% participated. Of those assessed in 2019 after a positive screen and then colonoscopy, 2,486 had an advanced adenoma and 1,375 either had confirmed cancer or suspected cancer⁵.

In New Zealand, after a pilot program, the new National Bowel Screening Programme (NBSP) commenced a staged rollout in January 2018 and is now available for eligible New Zealanders aged 60 to 74, with FOBT screening every 2 years. The New Zealand NBSP is in its infancy but their pilot program data predicts a 7% positivity rate based on 700,000 people being invited per year with initial detection rates estimated at 500-700 cancers each year.

A subset of patients from each national screening program are submitted to the BCCA 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), and has now fallen back to 16%. It is hoped this percentage will increase as the screening programs in both countries mature, and efforts to improve screening compliance remain important.

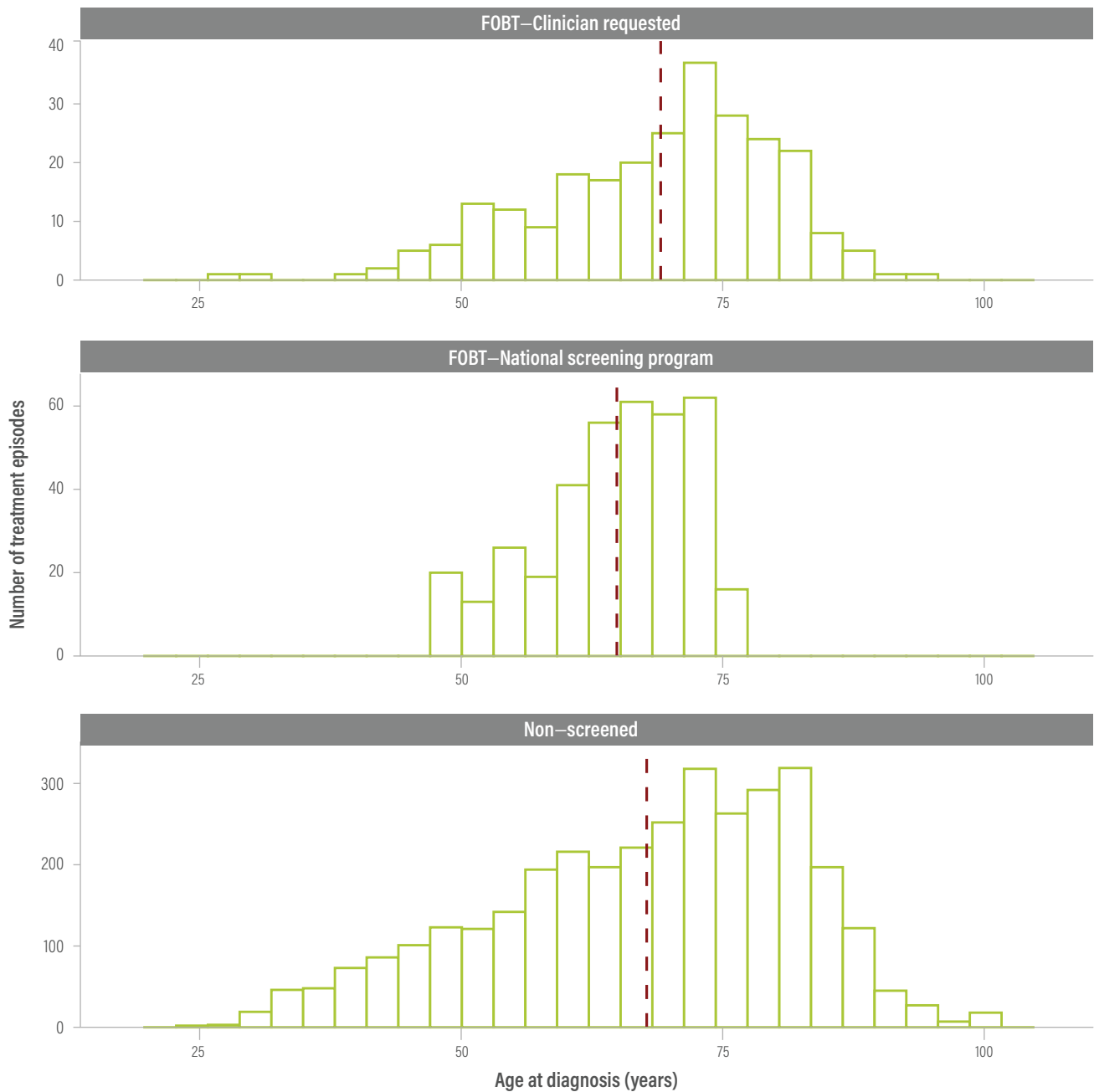
Table 6. Cumulative incidence and proportion of patients diagnosed by FOBT

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Diagnosed following FOBT	13%	11%	12%	11%	15%	16%	18%	19%	17%	16%
Count	1,358	1,827	2,667	3,076	3,147	3,659	4,261	4,656	4,165	3,539

Characteristics of patients diagnosed by screening vs symptoms

Mean age at diagnosis is earlier for patients participating in the NBCSP (64.9 years), than for those screened outside of the program (69.1 years) or for those diagnosed without screening (67.7 years) (Figure 7).

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

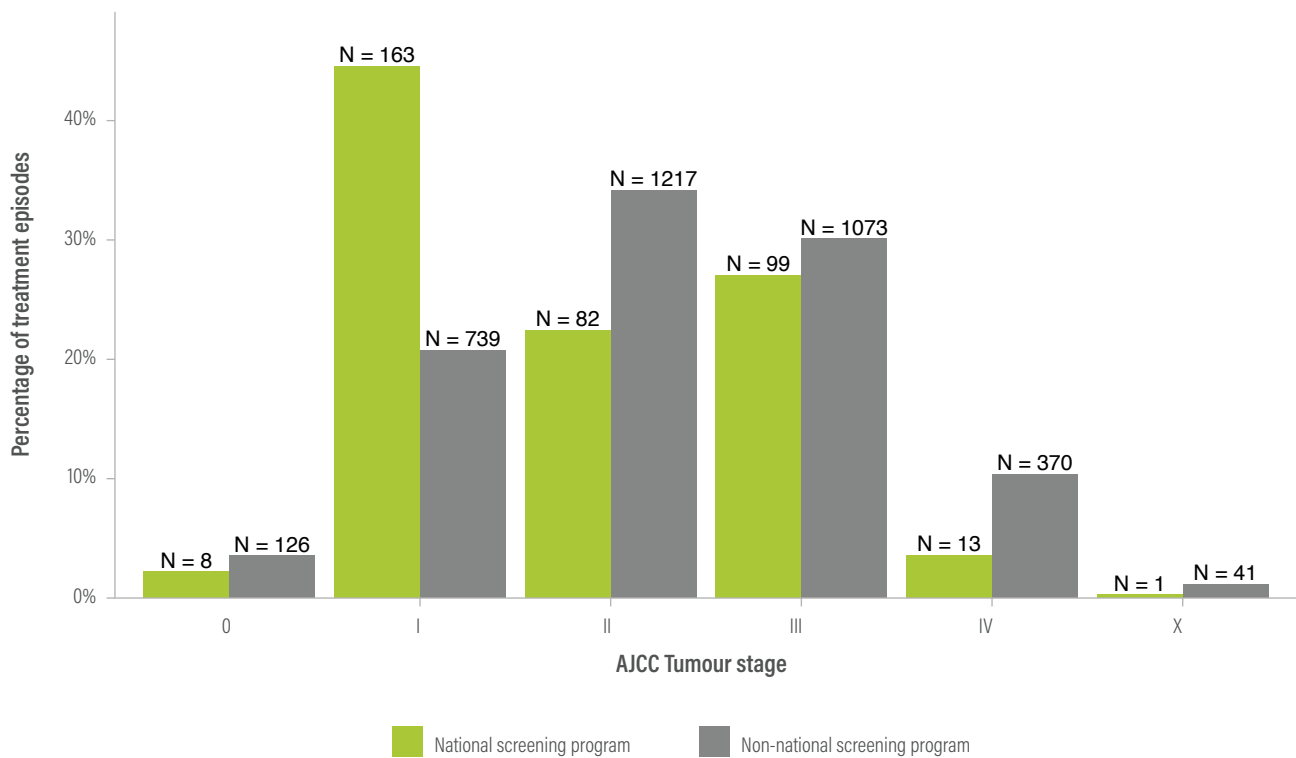


Vertical dashed lines represent average age within each category

Cancer stage

Patients diagnosed via the NBCSP are at an earlier stage than non-screened patients (Figure 8). This is expected, and highlights the significant value of the NBCSP. It is difficult to draw conclusions about patients diagnosed by FOBT requested by clinicians as though they do appear to be diagnosed at an earlier stage, it is unknown if they were asymptomatic or symptomatic. Diagnosis at an earlier stage has been previously shown to be associated with reduced colorectal cancer related mortality⁶⁻⁷.

Figure 8. NBCSP patients vs unscreened patients by cancer stage. Early stage diagnosis is strongly linked to survival



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.

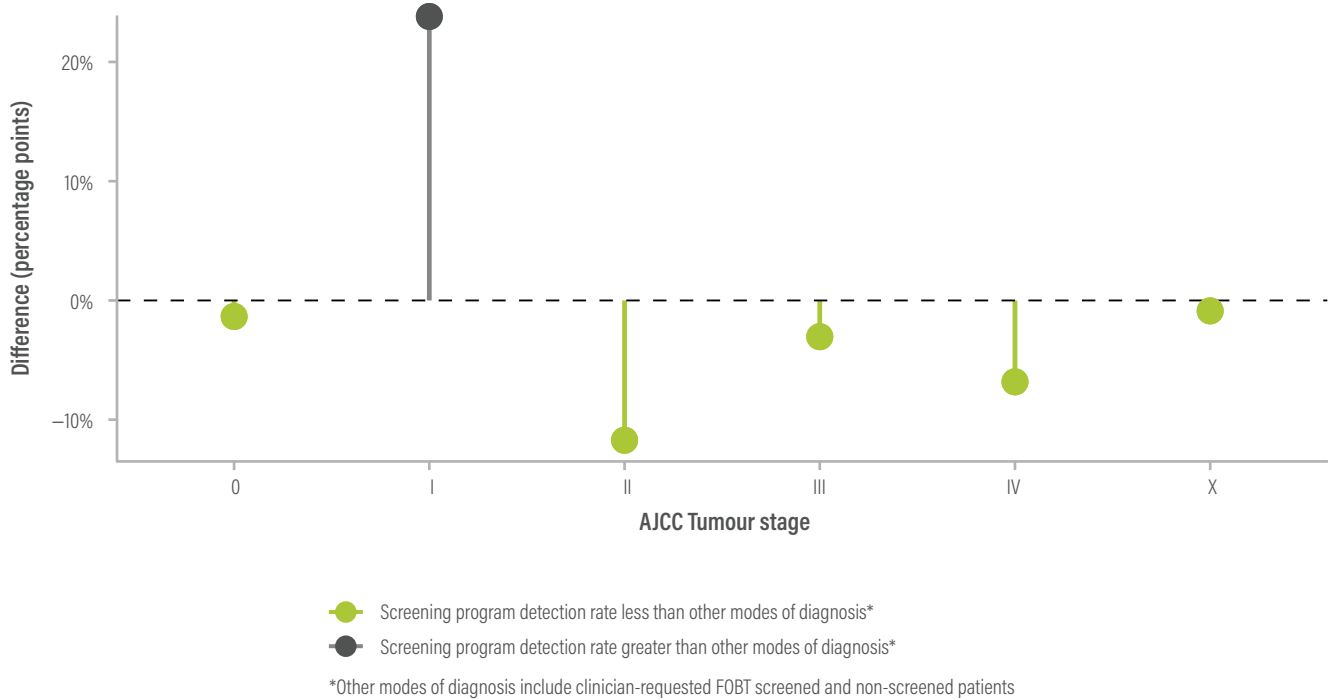
Table 7. Tumour stage of patients diagnosed with colorectal cancer by the national FOBT screening program vs non-screened (2021)

	FOBT - Clinician requested	FOBT - National screening program	Non-screened	Unknown	Total	p-value*
AJCC tumour stage						<0.001
0	9 (3.5%)	8 (2.2%)	117 (3.4%)	5 (4.2%)	139 (3.3%)	
I	81 (31.6%)	163 (43.8%)	658 (19.1%)	41 (34.2%)	943 (22.5%)	
II	89 (34.8%)	82 (22.0%)	1,128 (32.7%)	22 (18.3%)	1,321 (31.5%)	
III	54 (21.1%)	99 (26.6%)	1,019 (29.5%)	25 (20.8%)	1,197 (28.5%)	
IV	10 (3.9%)	13 (3.5%)	360 (10.4%)	3 (2.5%)	386 (9.2%)	
X	6 (2.3%)	1 (0.3%)	35 (1.0%)	2 (1.7%)	44 (1.0%)	
Unknown	7 (2.7%)	6 (1.6%)	135 (3.9%)	22 (18.3%)	170 (4.0%)	
Total	256 (6.1%)	372 (8.9%)	3,452 (82.2%)	120 (2.9%)	4,200 (100%)	

*Pearson's Chi -squared test

Figure 9 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 20% higher in the national FOBT screening program.

Figure 9. Difference in proportion of colorectal cancer patients diagnosed in the national FOBT screening program and outside the national FOBT screening programs (2021)



A 2021 publication in the Medical Journal of Australia utilising data from the BCCA assessed the short and medium term benefits of the Australian colorectal cancer screening program. Patients whose tumours were identified through the NBCSP had a lower long term mortality but also demonstrated a reduction in short term postoperative morbidity⁸.

4. MANAGEMENT

Colon cancer

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 report is divided into the following sections.

1. Colon cancer
 - a. Primary procedure
 - b. Operative approach
 - c. Adjuvant therapy
2. Rectal cancer
 - a. MRI utilisation
 - b. MDT utilisation
 - c. Neoadjuvant therapy
 - d. Primary procedure
 - e. Operative approach

Primary procedures for colon cancer

Right hemicolectomy remains the most commonly performed surgical procedure for colon cancer, accounting for 49% of operations (Table 8).

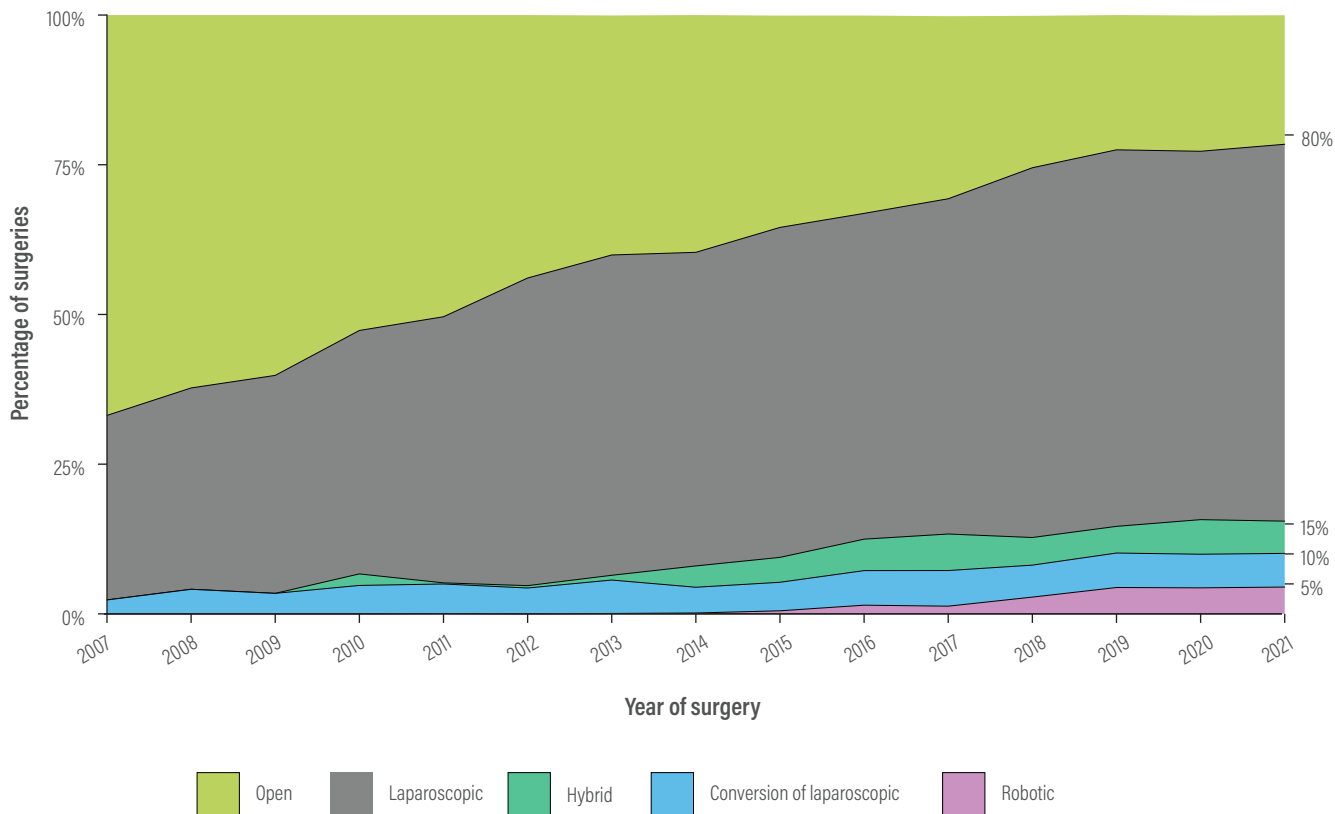
Table 8. Primary procedure for colon cancer patients who received surgical treatment in 2021

Operation	Count	Percentage
Right hemicolectomy	1,321	49%
Extended right hemicolectomy	222	8%
Left hemicolectomy	150	6%
Sigmoid colectomy	31	1%
Total colectomy	29	1%
Sub total colectomy	119	4%
Proctocolectomy	10	<1%
High anterior resection (10.1-15 cm)	728	27%
Transverse colectomy	16	1%
Laparotomy	10	<1%
Other	42	2%
Total	2,678	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.

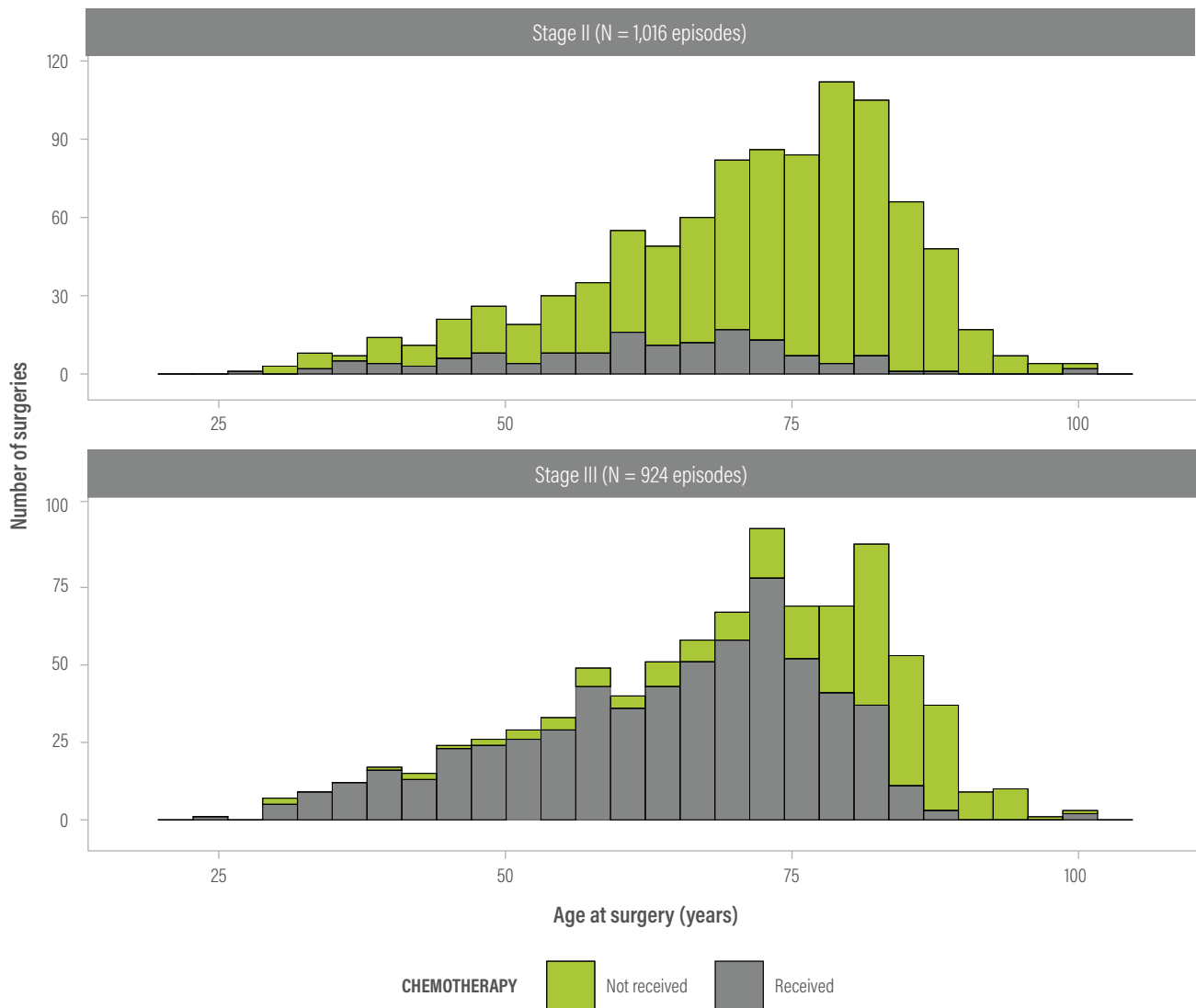
Figure 10. Operative approach for colon cancer patients who received surgical treatment



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, following resection of the primary tumour. 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 2021, stratified by chemotherapy treatment status



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.

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).

Rectal cancer patients undergoing MRIs

Figure 12. Proportion of patients with rectal cancer undergoing MRI scan as part of preoperative staging over time

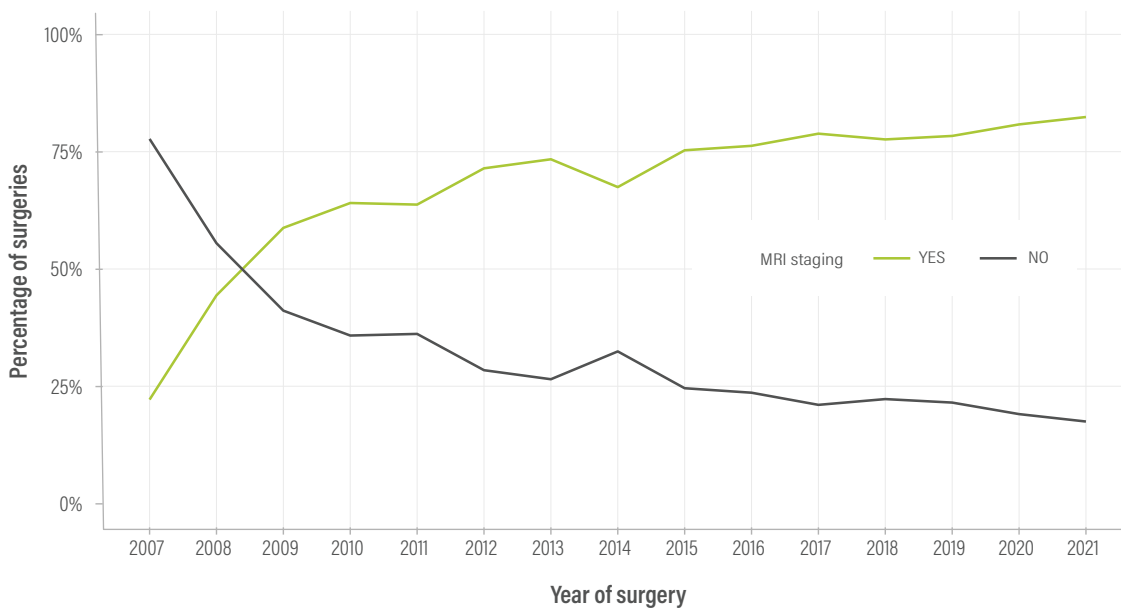
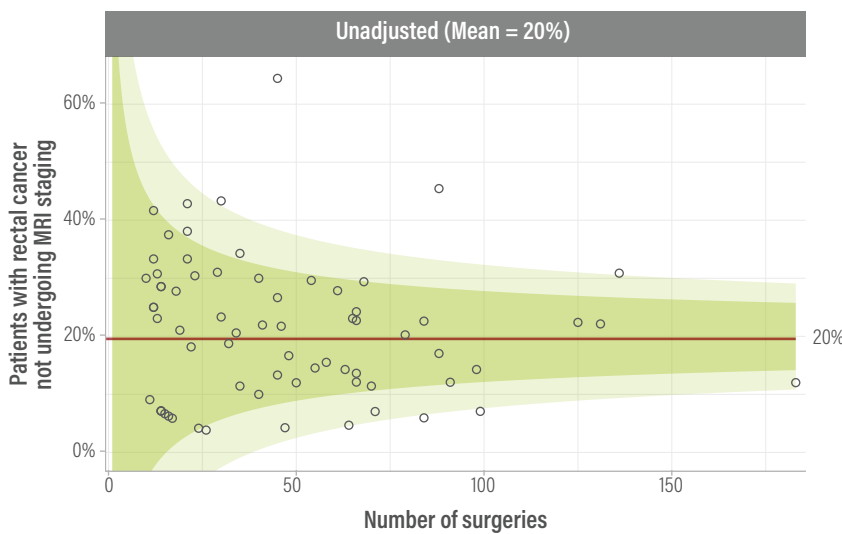


Figure 13. Proportion of rectal cancer patients who received surgical treatment between 2019 and 2021, but did not receive any MRI staging



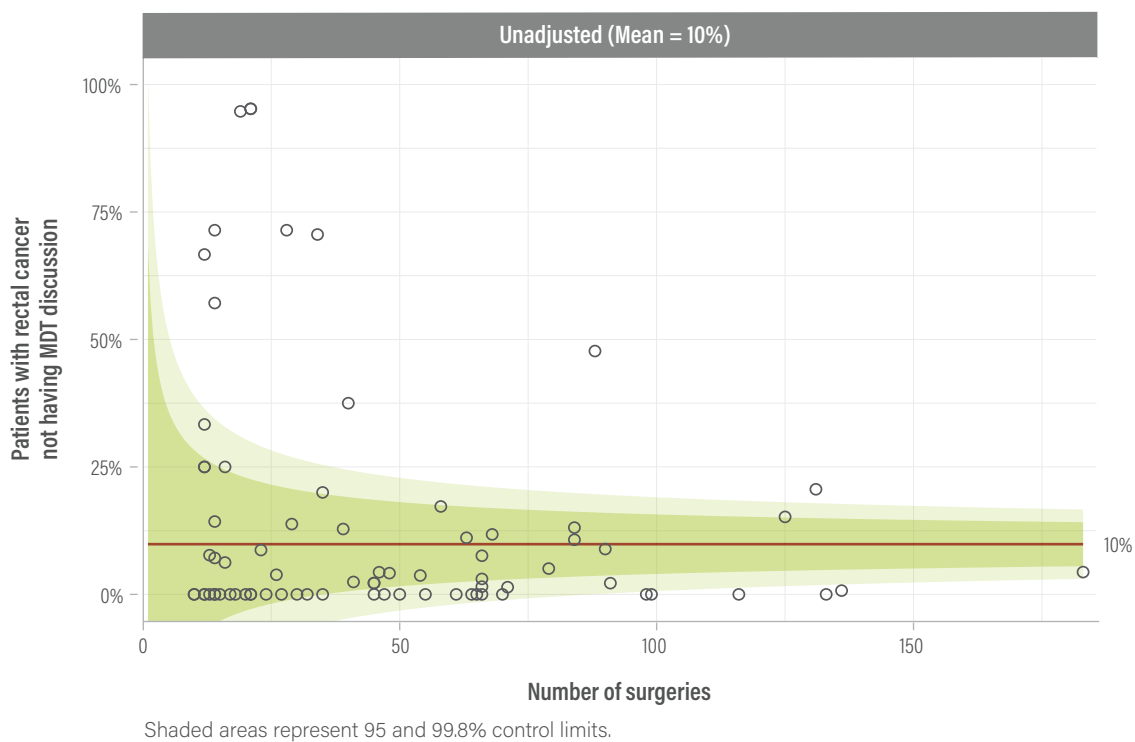
Shaded areas represent 95 and 99.8% control limits.

Rectal cancer discussed at MDT

Table 9. Patients with rectal cancer discussed at MDT

Discussed at MDT	Count	Percentage
Yes	978	92%
No	77	7%
N/A	8	1%
Total	1,063	100%

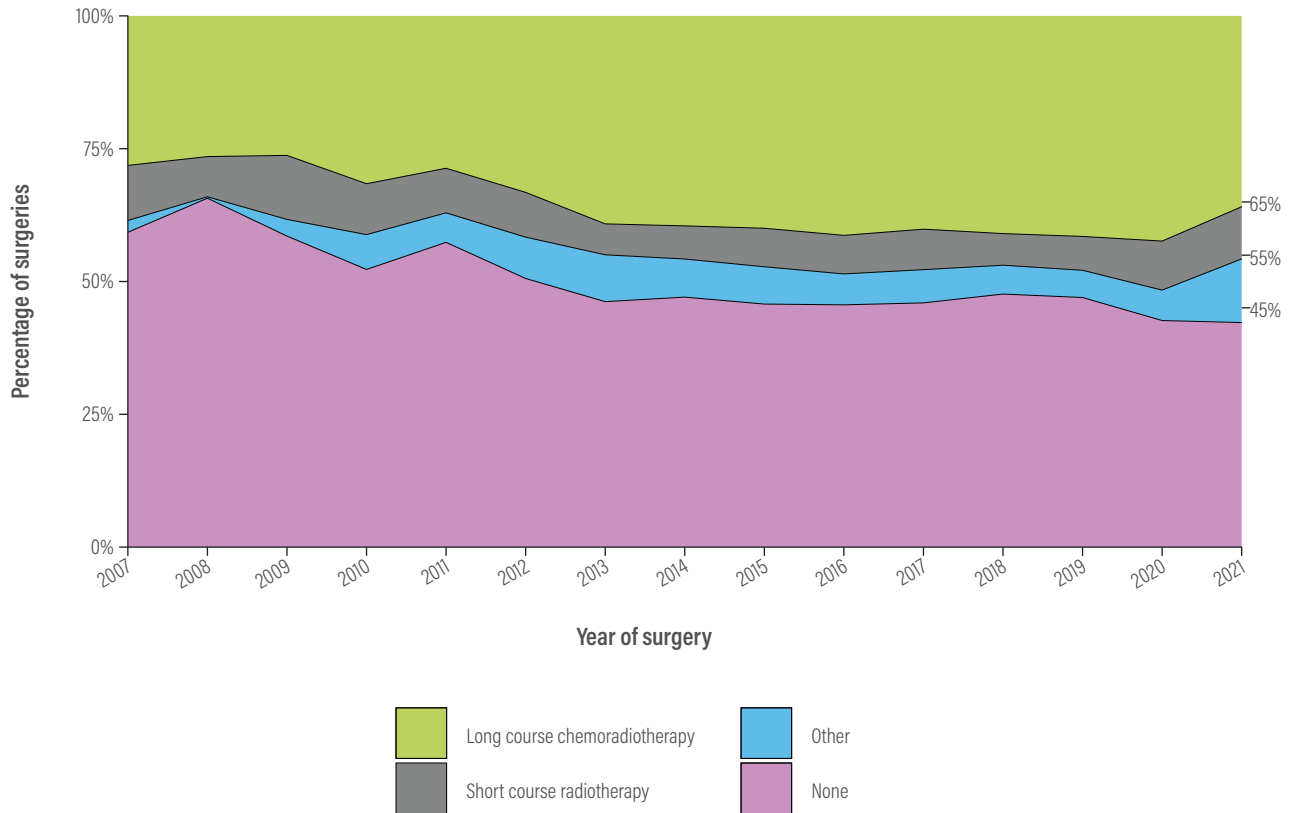
Figure 14. Rate of rectal cancer patients who received surgical treatment between 2019 and 2021 not discussed at MDT, by site



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 used regimen remains long course chemoradiotherapy.

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 2021

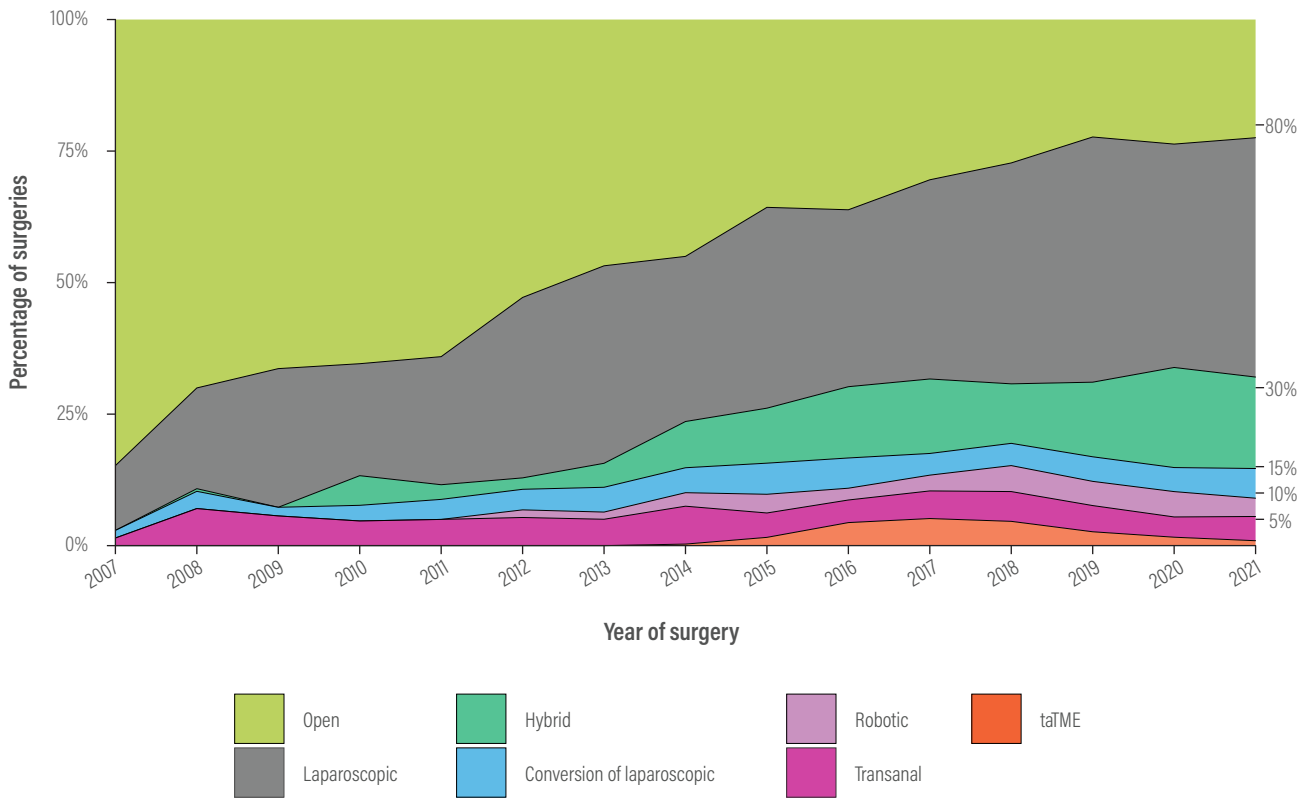
Operation	Count	Percentage
Ultra low anterior resection (0-6 cm)	412	39%
APR	212	20%
Low anterior resection (6.1-10 cm)	210	20%
High anterior resection (10.1-15 cm)	72	7%
Hartmanns	47	4%
TEMS/TAMIS	39	4%
Other	35	3%
Proctocolectomy	13	1%
Local excision	8	1%
Colo-anal anastomosis	6	1%
Laparotomy	3	<1%
Total	1,159	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, with a small increase in hybrid approach surgery versus straight laparoscopy (Figure 16). Adoption of newer MIS approaches such as robotic resection and transanal total mesorectal excision (taTME) has also stabilised. 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 16. Operative approach for rectal cancer patients who received surgical treatment



5. COMPLICATIONS

A summary of complications for patients undergoing colonic and rectal cancer operations is shown in Tables 11 and 12 respectively. General trends for medical and surgical complications from 2012 to 2021 are shown in Figure 17. Data in these tables and figures should be interpreted with caution due to the self-reported nature of the data and absence of risk stratification. The complication rates are broadly consistent with international standards. The anastomotic leak rate for colonic (2%) and rectal (3%) resections remains low. Wound infection rates improved from 4% of cases in 2020 to 2% of cases in 2021.

Colon cancer

Table 11. Summary of surgical and medical complications of colon cancer patients who received surgical treatment in 2021

Complication	Count	Percentage
Surgical complications	514	17%
Abdominal pelvic collection	61	2%
Anastomotic leak	73	2%
Enterocutaneous fistula	3	<1%
Superficial wound dehiscence	35	1%
Deep wound dehiscence	13	<1%
Wound infection	70	2%
Sepsis	40	1%
Prolonged ileus	225	7%
Small bowel obstruction	14	<1%
Urinary retention	21	1%
Ureteric injury	6	<1%
Splenectomy	2	<1%
Postoperative haemorrhage	48	2%
Other surgical complications	82	3%
Medical complications	414	14%
DVT / PE*	27	1%
Chest infection	114	4%
Cardiac	128	4%
Other medical complications	251	8%

n = 3,015 treatment episodes

*Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE)

Rectal cancer

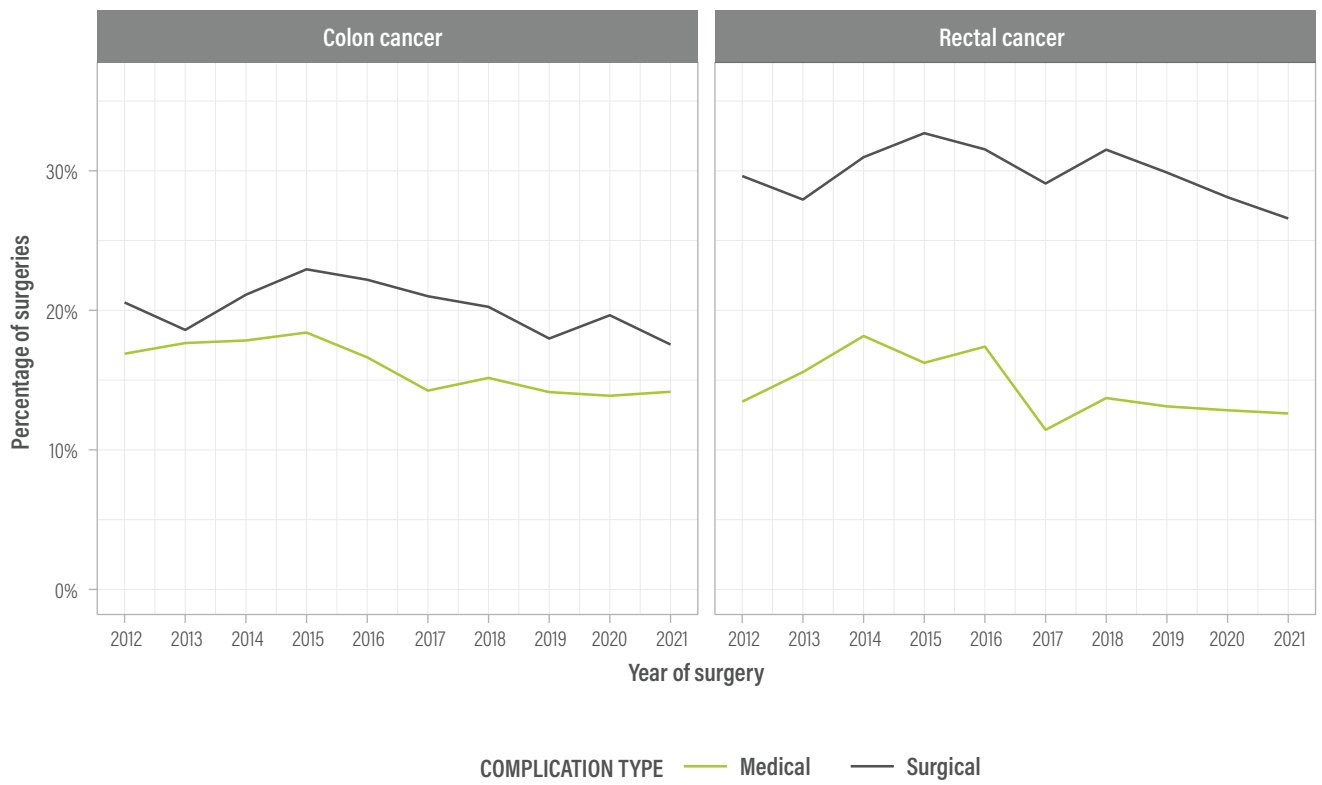
Table 12. Summary of surgical and medical complications of rectal cancer patients who received surgical treatment in 2021

Complication	Count	Percentage
Surgical complications	277	26%
Prolonged ileus	106	10%
Abdominal pelvic collection	56	5%
Urinary retention	20	2%
Wound infection	32	3%
Anastomotic leak	31	3%
Superficial wound dehiscence	29	3%
Sepsis	28	3%
Small bowel obstruction	21	2%
Postoperative haemorrhage	17	2%
Deep wound dehiscence	9	1%
Ureteric injury	2	<1%
Other surgical complications	66	6%
Enterocutaneous fistula	2	<1%
Splenectomy	1	<1%
Medical complications	131	12%
Cardiac	33	3%
Chest infection	32	3%
DVT / PE*	10	1%
Other medical complications	78	7%

n = 1,065 treatment episodes

*Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE)

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



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 this⁹. The clinical indicators used in the BCCA 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.

The BCCA has reported against a number of clinical quality indicators (or KPIs) since 2017. These include:

Primary KPIs:

- Inpatient mortality
- Return to theatre
- Anastomotic leak rate
- Number of lymph nodes examined (colon)
- Circumferential margins (rectal)

Secondary KPIs:

- 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 KPIs 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. As a compromise between having contemporaneous data and having sufficient site caseload with which to benchmark sometimes rare events, for Annual Reports since 2018, BCCA KPIs comprise the most recent 3 years of data only (unless otherwise indicated). Prior to 2018, these KPIs 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.

KPIs 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.

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

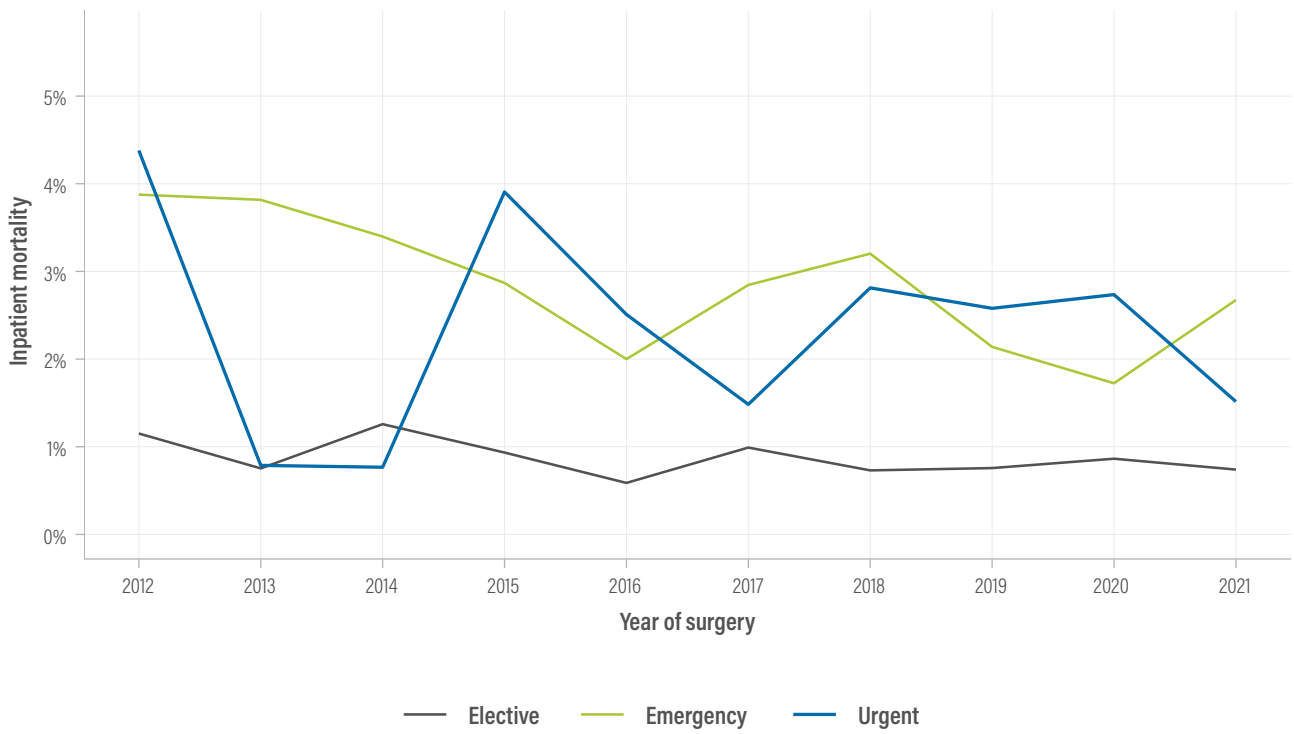
Inpatient mortality

Inpatient mortality remains low at 1% of reported cases (Table 13). Urgency of admission is a factor in hospital mortality. Higher mortality is seen in urgent or emergency cases (Figure 18). In the 2019 to 2021 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)

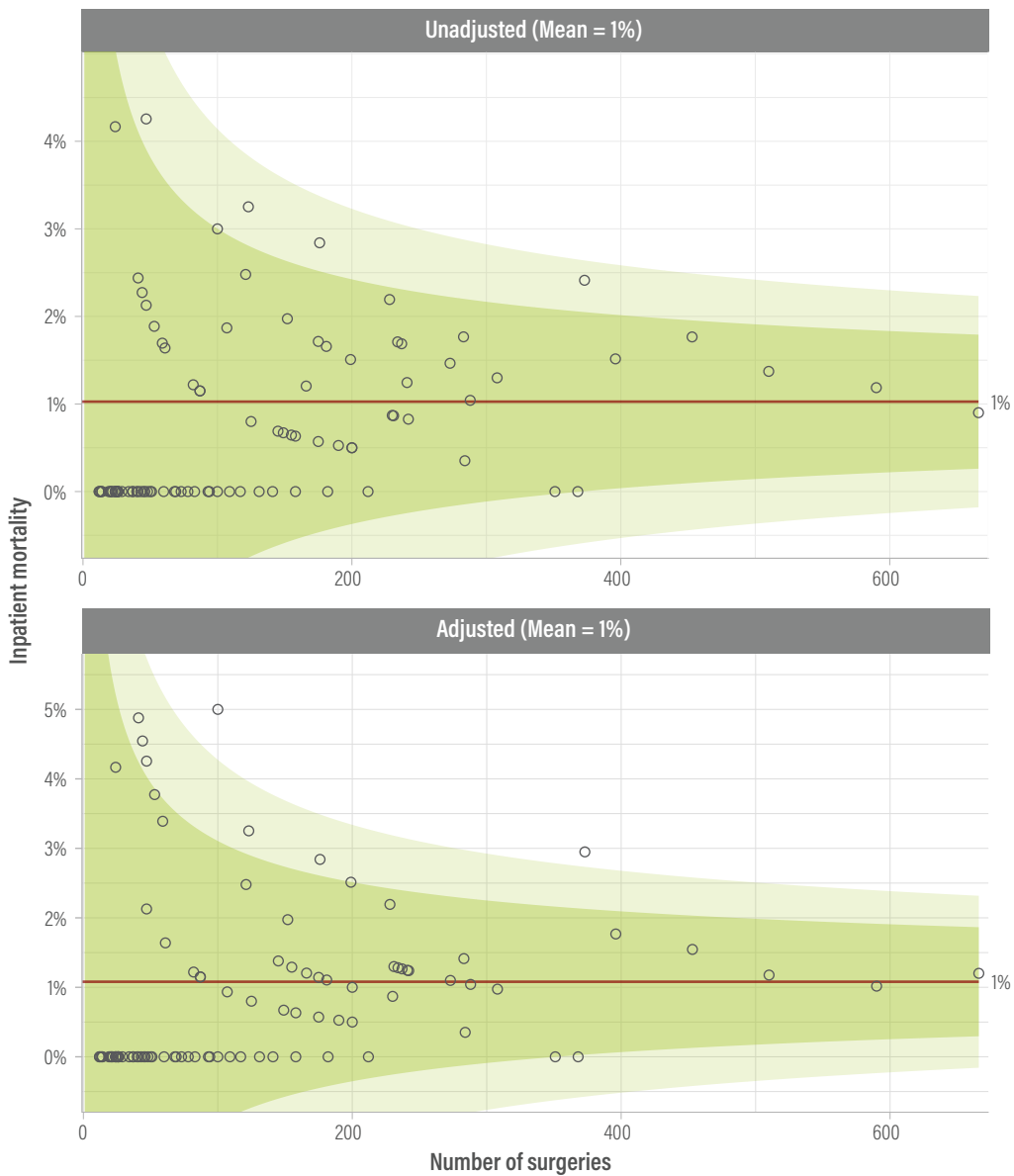
	Treatment Episode	Inpatient death	Inpatient mortality rate (%)
2007	497	10	2
2008	1,237	16	1
2009	1,484	19	1
2010	2,024	24	1
2011	2,277	38	2
2012	2,184	33	2
2013	2,121	20	1
2014	3,023	41	1
2015	3,293	43	1
2016	3,375	28	1
2017	3,716	43	1
2018	4,299	45	1
2019	4,695	47	1
2020	4,325	47	1
2021	4,033	40	1
Total	42,583	494	1

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



Emergency N = 3,019, Urgent N = 3,277, Elective N = 36,184, Total N = 42,480

Figure 19. Mortality rate in colorectal cancer patients who received surgical treatment between 2019 and 2021, by site

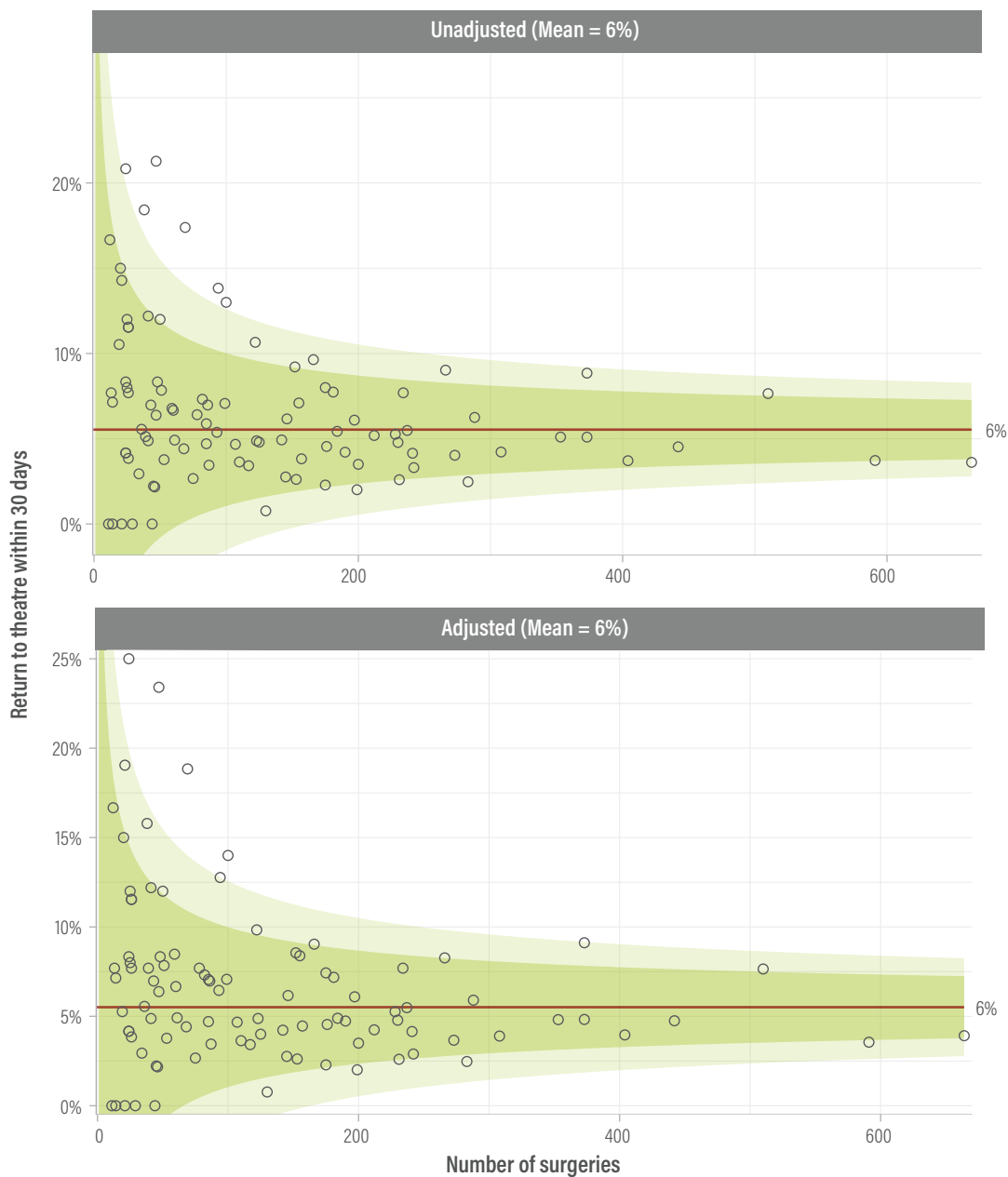


Adjusted for ASA score, patient age at diagnosis, operative urgency, sex, and overall stage.
 Shaded areas represent 95 and 99.8% control limits.
 6 sites were excluded due to low completeness of the adjusting covariates and/or outcome.

Return to theatre

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

Figure 20. Return to theatre rate in colorectal cancer patients who received surgical treatment between 2019 and 2021, by site



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

Surgical complications

Approximately 1 in 5 patients who underwent colorectal resection between 2019 and 2021 were reported to experience a surgical complication. Funnel plots showing surgical complications for the period 2019-2021 are presented below for colon (Figure 21) and rectal (Figure 22) cancer surgery. Surgical complications resulting from surgery for colon and rectal cancer combined are shown in Figure 23, with adjusted funnel plots presented. All data presented is self-reported and has not been externally validated.

Figure 21. Surgical complication rate in colon cancer patients who received surgical treatment between 2019 and 2021, by site

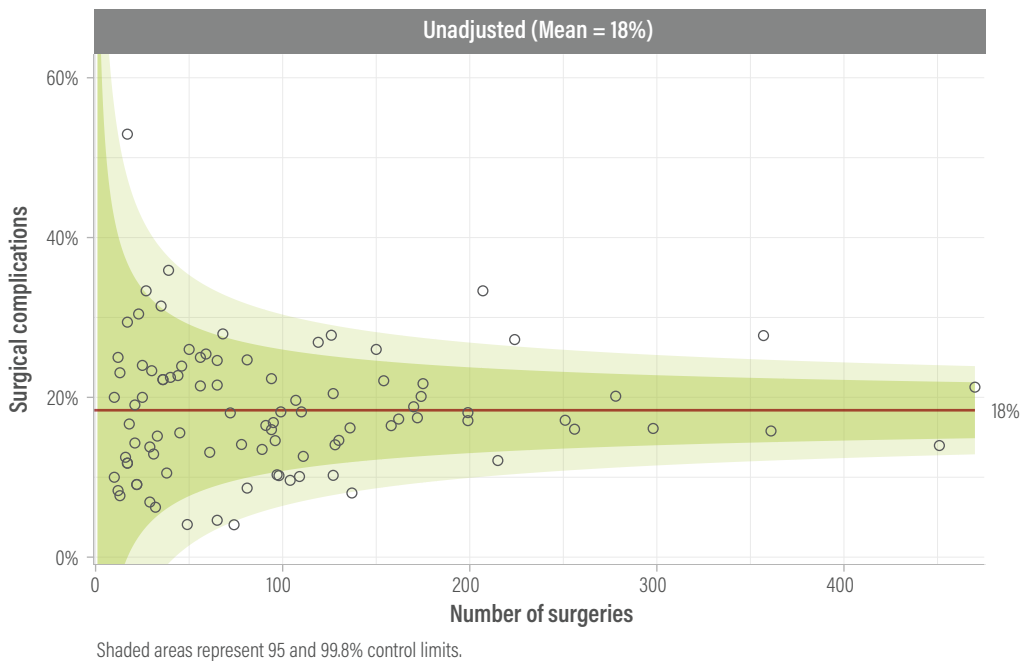


Figure 22. Surgical complication rate in rectal cancer patients who received surgical treatment between 2019 and 2021, by site

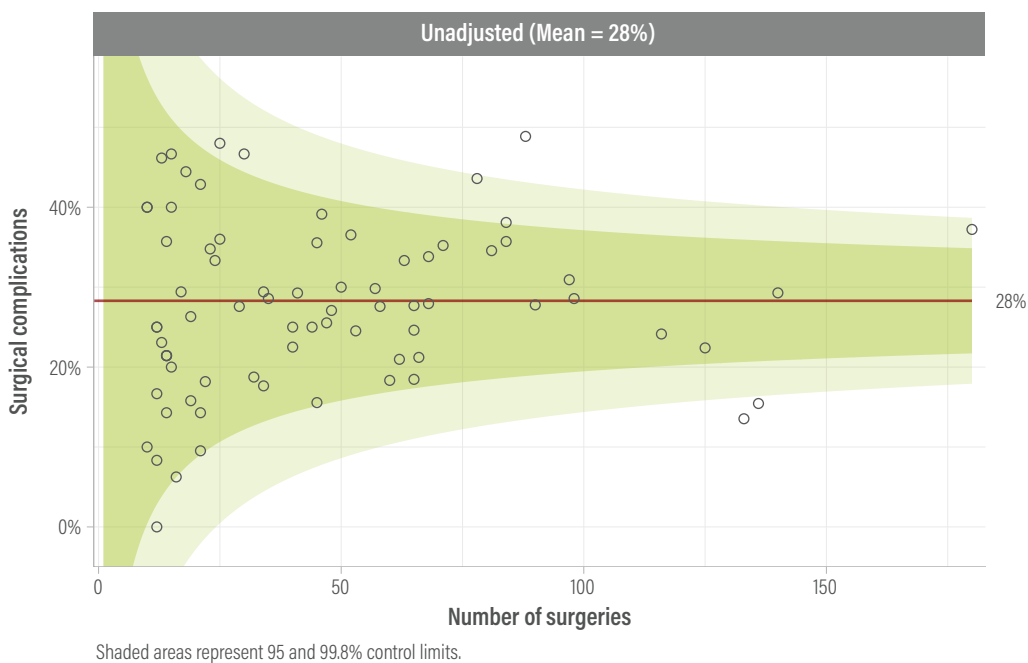
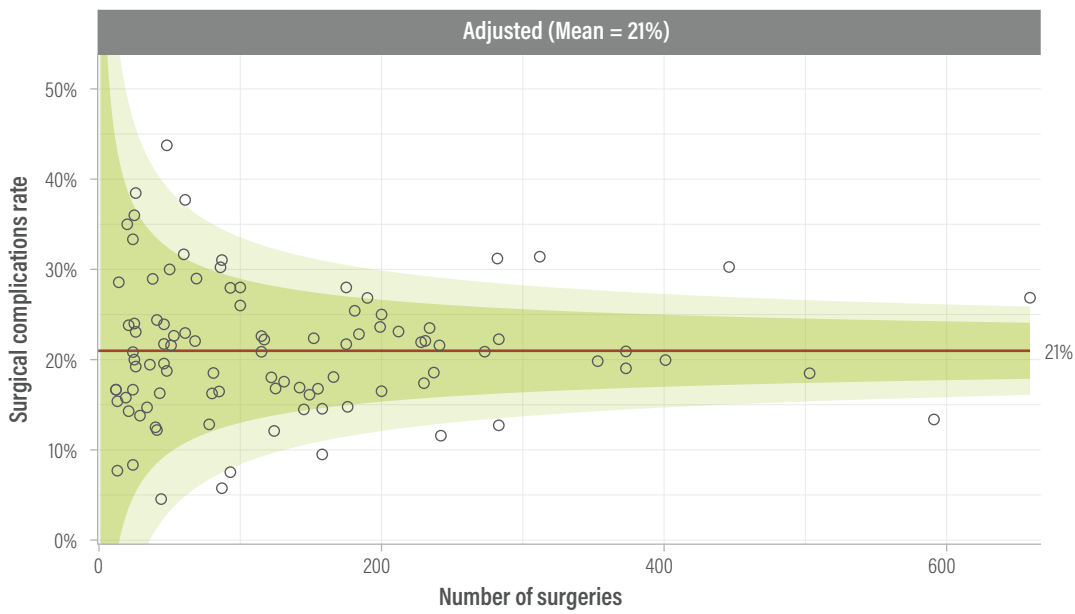


Figure 23. Surgical complication rate in colorectal cancer patients who received surgical treatment between 2019 and 2021, by site



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

Anastomotic leak

The rate of anastomotic leak in patients undergoing colonic surgery with anastomosis was lower than those undergoing rectal surgery (unadjusted mean 3% vs 5%, 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. Higher volume centres had lower rates of anastomotic leak although variation between centres may occur due to differences in case complexity. Factors that may account for potential under-reporting of anastomotic leak include delayed diagnosis of leak on subsequent contrast enema study, leaks classified as abdominal collections and reporting bias.

Figure 24. Anastomotic leak rate in colon cancer patients who received surgical treatment between 2019 and 2021, by site

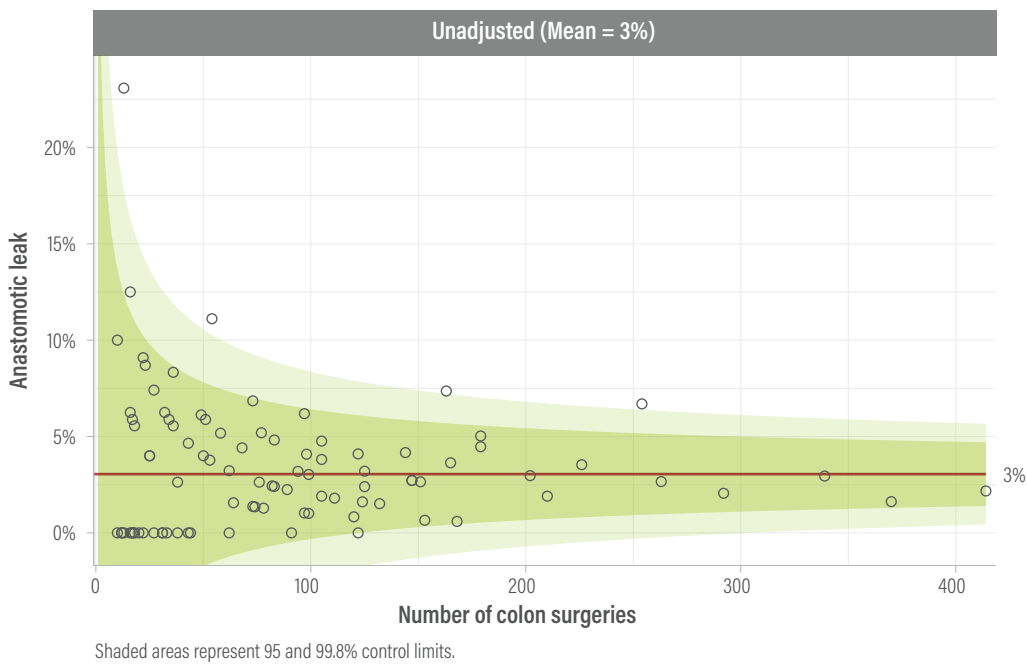


Figure 25. Anastomotic leak rate in rectal cancer patients who received surgical treatment between 2019 and 2021, by site

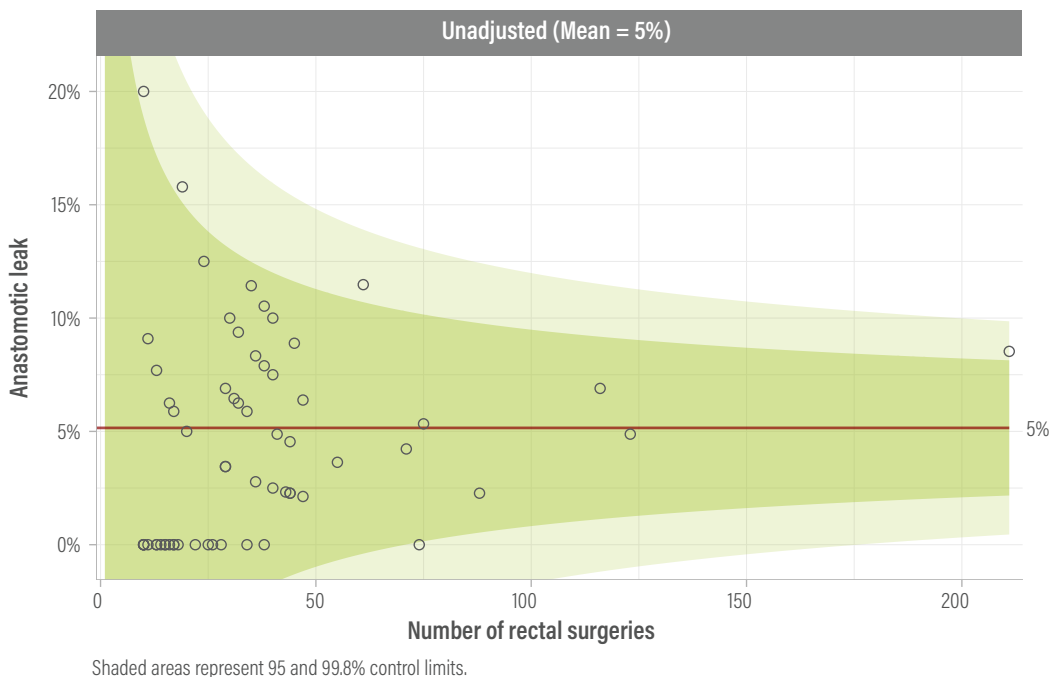
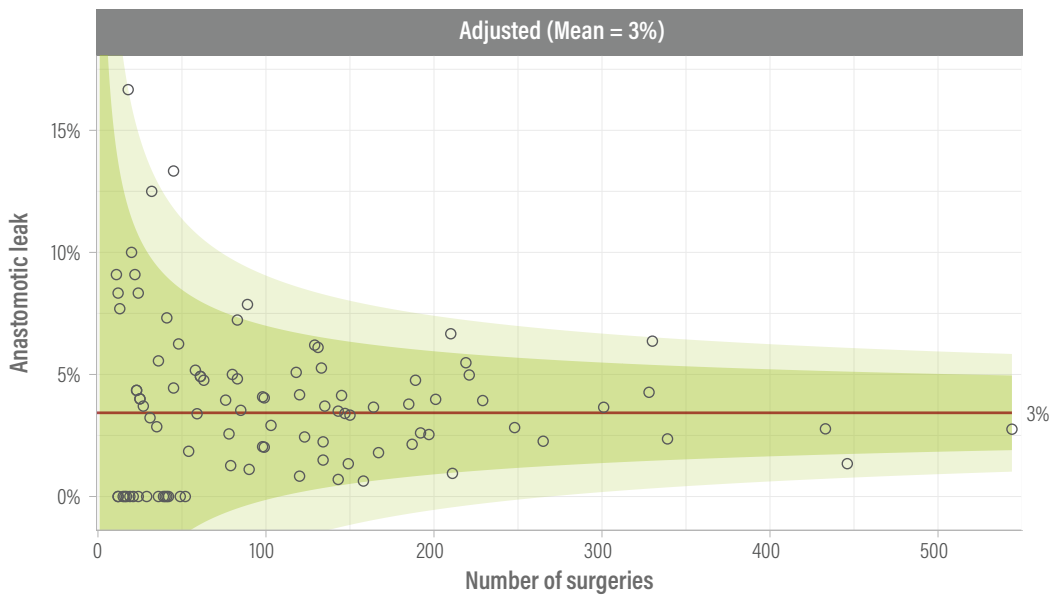


Figure 26. Anastomotic leak rate in colorectal cancer patients who underwent surgery with anastomosis between 2019 and 2021, by site



Adjusted for sex, and cancer type.
Shaded areas represent 95 and 99.8% control limits.
4 sites were excluded due to low completeness of the adjusting covariates and/or outcome.

Length of stay

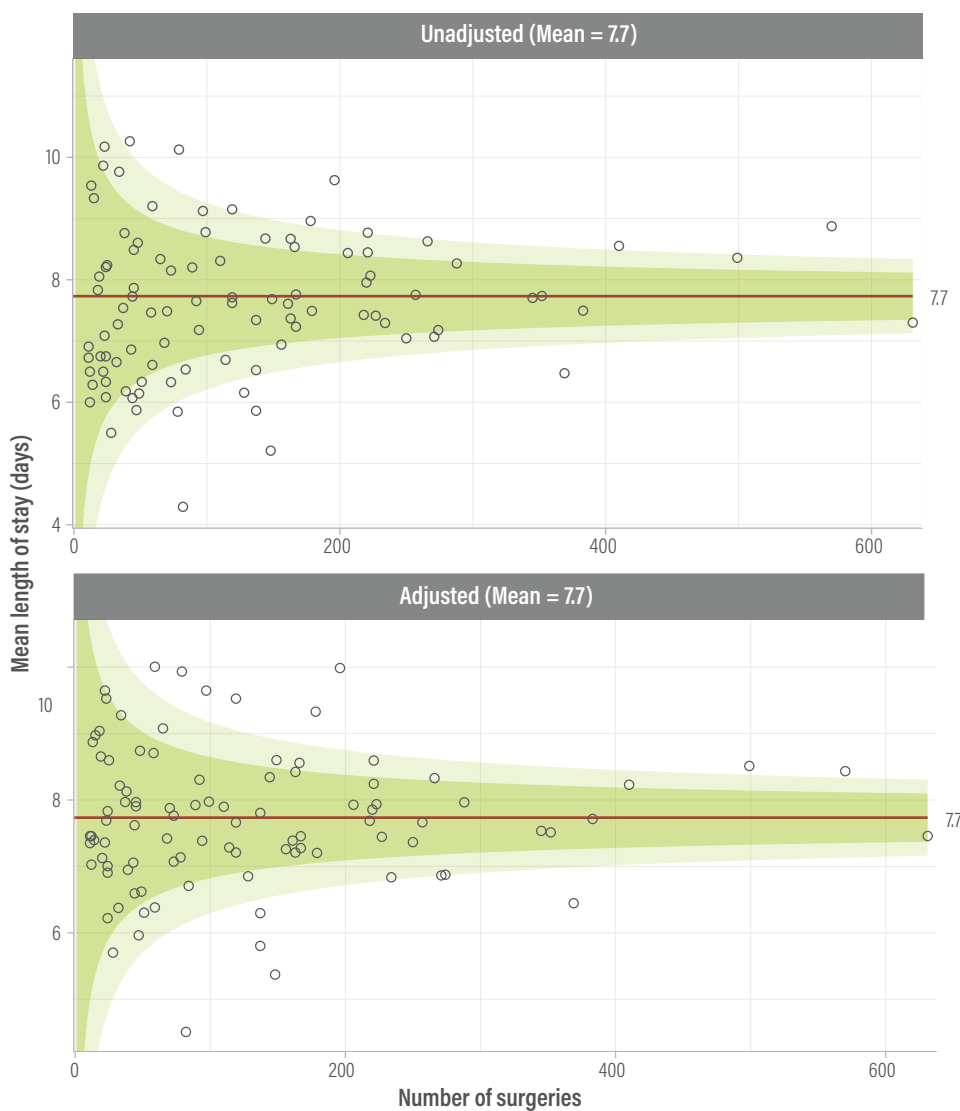
Since the last BCCA reporting period, the overall adjusted mean length of stay (LOS) has remained mostly consistent with a slight overall improvement. The overall LOS (Figure 27) is 7.7 days (vs 7.9 in 2020). The mean LOS of patients undergoing colonic surgery was 7.2 days (vs 7.6 in 2020) and rectal surgery was 9 days (vs 9.4 in 2020).

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 by the BCCA, 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).

In this report, there were three reporting sites that were excluded from the final analysis due to incomplete data to adjust for covariates.

Figure 27. Mean length of post-surgical hospital stay in colorectal cancer patients who received surgical treatment between 2019 and 2021, by site



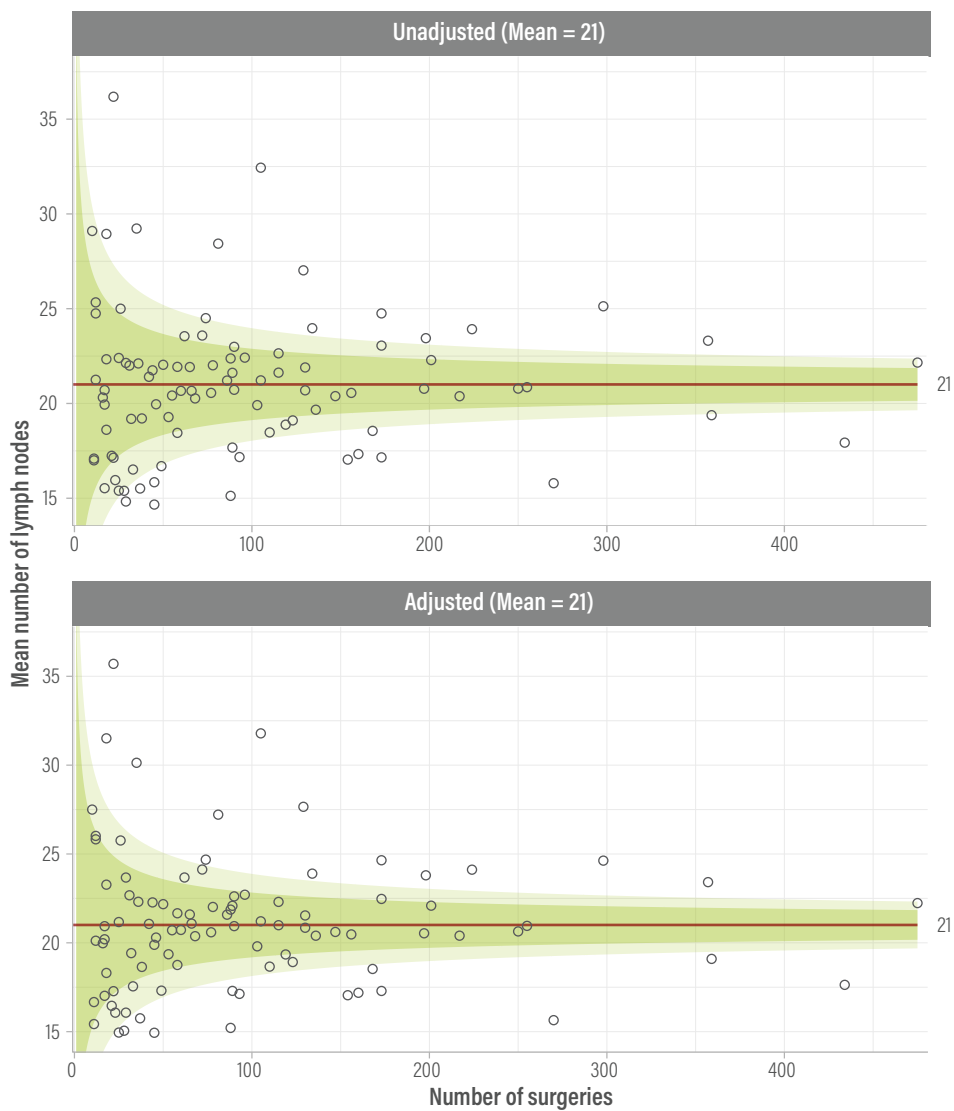
Adjusted for ASA score, cancer type, operative urgency, overall stage, patient age at diagnosis, and sex.
Shaded areas represent 95 and 99.8% control limits.
3 sites were excluded due to low completeness of the adjusting covariates and/or outcome.

Lymph node examination

Lymph node (LN) status in colorectal cancer is a key factor in determining staging and prognosis. It also guides further interventions, particularly the need for adjuvant therapy and subsequent follow up. Optimal lymph node harvest allows accurate decision making which thereby improves survival. Several variables play a role in LN yield including the quality of surgical resection and pathology assessment, tumour laterality, stage at presentation and the use of neoadjuvant therapy (e.g. rectal cancer). Several international bodies recommend assessment of a minimum of 12 LNs for adequate staging¹⁰⁻¹².

The mean number of nodes per colonic resection in patients who received surgical treatment between 2019-2021 was 21 LNs (Figure 28). This was the same (21 LNs) when adjusted for overall stage, age, sex, operative urgency and ASA (Figure 28). The data is symmetrically distributed with the majority of centres achieving a mean well above the recommended minimum 12 LNs.

Figure 28. Mean number of lymph nodes harvested in colorectal cancer patients who received surgical treatment between 2019 and 2021, by site

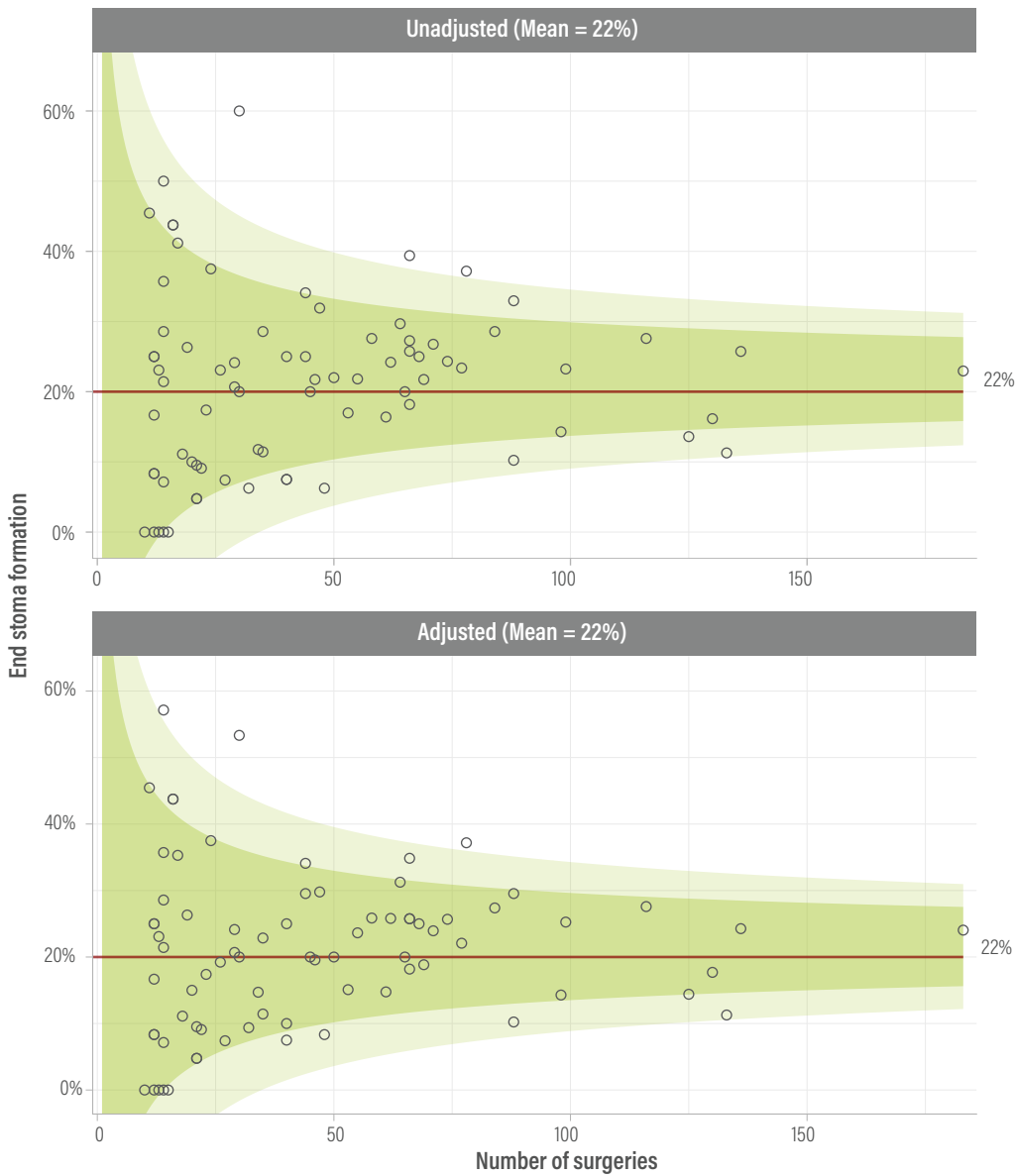


Adjusted for overall stage, patient age at diagnosis, sex, operative urgency, and ASA score.
Shaded areas represent 95 and 99.8% control limits.
2 sites were excluded due to low completeness of the adjusting covariates and/or outcome.

End stoma

End stoma rate has been identified as a marker of quality of care in rectal cancer surgery with APR associated with poorer long-term survival, higher local recurrence and CRM positivity¹³. There are a range of surgical techniques, both well established and newer to facilitate anastomosis and minimise the requirement for permanent stoma. In the 2019-2021 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 data¹⁴⁻¹⁵.

Figure 29. End stoma rate in rectal cancer patients who received surgical treatment between 2019 and 2021, by site



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

Circumferential margin involvement

A positive circumferential margin (CRM) is an important poor prognostic predictor of local and survival in patients who undergo rectal cancer surgery. In this report, the rate of positive CRM remains stable at around 6% (Figures 30 and 31) and this is comparable with the 2021 UK National Bowel Cancer Audit (7.3%)¹⁶. In the previous report there was a trend towards a higher positive CRM in patients who received neoadjuvant therapy. However this year the rate of positive CRM in patients who received neoadjuvant therapy (5%) was similar with those who did not (4%) (Table 14), indicating perhaps improved surgical planning for more advanced tumours. The mean rate of positive CRM is reassuring given the total mesorectal excision (TME) surgery is performed almost equally open/hybrid and laparoscopically. The increased adoption of organ preservation in rectal cancer treatment may potentially affect this variable in the future.

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

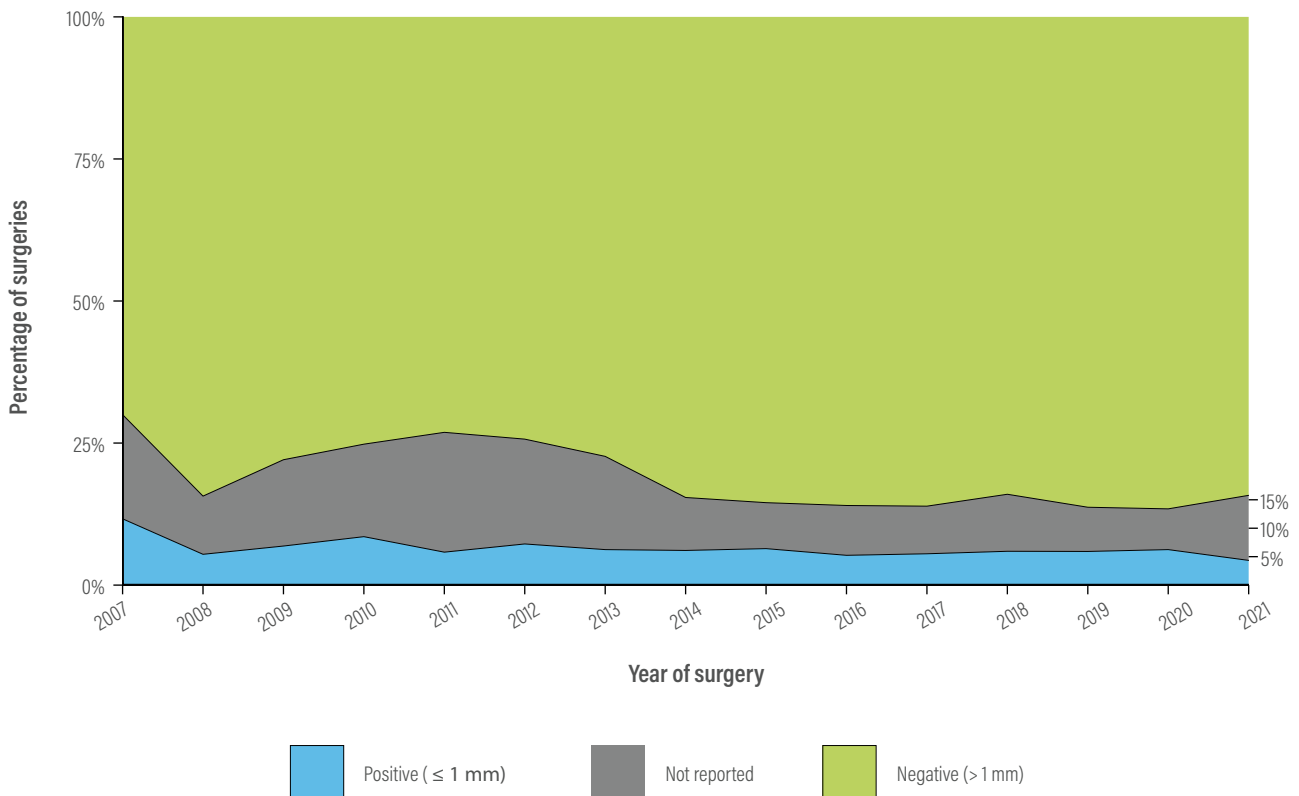
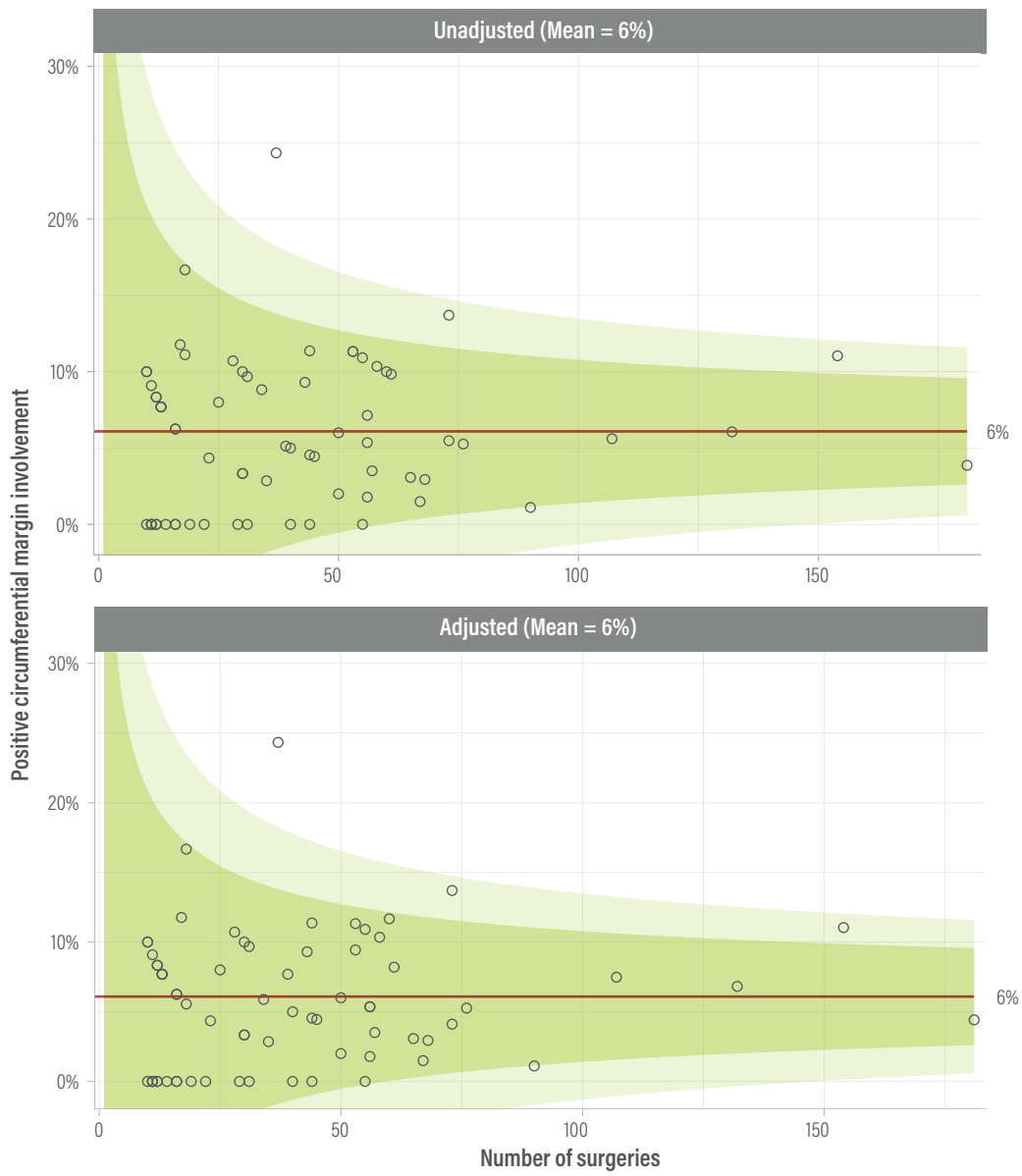


Figure 31. Positive circumferential margin involvement rate in rectal cancer patients who received surgical treatment between 2019 and 2021, by site



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

Table 14. Use of neoadjuvant therapy and circumferential margin involvement in rectal cancer patients who received surgical treatment in 2021

	Neoadjuvant therapy not received		Neoadjuvant therapy received	
	Count	Percentage	Count	Percentage
Negative (> 1mm)	336	87%	448	83%
Not reported	38	10%	69	13%
Positive (<= 1mm)	14	4%	26	5%
Total	388	101%	543	101%

Neoadjuvant therapy received total exceeds 100% due to rounding error.

7. RESEARCH, PUBLICATIONS AND PRESENTATIONS (2021)

Published research projects

Publications:

Taylor S, Salimi F, Earnest A, Heriot AG, Zalcborg JR, Ahern S. (2021). The short to medium term benefits of the Australian colorectal cancer screening program. *Med J Aust*, 214(2):90-2. DOI: [10.5694/mja2.50859](https://doi.org/10.5694/mja2.50859).

Kong JC, Su WK, Ng CW, Guerra GR, Chakraborty J, Lutton N, et al. (2021). Colorectal cancer in younger adults from a Bi-National Colorectal Cancer Audit registry. *ANZ J Surg*, 91(3):367-74. DOI: [10.1111/ans.16250](https://doi.org/10.1111/ans.16250).

Grupa VEM, Hidde KM, Ozmen I, Bedrikovetski S, Dudi-Venkata NN, Hunter RA, Sammour T. (2021). Current practice in Australia and New Zealand for defunctioning ileostomy after rectal cancer surgery with anastomosis: Analysis of the Binational Colorectal Cancer Audit. *Colorectal Dis*, 23(6):1421-33. DOI: [10.1111/codi.15607](https://doi.org/10.1111/codi.15607).

Clarke EM, Rahme J, Larach T, Rajkomar A, Jain A, Hiscock R, Warriar S, Smart P. (2021). Robotic versus laparoscopic right hemicolectomy: a retrospective cohort study of the Binational Colorectal Cancer Database. *J Robot Surg*. 2021 Oct 28. DOI: [10.1007/s11701-021-01319-z](https://doi.org/10.1007/s11701-021-01319-z).

Williams E, Kong JC, Singh P, Prabhakaran S, Warriar SK, Bell S. (2021). The impact of the COVID-19 pandemic on colorectal cancer diagnosis and management: A Binational Colorectal Cancer Audit study. *ANZ J Surg*, 91(10):2091-6. DOI: [10.1111/ans.17071](https://doi.org/10.1111/ans.17071).

Cheong JY, Young CJ, Byrne C. (2021). Does the body mass index impact lymph node yield for colorectal cancer resection, and does operative approach influence this: a review of bi-national colorectal cancer audit database. *ANZ J Surg*, 91(12):2707-13. DOI: [10.1111/ans.17227](https://doi.org/10.1111/ans.17227).

Presentations:

Kroon H, Grupa V, Ozmen I, Bedrikovetski S, Dudi-Venkata N, Hunter R, Sammour T. (RACS, ASC 2021, May). Current practice in Australia and New Zealand of covering low anastomoses with a loop ileostomy after rectal cancer surgery: analysis of the Bi-National Colorectal Cancer Audit (BCCA). *ANZ J Surg* 91 (S1); CR045P, 39.

Kroon H, Van Harten M, Ceuppens E, Bedrikovetski S, Dudi-Venkata N, Hunter R, Sammour T. (RACS, ASC 2021, May). Minimally invasive surgery in elderly patients with rectal cancer is safe: an analysis of the Binational Colorectal Cancer Audit (BCCA). *ANZ J Surg* 91 (S1); CR067P, 45.

Tiang T, Proud D. (ASCRS Annual Scientific Meeting 2021, July). Does complete pathological response increase perioperative morbidity risk in patients undergoing resection for rectal cancer following neoadjuvant treatment? *Dis Colon Rectum*, 64 (5); POD320, 120.

Cheong J, Byrne C, Young C. (ASCRS Annual Scientific Meeting 2021, July). The effect of BMI on the LN harvest yield in the four different colorectal cancer resection approaches: review of BCCA database. *Dis Colon Rectum*, 64 (5); POD102, 147.

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 Bi-National 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 neo-adjuvant (chemo)radiotherapy in Australasia: Analysis of the Bi-National Colorectal Cancer Audit (BCCA). *Colorectal Dis*, 24 (S1); P125, 106.

Yeoh A, Tiang T, Proud D. (Tripartite Colorectal Meeting 2022, February). Complete pathological response does not increase perioperative morbidity in patients undergoing resection for rectal cancer following neoadjuvant treatment. *Colorectal Dis*, 24 (S1); P154, 118.

Thungathurthi K, Narasimhan V, Antoniou E, Arachchi A, Chouhan C, 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, Warriar 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, Warriar 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.

Currently approved projects

1. Right hemicolectomy anastomotic leak rate study (RALS).

Investigator: Associate Professor Matthew Rickard, Concord Hospital Clinical School.

Status: Approved.

The objective of this project is to investigate anastomotic leak rates following stapled versus handsewn ileo-colic anastomoses in Australasian patients in the Binational Colorectal Cancer Audit.

2. Effect of the Coronavirus/ COVID-19 pandemic on colorectal cancer diagnosis and management.

Investigator: Mr Stephen Bell, Evan Williams, Alfred Health.

Status: Approved.

Publication: Poster presentation, Tripartite Colorectal Meeting 2022, Auckland, NZ; Published in ANZ Journal of Surgery.

The objective of this project is to analyse patients entered into the Binational Colorectal Cancer Audit (BCCA) and compare groups before, during and in the aftermath of the Coronavirus/COVID-19 pandemic.

3. Does type of colonic resection affect leak rate in colon cancer surgery?

Investigator: Dr Suat Chin Ng, Christchurch Hospital.

Status: Approved.

The objective of this project is to determine the anastomotic leak rate for different colon cancer resections, and the rate of surgical and medical morbidities associated with the type of colonic resections.

4. Impact of obesity on outcomes of patients undergoing surgery for rectal cancer: an analysis of BCCA data.

Investigator: Associate Professor Matthew Morgan, Bankstown-Lidcombe Hospital.

Status: Approved.

The objective of this project is to compare rectal cancer surgery outcomes of obese and non-obese patients

5. Comparison of outcomes between different surgical techniques for splenic flexure cancers.

Investigator: Asiri Arachchi, Monash Health.

Publication: Poster presentation, Tripartite Colorectal Meeting 2022, Auckland, NZ.

The objective of this project is to evaluate the outcomes of the different techniques for splenic flexure cancers.

6. Technical (robotic versus lap versus open) approach in obese patients for colorectal cancer.

Investigator: Dr Peter Carne, Alfred Health.

Status: Approved.

The objective of this project is to compare perioperative parameters, complications and long-term oncological outcomes between obese patients undergoing open, laparoscopic and robotic colorectal surgery.

7. Surgical treatment of transverse colon cancer: Analysis of current practice and patient outcomes using the Binational Colorectal Cancer Audit.

Investigator: Mr Andrew Ing, Hawkes Bay District Health Board.

Status: Approved.

The objective of this project is to investigate the outcomes associated with different surgical approaches to management for transverse colon cancer.

8. Treatment of stage I low rectal cancer in Australia: analysis of trends over 10 years.

Investigator: David Cruise, Joondalup Health Campus.

Status: Approved.

The objective of this project is to ascertain the evolving preferences of surgeons in the management of T1 and T2 low rectal cancers.

9. Configuration of ileocolic anastomosis after right hemicolectomy and short-term outcomes.

Investigator: Dr Vignesh Narasimhan, Monash Health.

Status: Approved.

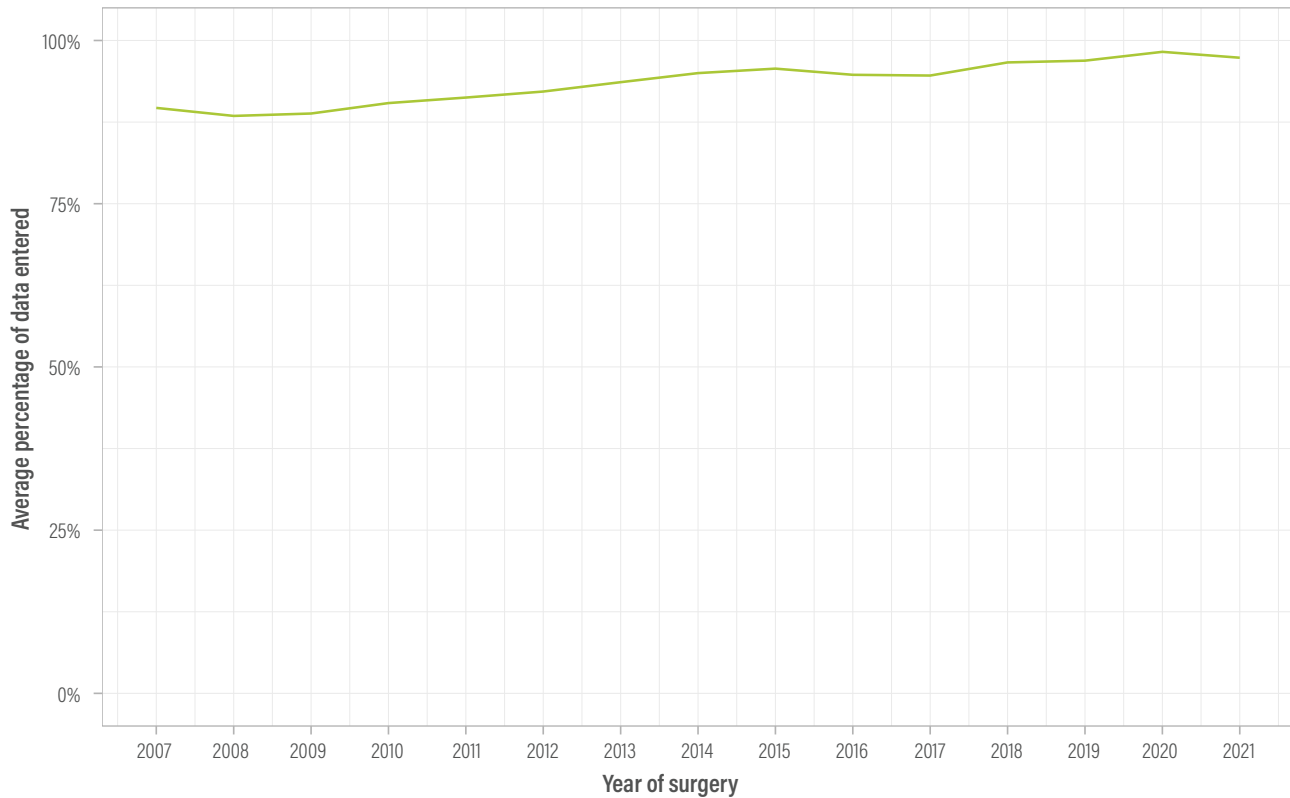
The objective of this project is to evaluate the role of the anastomotic type on short term outcomes.

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

Figure 32. Mean percentage of data completion over time across 29 key BCCA items



BCCA 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 stage, lymph nodes harvested, adjuvant therapy, circumferential margins, and neoadjuvant therapy) (Figure 32).

APPENDIX A – Registry Personnel 2021

BCCA Steering Committee Membership

Dr Andrew Hunter (Chair until November 2021)
Professor Alexander Heriot (Victoria)(Chair) since November 2021
Dr Philip Smart (Chair BCCA Operations Committee)
Dr Rowan Collinson (CSSANZ)
Dr Ian Faragher (Colon and Rectal Surgery Section, RACS) until May 2021
Dr Raymond Yap (Colon and Rectal Surgery Section, RACS) since May 2021
Dr Andrew Hughes (GSA)
Dr Jasen Ly (NZAGS) since May 2021
Professor John Zalcborg (Interested Clinician)
John Stubbs (Consumer Representative)

The BCCA 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 BCCA Operations Committee.

BCCA Operations Committee Membership

Dr Philip Smart (Victoria) (Australian Co-Chair)
Dr Sze-Lin Peng (New Zealand Co-Chair)
Professor Alexander Heriot (Victoria) until December 2021
Professor Paul McMurrick (Victoria) (CRC Audit)
Associate Professor Chris Byrne (New South Wales)
Dr Elizabeth Murphy (South Australia)
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 Raymond Yap (Victoria) until May 2021
Dr Jesse Fischer (New Zealand) since September 2021
Dr Su Mei Hoh (Fellow representative) March 2021 to December 2021
Dr Thomas Arthur (Colorectal Fellow) since March 2021
Dr Ankur Sidhu (Fellow representative) since December 2021

Angela Brennan (DEPM)
Professor Susannah Ahern (DEPM)
Dr Farhad Salimi (DEPM)
Jacob Egwunye (DEPM) July 2021 until December 2021
Dr Vignesh Narasimhan (Fellow representative) February 2021 to December 2021
Nicole Cooper (Management Consultant and Bowel Cancer Patient) since May 2021
Associate Professor Christophe Rosty (RCPA representative) since July 2021
Professor Eva Segelov (Medical Oncologist), Monash Health since September 2021
Professor Katherine Clark (Palliative Care Australia Representative) since September 2021
Dr Helen Mohan (International Registry Collaboration Representative) since September 2021
Dr Stephen Chin (Radiation Oncologist) since December 2021
Dr Daryl Lim Joon (Radiation Oncologist) since December 2021
Professor John Zalcborg (DEPM) since December 2021

The BCCA Operations Committee membership is made up of the Chair, Representatives of the Department of Epidemiology and 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.

BCCA Research Committee Membership

Professor Alexander Heriot (Chair)
Associate Professor Tarik Sammour
Angela Brennan (DEPM)
Dr Farhad Salimi (DEPM)
Dr Vignesh Narasimhan (Fellow representative) June 2021 until December 2021

The BCCA Research Committee membership is made up of the Chair, Representatives of the Department of Epidemiology and 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
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
KPIs	– Key Performance Indicators
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 – BCCA Participating Hospitals

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

APPENDIX D – BCCA Participating Clinicians

Sarah Abbott	Benjamin Cribb	Ian Jones	Tamara Mullaney	Paul Sitzler
Damien Ah Yen	Matthew Croxford	Karolina Juszczak	Elizabeth Murphy	Stewart Skinner
Semisi Aiono	Austin Curtin	Alex Karatassas	Sanjeev Naidu	Tim Slack
Sinan Albayati	Alex Dalzell	Jamie Keck	Arun Naik	Philip Smart
Naghah AlMozany	Eric Daniel	Steven Kelly	Vignesh Narasimhan	Michelle Smigielski
Aymen Al-timimi	Atandrla Das	Anil Keshava	Kheng-Seong Ng	Nicholas Smith
Rafid Alzubaidy	Dayan De Fontgalland	Roger Khan	Suat Chin Ng	Stephen Smith
Vinna An	Servaise de Kock	Cherry Koh	Ba-Thinh Nguyen	Michael Solomon
Nabila Ansari	Angelina Di Re	Joe Kong	Khuong Nguyen	Luigi Sposato
Janet Ansell	Scott Diamond	Daniel Kozman	Thang Chien Nguyen	Havish Srinath
Asiri Arachchi	Mark Doudle	Mathew Kozman	Greg Nolan	Malcolm Steel
Thomas Arthur	Brian Draganic	Kelvin Kwok	Greg O'Grady	Bree Stephensen
Andrew Audeau	Basil D'Souza	Allan Kwok	Mark Omundsen	Andrew Stevenson
Kirk Austin	Tim Eglinton	Stephen Kyle	Eugene Ong	Bruce Stewart
Richard Babor	Toufic El-Khoury	Francis Lam	Kevin Ooi	Peter Stewart
Vikram Balakrishnan	Tom Elliot	Benjamin Lancashire	Blaithin Page	Neil Strugnell
Hasitha Balasuriya	Jodie Ellis-Clark	Ray Lancashire	Nimalan Pathmanathan	Michael Suen
Jon Barnard	Alistair Escott	John Lancaster	Szelin Peng	Thomas Suhardja
Walid Barto	Jimmy Eteuati	Yee Chen Lau	Shevy Perera	Senthilkumar Sundaramurthy
Nigel Barwood	Ian Faragher	Christopher Lauder	Damien Petersen	Ashish Taneja
Stephen Bell	Chip Farmer	Matthew Lawrence	Toan Pham	Richard Tapper
Tilan Beneragama	Jesse Fischer	Angus Lee	Kim-Chi Phan-Thien	Yeng Kwang Tay
Pia Bernardi	Tom Fisher	Peter Lee	Stephen Pillinger	David Taylor
Madhu Bhamidipaty	Frank Frizelle	Rebecca Lenzion	Turab Pishori	William Teoh
Magdalena Biggar	John Frye	Edmund Leung	Garth Poole	Michelle Thomas
Daniel Bills	Carey Gall	Mark Lewis	Jon Potter	Mark Thompson-Fawcett
David Bird	Steven Gan	Jennifer Liang	Chatika Premaratne	James Toh
Ian Bissett	Jamish Gandhi	James Lim	David Proud	Darren Tonkin
David Blomberg	Shanthan Ganesh	Tony Lin	Jevon Puckett	Eric Torey
Vlad Bolshinsky	Kate Gibson	Chris Liyanage	Philippa Rabbitt	Fidel Touma
Katherine Broughton	Chris Gillespie	Simi Lolohea	Ruben Rajan	Catherine Turner
Richard Brouwer	Andrew Gilmore	Cu Tai Lu	Siraj Rajaratnam	Greg Turner
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