2020

THE 2019 DATA

BINATIONAL COLORECTAL CANCER AUDIT REPORT

BCCA
BiNational
Colorectal Cancer Audit

BINATIONAL COLORECTAL CANCER AUDIT (BCCA) 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 BCCA to advance the quality of colorectal cancer care in Australia and New Zealand.

SUPPORTERS

The Royal Australasian College of Surgeons (RACS) is an independent professional body committed to enabling surgeons to achieve and maintain the highest standards of surgical practice and patient care. RACS contribute annually to fund ongoing operation of the BCCA.

Medtronic is a global leader in medical technology, services and solutions. Medtronic provide financial support to the BCCA through an annual medical grants program.

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Let's Beat Bowel Cancer is a not for profit initiative of Cabrini with a vision to significantly lower deaths related to bowel cancer through public awareness, research and medical advances. Let's Beat Bowel Cancer have collaborated with BCCA to aid database development though co-implementation of Patient Reported Outcome Measures (PROMs) software.

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 2020 and pertains to data that relates to patient episodes from January 1st to December 31st 2019 unless otherwise stated.

SUGGESTED CITATION:

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FOREWORD

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

The BCCA is an essential tool to allow surgeons to benchmark their performance amongst their peers. This process allows us to demonstrate to the public of Australia and New Zealand that the quality of surgery and cancer care is at the highest levels. This process also informs relevant health departments of our commitment to ensure the highest standards of patient care. Colorectal cancer is the commonest cancer in Australia and New Zealand (excluding skin cancer) and the age standardized rates remain on a steady rise. The national governments of Australia and New Zealand have recognized the importance of this disease and have invested in national screening programs to increase early detection.

Since 2007 the BCCA has acquired data on colorectal cancer management across Australia and New Zealand. This has been done exceptionally well with a limited budget principally provided by contributing surgeons and their representative surgical societies, including the CSSANZ Council.

I would like to thank the outstanding contribution of Professor Alexander Heriot to the BCCA through his role as Chair of the BCCA Operations Committee. Professor Heriot after years of tireless effort has passed the Chair to Dr Philip Smart. Dr Andrew Hunter remains as Chair of the Steering Committee.

I congratulate the hard work and commitment of the staff of the BCCA, it's governing boards and contributing surgeons.

Damien Petersen
President, CSSANZ

From the Chair of the Binational Colorectal Cancer Audit Steering Committee

The Steering Committee is responsible for overseeing BCCA and in particular, the running of the audit by the Operations Committee. The Steering Committee had 2 meetings in 2019 in June and December, both by teleconference. There was not a suitable opportunity to organise a Workshop.

The Steering Committee is made up of eight members, which include the chair (Andrew Hunter), who is a member of CSSANZ and nominated by the CSSANZ Council. In addition, there are representatives from CSSANZ Council (Damian Petersen), RACS section of colon and rectal surgery (Ian Faragher), General Surgeons Australia (GSA) Council (Andrew Hughes), New Zealand Association of General Surgeons (NZAGS) (Grant Coulter), as well as another clinician with an interest in colorectal cancer (John Zalcberg) and a consumer representative (John Stubbs) as well as the Chair of the BCCA Operations Committee (Alexander Heriot then Philip Smart) and the project manager (Hayat Dagher).

At each meeting, the Chairman of the Operations Committee gives a summary report of the activities of the BCCA Operations Committee over the last few months. Topics discussed included the Annual Report, discussions with Insurers and Cancer Australia, as well as discussions regarding funding, clinical quality policy, data importing, state and national cancer registries, data participation, and staffing issues.

The Steering Committee has provided valuable advice and support to the Operations Committee and is well represented by experienced clinicians from a number of different interest groups with expertise and involvement in the management of colorectal cancer.

Andrew Hunter
Chair, BCCA Steering Committee

From the President of the General Surgeons Australia

The BCCA is a well-established surgical registry applicable to all surgeons who see patients with a diagnosis of colorectal cancer.

The BCCA has aimed to make the audit accessible and relevant to surgeons, both general and sub-specialist, wherever they practice in Australia and New Zealand. The importance of high quality audit data is unquestionable, and GSA has been active in developing and refining the audit. We encourage all our members treating colorectal cancer and carrying out bowel resections to contribute their cases to this important registry.

The interface through which cases are entered is easy to use and forms a convenient database of colorectal cancers treated by the surgeon. Participation also satisfies a RACS Continuing Medical Education (CME) requirement for practice audit.

Trevor Collinson
President, GSA

From the President of the New Zealand Association of General Surgeons

Colorectal cancer is the second commonest cause of cancer death in New Zealand after lung cancer. Both surgeons sub-specialising in colorectal surgery and general surgeons can contribute to the BCCA, allowing important data to be collected across Australasia. This helps surgeons benchmark their management, allowing comparison of outcomes both for individual surgeons and units, which in turn provides avenues for improved care. The BCCA has collected over 34,000 episodes of patient care since its inception in 2007, providing an important database on the trends within colorectal cancer management in both Australia and New Zealand.

The New Zealand Association of General Surgeons encourage all of our members carrying out bowel resections to contribute their cases to this important binational audit. Members may be further encouraged to contribute as participation satisfies a RACS CME requirement for practice audit.

Julian Speight (FRACS)
President, NZAGS

EXECUTIVE SUMMARY

1. Audit Background

Bowel cancer is the second most common cause of cancer death in Australia. The BCCA aims to describe and compare quality of care and outcomes of patients diagnosed with bowel cancer in Australia and New Zealand.

The BCCA is now well established. The 2020 report is the eighth report to date and includes data on patients diagnosed with bowel cancer between 1st January 2019 and 31st December 2019.

The main audience of the Annual Report is clinicians who deliver care to bowel cancer patients, government bodies setting health policy direction, research groups, as well as patients themselves.

2. Key Findings

Participation

- As of 31st December 2019, there were 34,029 surgical treatment episodes registered, representing an additional 4,269 treatment episodes since December 2018.

- The number of treatment episodes has increased steadily since 2007 and for 2019 represents approximately one quarter of all colorectal cancer diagnosis recorded binationally. In 2019, half of these episodes occurred in New South Wales and Victoria (49%), with 19% in New Zealand, 13% in Queensland, 12% in South Australia and less than 10% in Western Australia, Tasmania and the Northern Territory.

- The majority of episodes are from public hospitals (79%). This varies by jurisdiction with 86% of episodes in New South Wales being from public hospitals compared to 38% of episodes from Western Australia, reflecting varying participation by the private sector.

Demographics

- This year 45% of the cohort were classified as American Society of Anaesthesiologists Classification (ASA) 3 or greater, representing 37% increase compared to the prior combined cohort. 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 diagnosis. The number of patients with Stage IV disease reduced slightly to 9% from 11%.

- The majority of cases were elective (85%), with emergency cases and urgent cases 8% and 7% respectively.

Screening

- Patients diagnosed following positive FOBT increased from 17% to 20% of the 2019 BCCA cohort.

- FOBT screened patients presented at an earlier tumour stage.

Colorectal Cancer Management

• A minimally invasive surgical approach was utilised in 76% of colon cancers. There has been an increase in robotic colonic resections over the last 3 years.

• There has been a further decrease in the proportion of rectal cancers removed via open resection with a corresponding increase in either laparoscopic or hybrid cases.

• Growth in transanal total mesorectal excision (taTME) has tempered in 2019.

• Preoperative management of rectal cancers continues to evolve. Most have a magnetic resonance imaging (MRI), and 86% of rectal cancer cases are discussed in a multidisciplinary team meeting (MDT).

• More than half the patients with rectal cancer received neoadjuvant therapy, the majority receiving long course chemoradiotherapy.

• 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 rate of patients undergoing surgery for colon cancer experiencing one or more surgical complications was 17%. Fifteen per cent of patients had one or more medical complication post-surgery.

• In rectal cancer the surgical complication rate is 30%.

• The anastomotic leak rate was 3.3% and would generally be considered consistent with good practice, albeit with caveats regarding reporting bias.

Clinical Quality Indicators

• For this 2019 data Annual Report, key performance indicators (KPIs) comprise the most recent 3 years of data only (2017-2019). Comparisons noted in this report are between 2016-2018 data and 2017-2019 data, unless otherwise stated.

• Inpatient mortality remains low at 1%. Inpatient mortality is lower in higher case volume hospitals. In risk adjusted analyses (age, sex, ASA, urgency of admission, cancer stage) and excluding 5 sites with incomplete data, 5 sites were outliers. Only one of these sites reported more than 100 cases with an inpatient mortality of 4%.

• Return to theatre within 30 days is a broad indicator of significant complications related to surgery. The rate was 5.7% across the audit when risk adjusted.

• Length of stay (LOS) reduced from 8.1 to 7.8 days. The mean LOS of patients undergoing colonic surgery was 7 days and rectal surgery 9 days. Factors that influence LOS include age, ASA, cancer type, operative urgency, age, overall stage and gender. These likely account for the variation in LOS across the different participating hospitals.

• The number of nodes retrieved per colonic resection was 18.6 for the period 2017-2019, unchanged from prior reporting period.

• The permanent colostomy rate was 22%, similar to previously reported and consistent with international data.

• The rate of CRM involvement has increased from 5.6% to 6.7%.

• The number of patients with an involved CRM who received neoadjuvant therapy was higher in the 2019 audit period (8%) when compared to those who did not (4%) suggesting that preoperative staging was selecting high risk patients for neoadjuvant therapy.

INTRODUCTION

The Binational Colorectal Cancer Audit (BCCA) is a surgical audit applicable to all surgeons who perform colorectal cancer surgery. It is a surgeon driven project led by a group of surgeons who are 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 future research. Audit is a requirement for registration of surgeons in Australia and New Zealand and BCCA is a recognised audit for this purpose for RACS.

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 comprised of various stakeholders including clinicians, funders, consumers and other relevant specialists. The Steering Committee is responsible for oversight of BCCA activities, including that of the Operations Committee, providing ongoing review of objectives and effectiveness in meeting these and approving any new policies to address issues of clinical interest that may arise. The Operations Committee is responsible for the day to day management of BCCA, developing quality measures and forming relevant sub-committees to address data access, research and quality issues. In 2019, Professor Alexander Heriot stepped down as Chair of the Operation Committee and Dr Philip Smart took over as Chair of the Operation Committee. The Steering Committee welcomed Dr Philip Smart and the Operation Committee welcomed Mr John Lengyel, Dr Greg Nolan and Dr Aymen Al-Timimi.

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.

Data management

BCCA data is recorded per surgeon per site, and information is collected about patient diagnosis, treatment and surgical outcomes and is entered directly into the BCCA database or uploaded into the database via an import function. The database is secure and accessible via any Internet browser. Surgeons can run live deidentified summary reports at any time, comparing their outcomes to their site and to the whole database. Surgeons also have access to their own raw identifiable data at any time at the click of a button after logging into the secure system.

2019 Data analyses

In January 2020, the data entered to the online BCCA system up until surgery date 31 December 2019 was extracted for analyses.

Unless stated otherwise, analyses were undertaken on the 2019 dataset, including surgeries performed from 1 January 2019 to 31 December 2019. 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) were included in the analysis.

Three-year (2017 - 2019) data was used to generate funnel plots as this period would provide adequate power and recency of information. Funnel Plots are a visual representation of how individual units fare 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. In the preparation of funnel plots all units of less than 10 surgeries were grouped in a single group. Including this group, there were 97 units analysed. For the 97 units the median number of patients was 86, mean 126, with a range from 11 to a maximum of 572 surgeries.

Some funnel plots present unadjusted crude rate or mean while others (where noted) are risk-adjusted. Risk-adjustment considers differences in patient-level risk-factors; it 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 and include both statistical and clinical considerations. The variables used in the risk adjustment model are noted under each graph. Clinical input identified the following risk factors for adjustment: 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 risk factors were not included in the risk adjusted funnel plots. Outliers are represented as coloured dots in the plots.

For LOS, we excluded LOS ≤ 0 and > 30 days as these were deemed clinically unlikely and potential data entry errors. This resulted in 96% of all data submitted included in the analysis. This approach was also applied to the lymph node data, with the highest figure of 40 as cut-off as this represents 96% of all data submitted.

1. PARTICIPATION

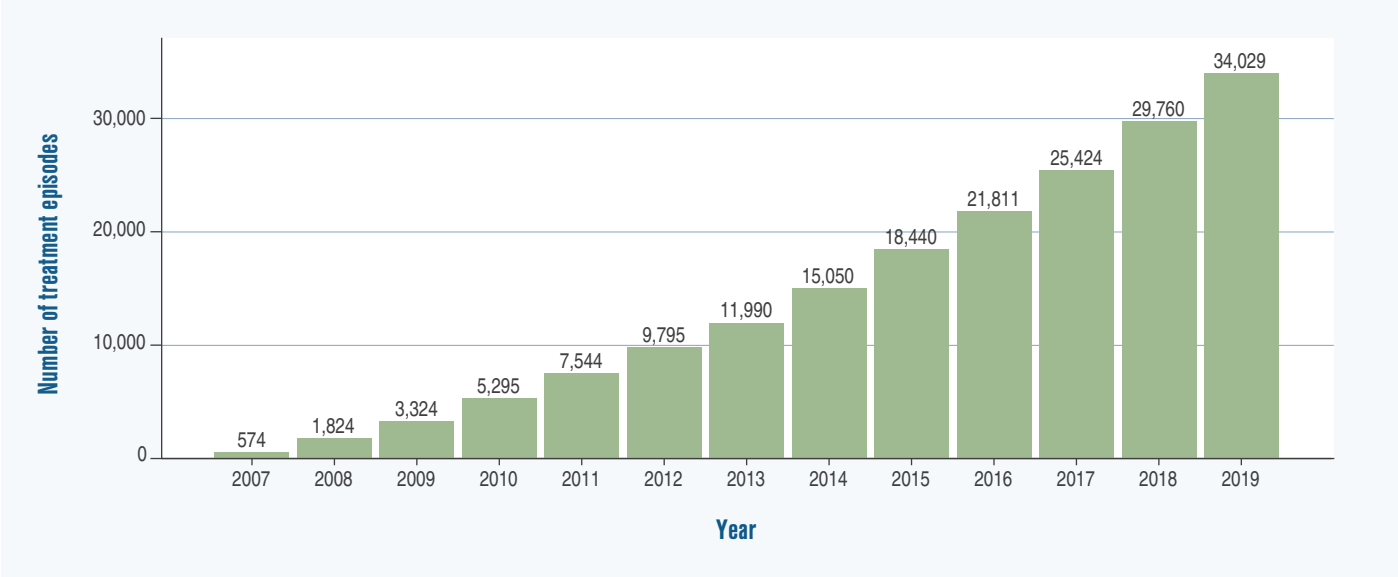
As of 31st December 2019, there were 34,029 surgical treatment episodes registered with the BCCA database (Figure 1). This is an additional 4,269 treatment episodes since December 2018, at 29,760. (It should be noted that the 2018 data-2019 BCCA Annual Report had 28,746 patients as at December 2018[1]. This discrepancy is due to an additional 1,014 patients being entered for 2018 following the 2018 report deadline.)

Traditionally the database has captured patients treated surgically and has been updated to capture all patients to include all colorectal cancer patients including those treated medically and with radiotherapy to reflect the burden of disease in Australasia.

In 2019, in addition to the reported 4,269 surgical treatment episodes, BCCA captured 278 non-surgical treatment episodes. This represents 24% of the 18,638 estimated colorectal cancer cases binationally#. Cases captured in the database for the reporting year has increased by almost double since the 2018 annual report[2]. Data capture is an important KPI for the database, and we are aiming to increase data capture of colorectal cancer cases binationally.

Cumulative participation (2007-2019)

Figure 1. Total treatment episodes submitted to BCCA over time



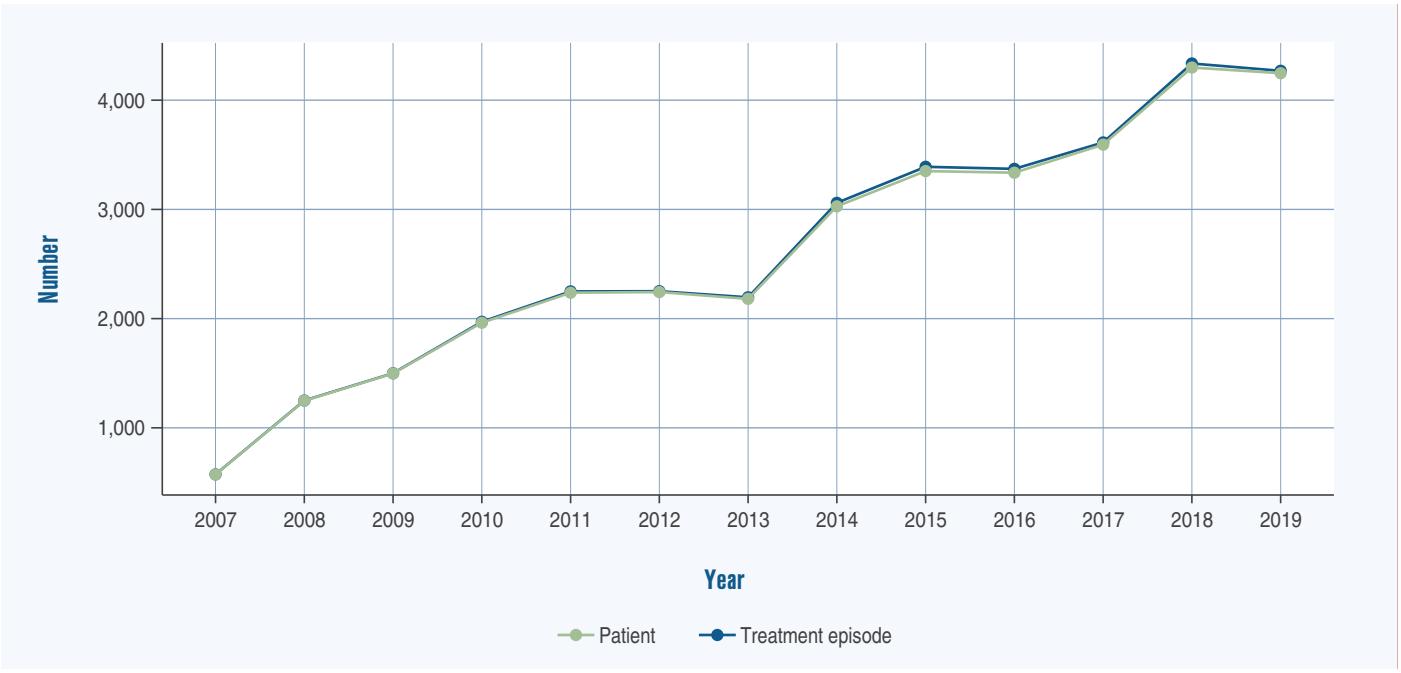
 # The number of 2019 colorectal cancer cases was an estimate published on the AIHW website for Australia and preliminary data obtained by personal correspondence with the New Zealand cancer registry.

Annual participation (2007-2019)

The number of treatment episodes entered into the BCCA database per year has increased steadily since 2007 (Figure 2). Between 2007 and 2013 the annual number of treatments registered increased from approximately 1,300 episodes to approximately 2,000 episodes. Since 2014 the annual number of treatments registered has been over 3,000 and this is increasing every year. The drop in registered treatments in 2013 coincided with the change from paper to online data entry.

The number of registered patients in 2019 (4,247), indicating that the vast majority of patients have a single treatment episode per year. While treatment episodes have been over 4,000 for each of 2018 and 2019, there has been a plateauing for 2019 (4,677 new episodes for 2018 vs 4,269 for 2019), although delayed reporting for 2019 in 2020 may change this.

Figure 2. Annual treatment episodes registered with the BCCA

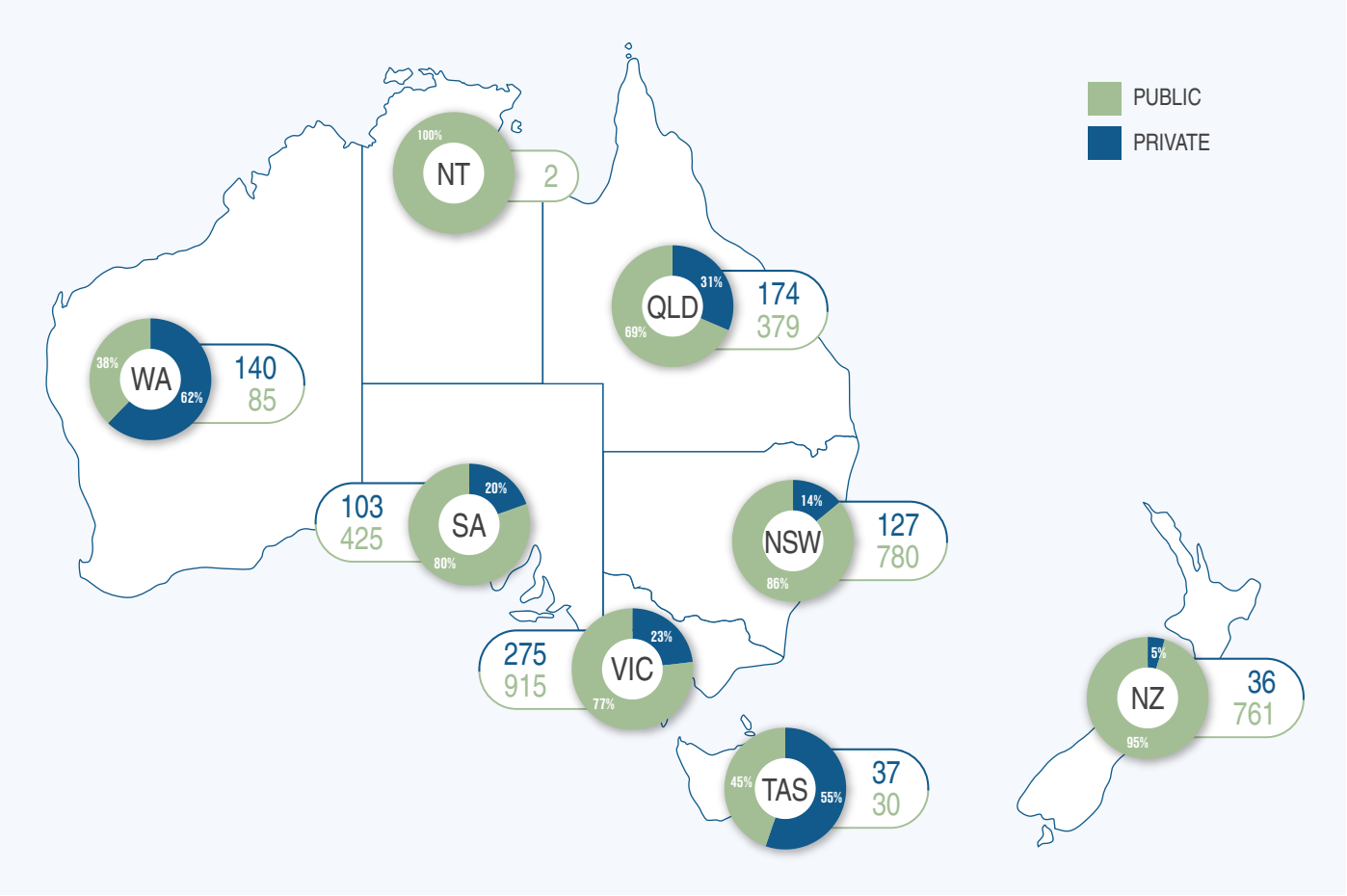


Participation by jurisdiction (2019)

Out of 4,269 episodes, approximately one half of episodes (49%) occurred in Victoria and New South Wales combined, with 19% occurring in New Zealand, 13% in Queensland, 12% in South Australia and less than 10% in Western Australia, Tasmania and the Northern Territory combined.

The majority of episodes in the BCCA database are from public hospitals (79%). This varies by jurisdiction, with 86% of episodes in New South Wales being from public hospitals, but only 38% of episodes in Western Australia. Ninety-five percent of episodes from New Zealand are from the public sector. A breakdown of treatment episodes by hospital type is shown in Figure 3.

Figure 3. BCCA participation by jurisdiction and public/private hospital (2019)



2. DEMOGRAPHICS

Age and gender characteristics

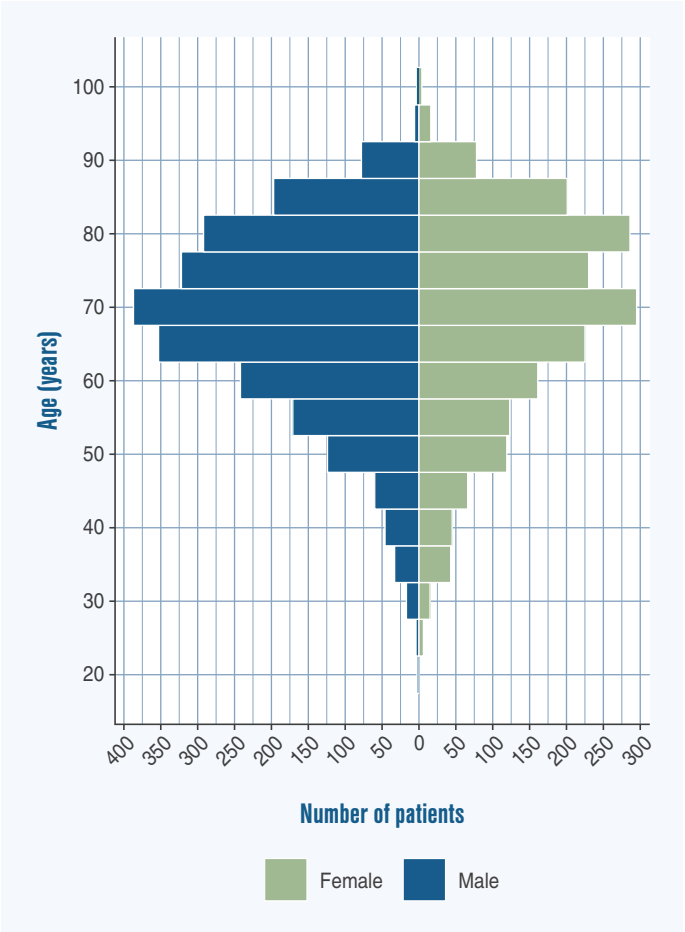
Approximately 55% of patients diagnosed with colorectal cancer in 2019 were male, and approximately 45% were female, representing a ratio of 1:1.2 which is the same as the long-term cohort average noted in the previous annual report. The mean age of patients diagnosed with colorectal cancer in 2019 was 68 years for both males and females (Table 1).

Table 1. Age and gender of colorectal cancer patients (2019)

	Female	Male
Min	24	20
Max	100	100
Median	70	69
Mean	68	68
SD	14	13
Count	1,912	2,335

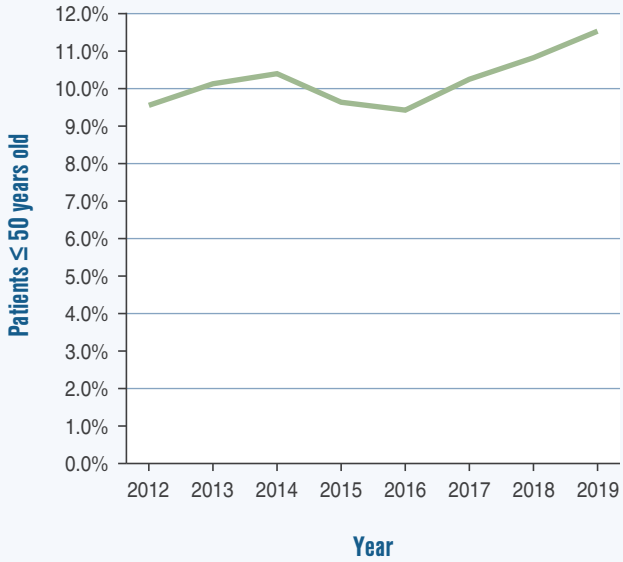
The age distributions for patients diagnosed with colorectal cancer in 2019 are similar across gender (Figure 4). Overall, 89% of patients are aged over 50 years at presentation, with the most common age group being those aged between 69 and 72 years. The under-50 age group comprised 11% of total patients, compared with a long-term average for the BCCA of 8% reported previously (Figure 5).

Figure 4. Age and gender distribution of colorectal cancer patients (2019)



n = 4,247 patients

Figure 5. Colorectal cancer patients under 50 years (2019)

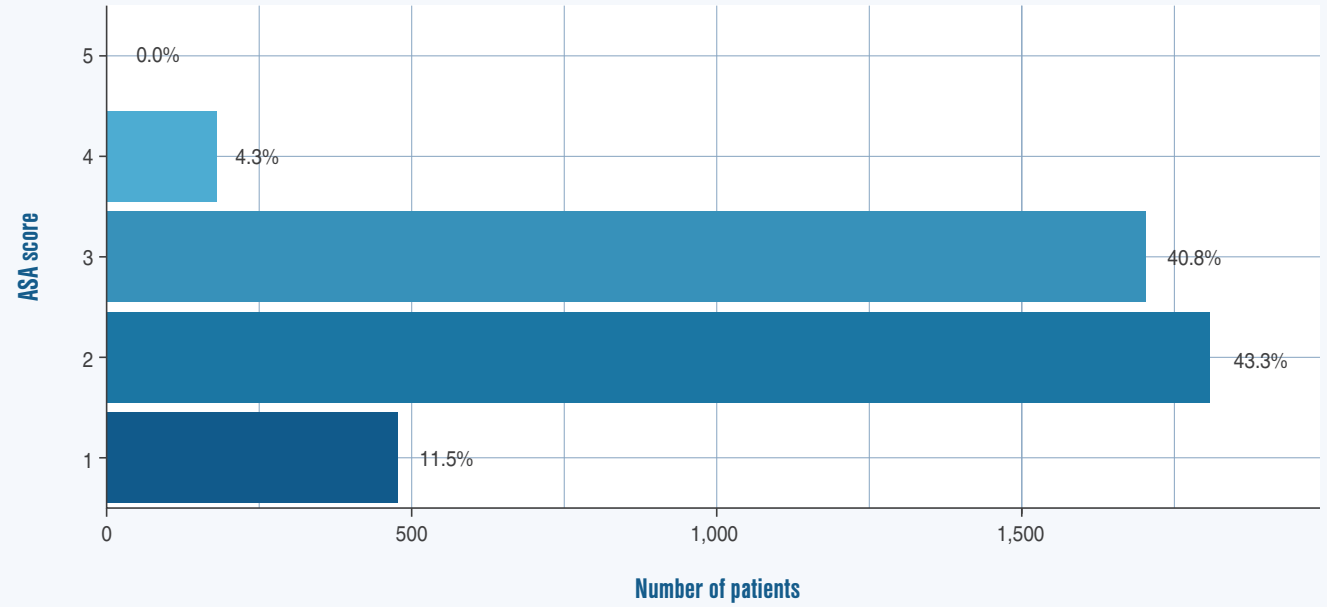


ASA status

The American Society of Anaesthesiologists classification allows for an assessment of fitness for surgery of patients and provides an overall indication of the health of patients at the time of surgery (where an ASA score of 1 represents a healthy person and 5 represents someone who is not expected to survive without surgery).

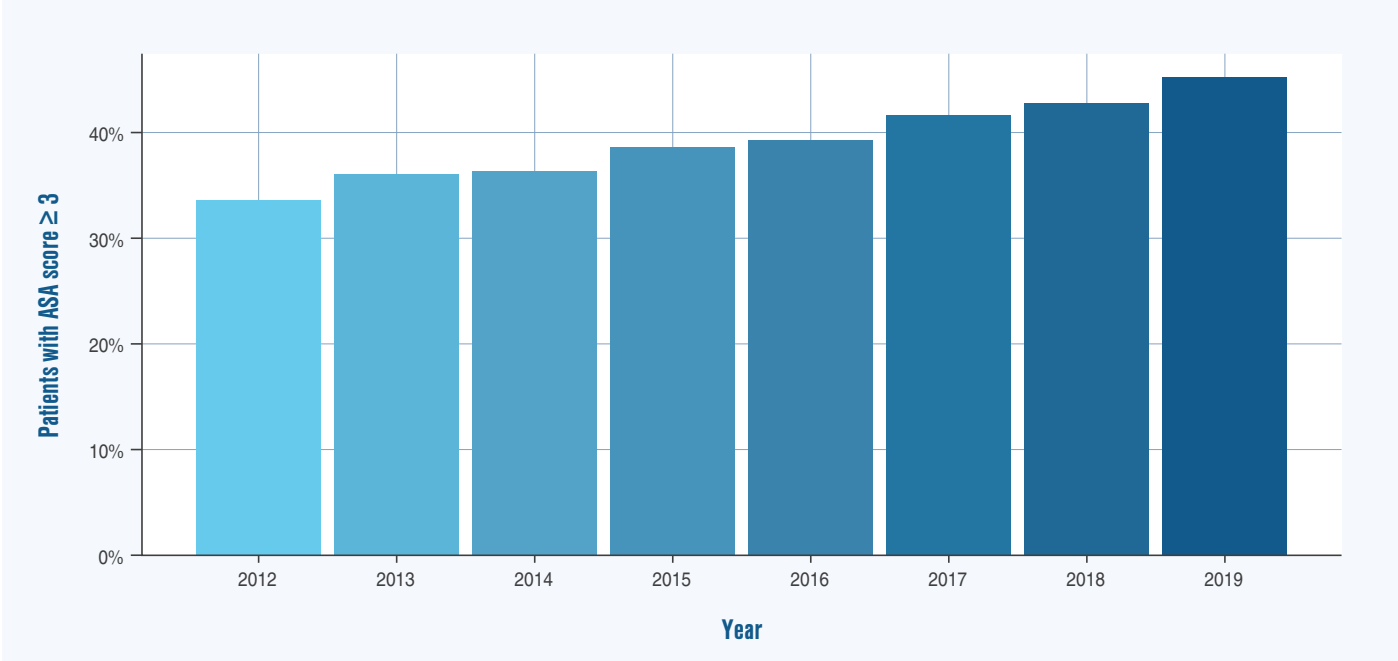
The ASA status of the 2019 cohort of patients in the BCCA is represented in Figure 6. Over 45% of 2019 patients were ASA score 3 or greater, which is an increase on the long-term cohort percentage (37%, with 2018 value being 42%) and reflects the increasing complexity of patients presenting for surgery (Figure 7).

Figure 6. ASA classification for all colorectal cancer patients (2019)



n = 4,172 patients

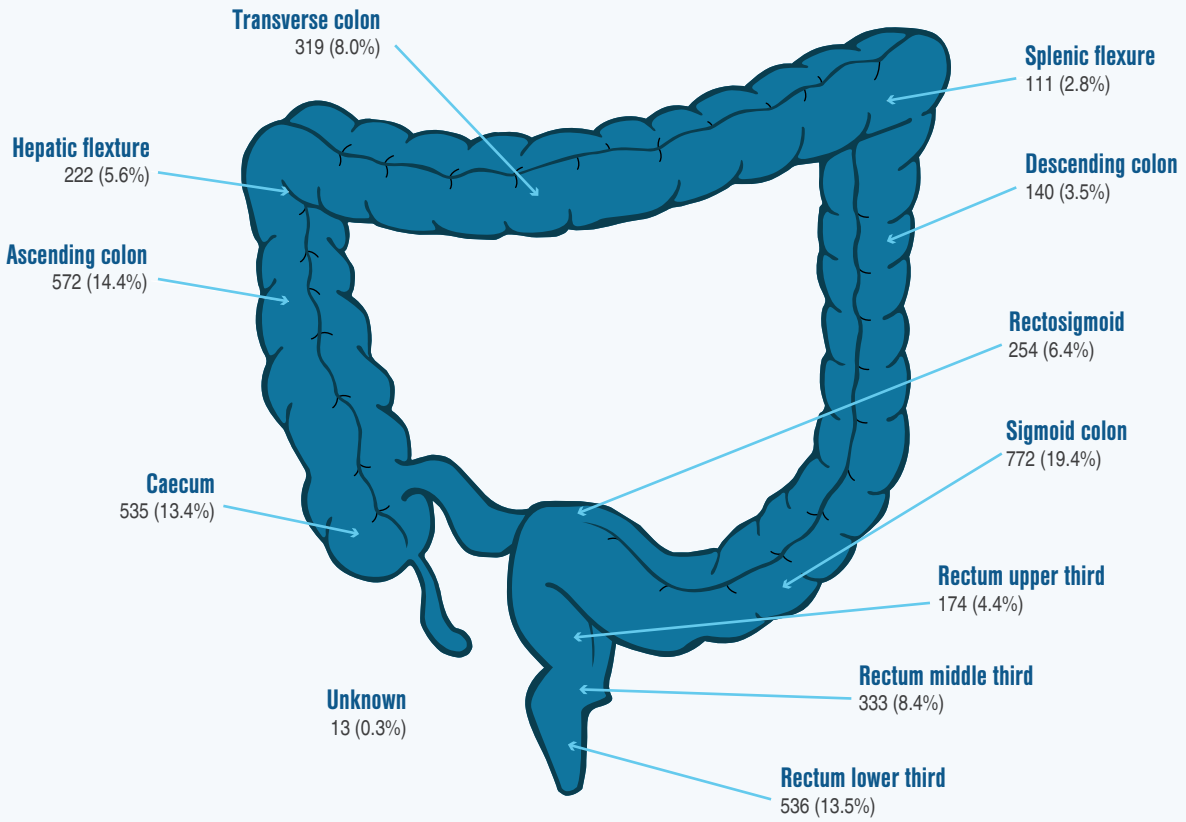
Figure 7. Colorectal cancer patients with ASA 3 or greater (2019)



Tumour location

Colorectal cancer distribution for 2019 patients is similar to previous long–term trends, with the highest proportion of patients presenting with tumours in the sigmoid colon (19.4%), followed by the ascending colon (14.4%), the lower third of the rectum (13.5%), and caecum (13.4%) (Figure 8).

Figure 8. Diagram of primary tumour location, count and percentage (2019)*



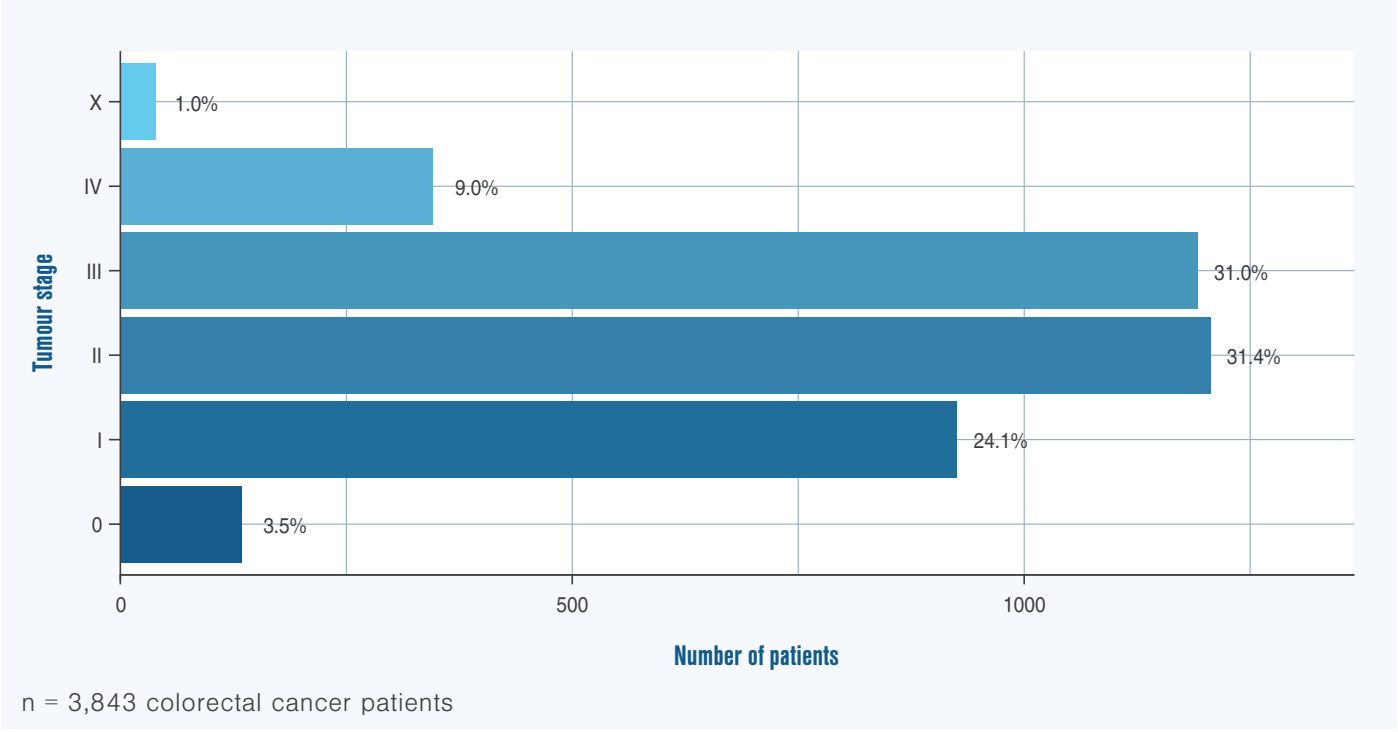
*n=3,981 patients

Stage of cancer

Colorectal

Colorectal cancer stage for new diagnoses in 2019 is shown in Figure 9. Stage II and III cancers represent 62% of the cohort, and stage IV cancer represents 9% of total cancers, which is a slight decrease from the previous long-term trend of 11%[2].

Figure 9. Tumour stage* for all colorectal cancer patients (2019)



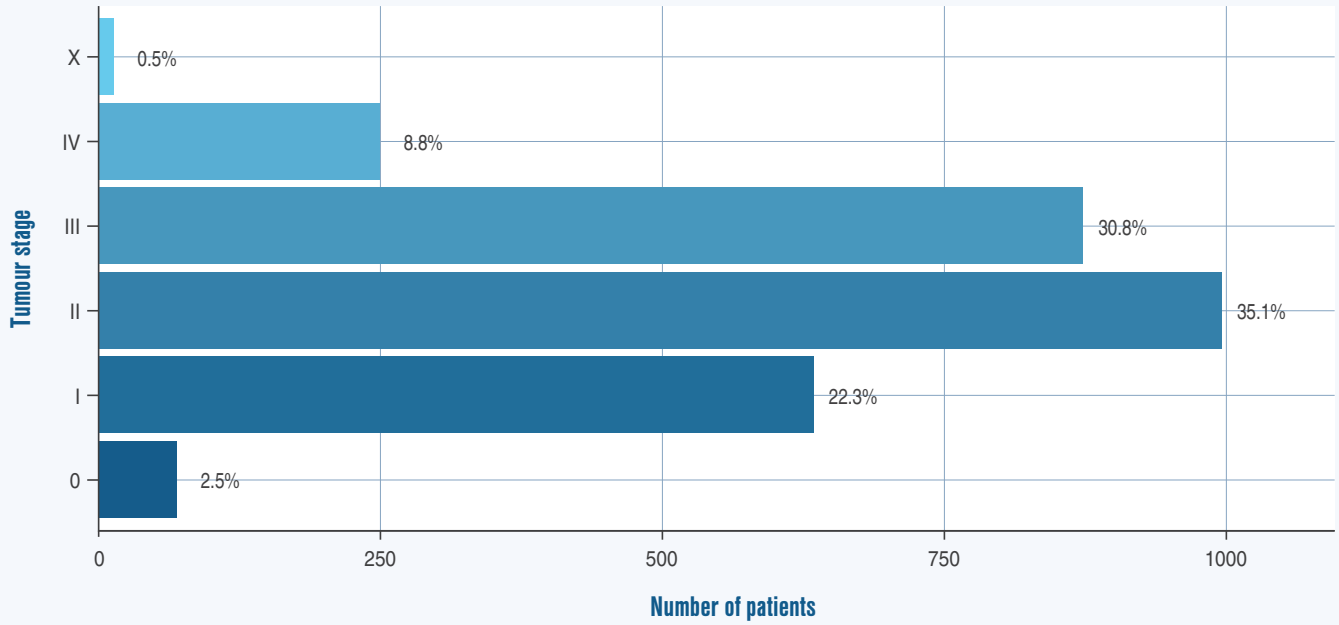
n = 3,843 colorectal cancer patients

*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)[3].

Cancers of the colon and rectum (2019) have a slightly different profile (Figures 10 & 11).

Colon

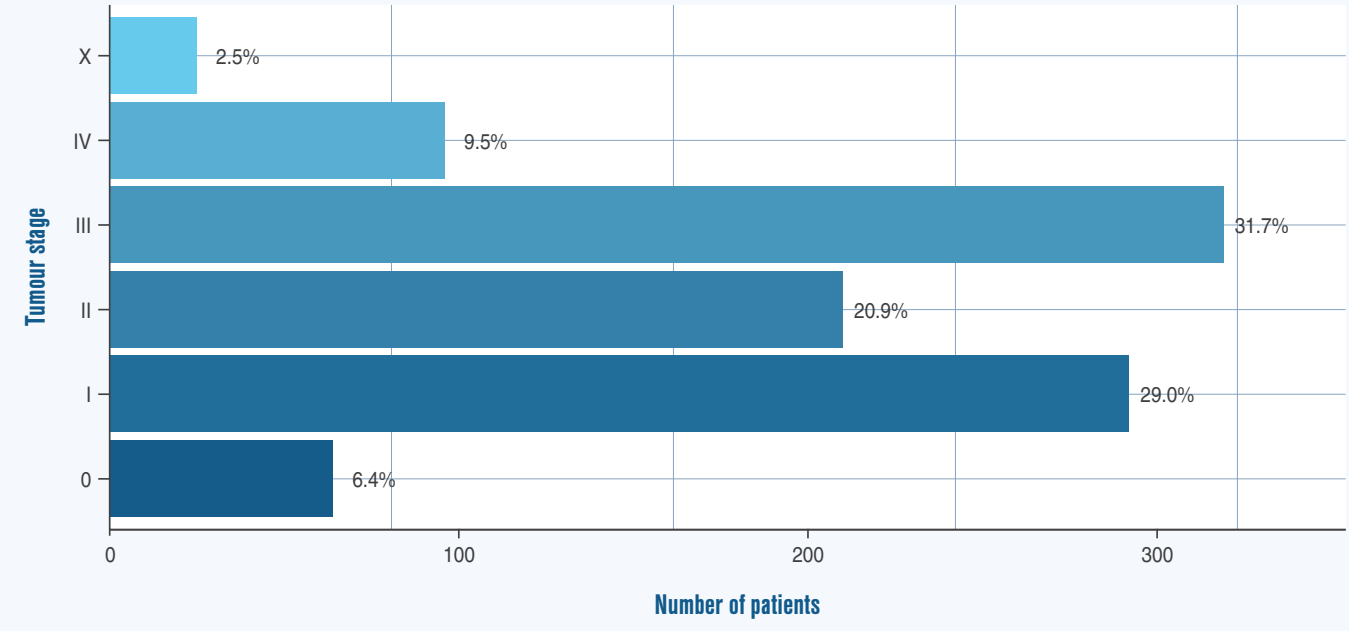
Figure 10. Tumour stage for colon cancer patients (2019)



n = 2,837 colon cancer patients

Rectal

Figure 11. TNM tumour stage for rectal cancer patients (2019)

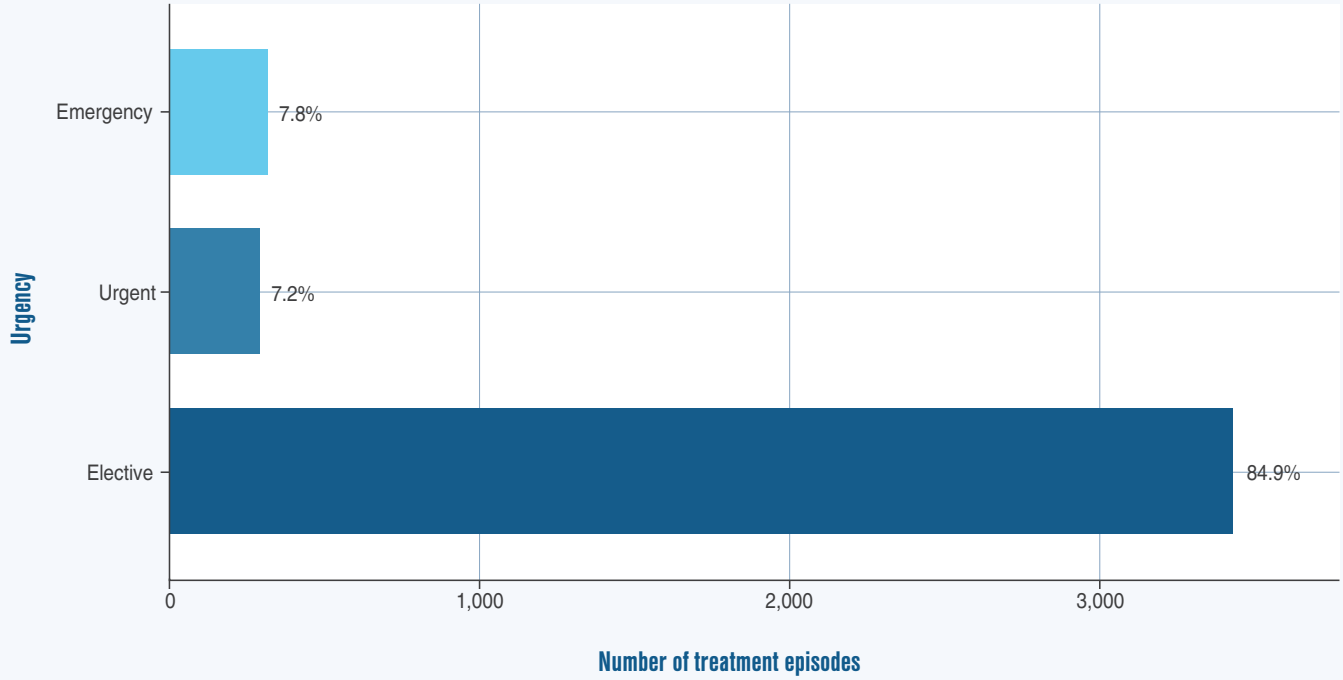


n = 1,006 rectal cancer patients

Urgency of hospital admission

The majority of 2019 patients presented to hospital as elective patients (85%), with 7% of patients being classified as urgent, and nearly 8% being classified as emergency presentations (Figure 12). These proportions of presentation type have been consistent for the duration of the BCCA.

Figure 12. Elective vs emergency presentations (2019)



n = 4,039 episodes

3. SCREENED VS NON FOBT-SCREENED CANCERS

Australia has one of the highest rates of bowel cancer in the world. 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 subsequently been an incremental rollout of the National Bowel Cancer Screening program (NBCSP), such that Australia now operates a population-based screening program. As of 2020, 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 per year.

The most recent Australian Institute of Health and Welfare technical report on the NBCSP published in 2019, reported that of individuals sent screening tests in 2017-2018, approximately 2.1 million people participated, comprising 42% of those invited (45% of women, and 40% of men), with 9% of participants returning a positive FOBT result[4].

In New Zealand, a pilot program was carried out by the Waitemata District Health Board between 2011 and 2017. As of January 2018, the new National Bowel Screening Programme (NBSP), commenced a staged rollout across health boards for eligible New Zealanders aged 60 to 74, with FOBT screening every 2 years, which is expected to be completed by 2021. The New Zealand National program is in its infancy but based on their pilot program they are predicting a 7% positivity rate, with 700,000 people being invited per year, once the program is fully rolled out.

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. It is reassuring to note that the proportion of patients diagnosed following FOBT has increased from 12% in 2012 to 20% in 2019 (Table 2), and it is expected this percentage will increase as the screening programs are fully implemented in both countries.

Table 2. Number of patients diagnosed with colorectal cancer following FOBT over time

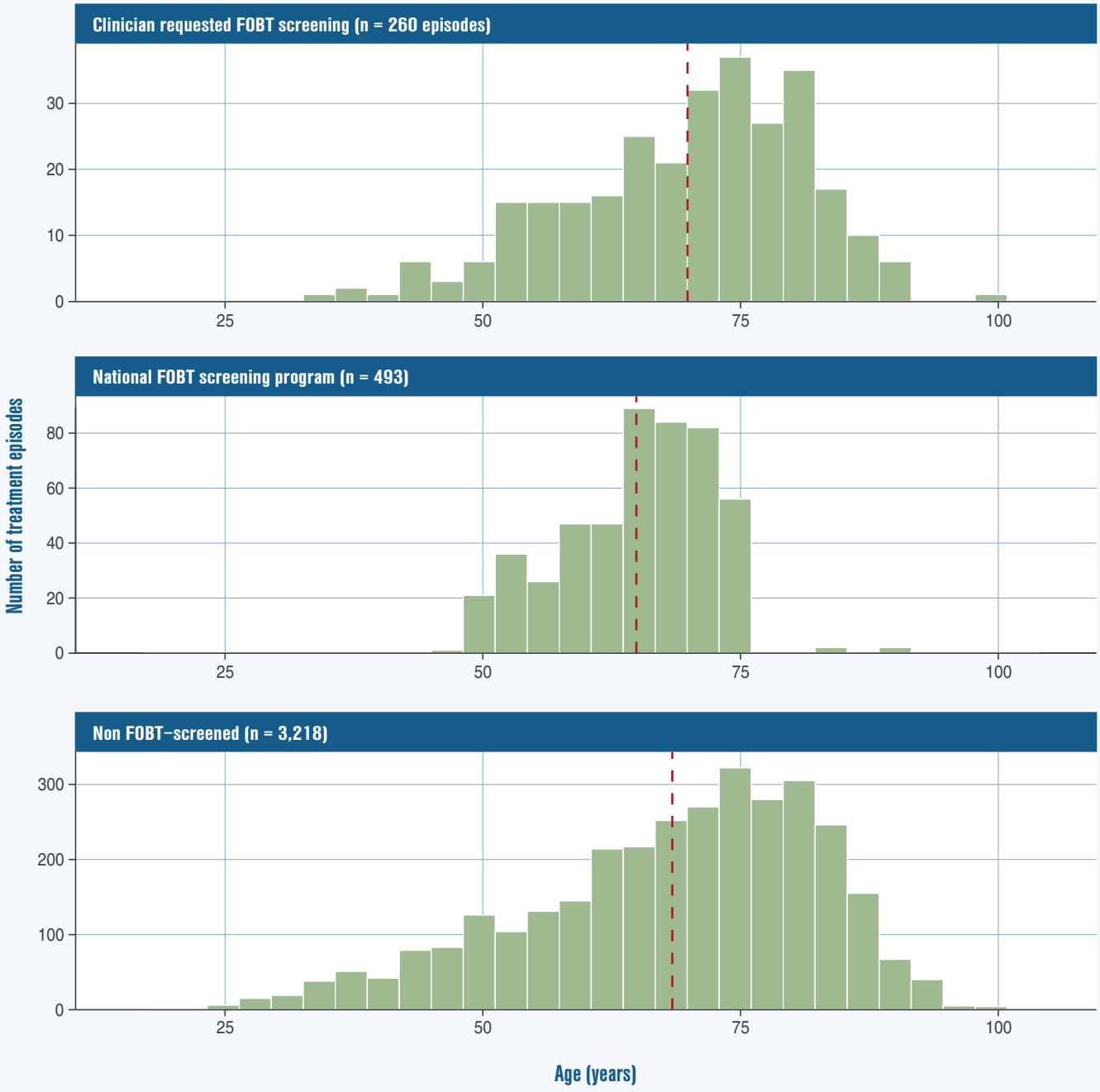
	2012	2013	2014	2015	2016	2017	2018	2019
Diagnosed following FOBT	12%	11%	11%	10%	14%	15%	17%	20%
Count	1,466	1,958	2,857	3,285	3,264	3,745	4,463	4,002

Characteristics of patients diagnosed via national screening compared with symptomatic cohort

Age

In comparing the age at diagnosis, the mean age at diagnosis is earlier for these individuals who participated in the NBCSP (64.9 years), than for those screened outside of the program (69.9 years) or for those diagnosed without screening (68.4 years) (Figure 13).

Figure 13. Age distribution of screened vs non FOBT-screened colorectal cancers (2019)



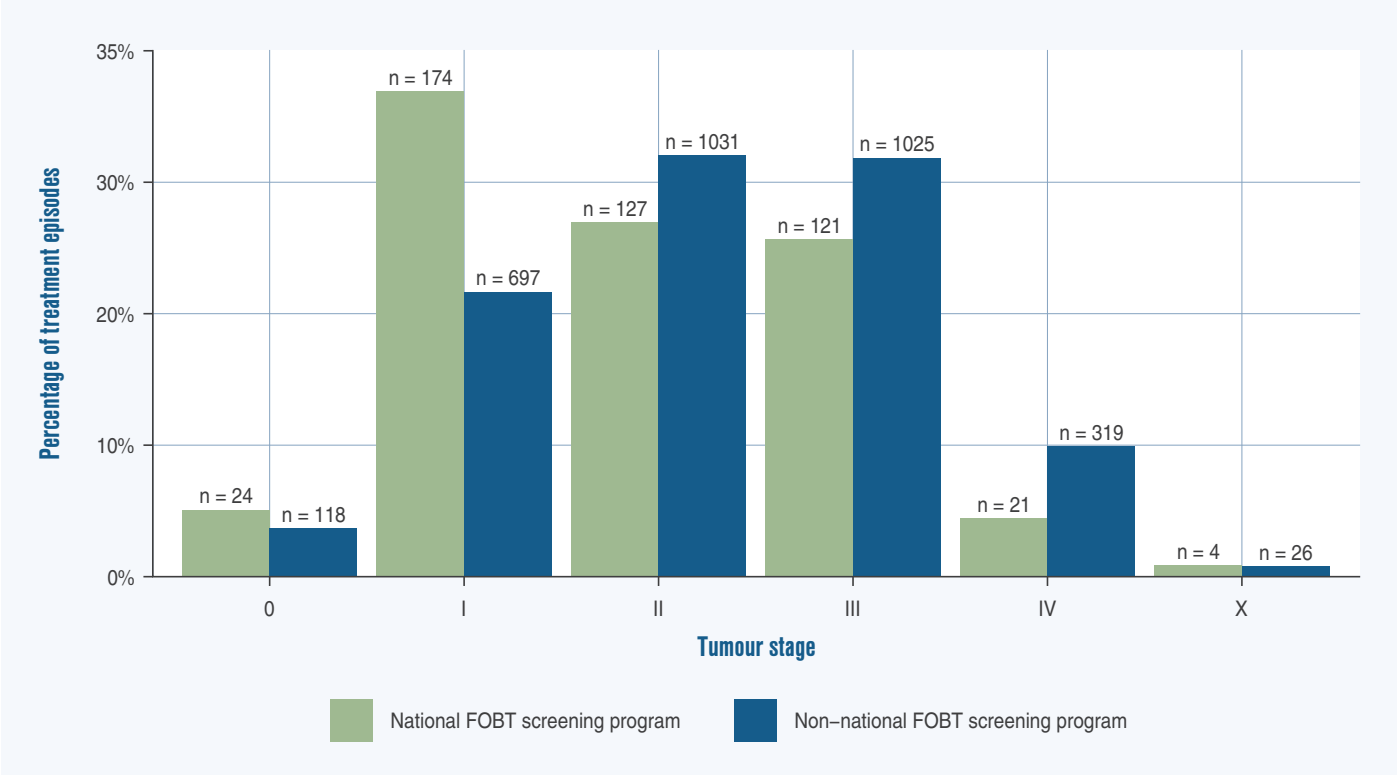
Vertical dashed lines represent average age

Cancer stage

Colorectal cancer diagnosed within the NBCSP continues to be diagnosed at an earlier stage than cancers diagnosed without screening (Figure 14). This is not unexpected as non FOBT screened patients will usually present when symptomatic as compared to patients diagnosed through the national FOBT screening program being diagnosed at a time when they are still asymptomatic. It is difficult to make any conclusion as to the 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 in data- linkage studies using BCCA data to be associated with reduced colorectal cancer related mortality[5,6].

Figure 14. Stage of national FOBT screened vs non-national FOBT-screened colorectal cancers (2019)



Differences between proportion of tumour stages across two screening categories (national FOBT screening program vs non- national FOBT-screened colorectal cancer) was tested using the Chi-square goodness of fit (Table 3).

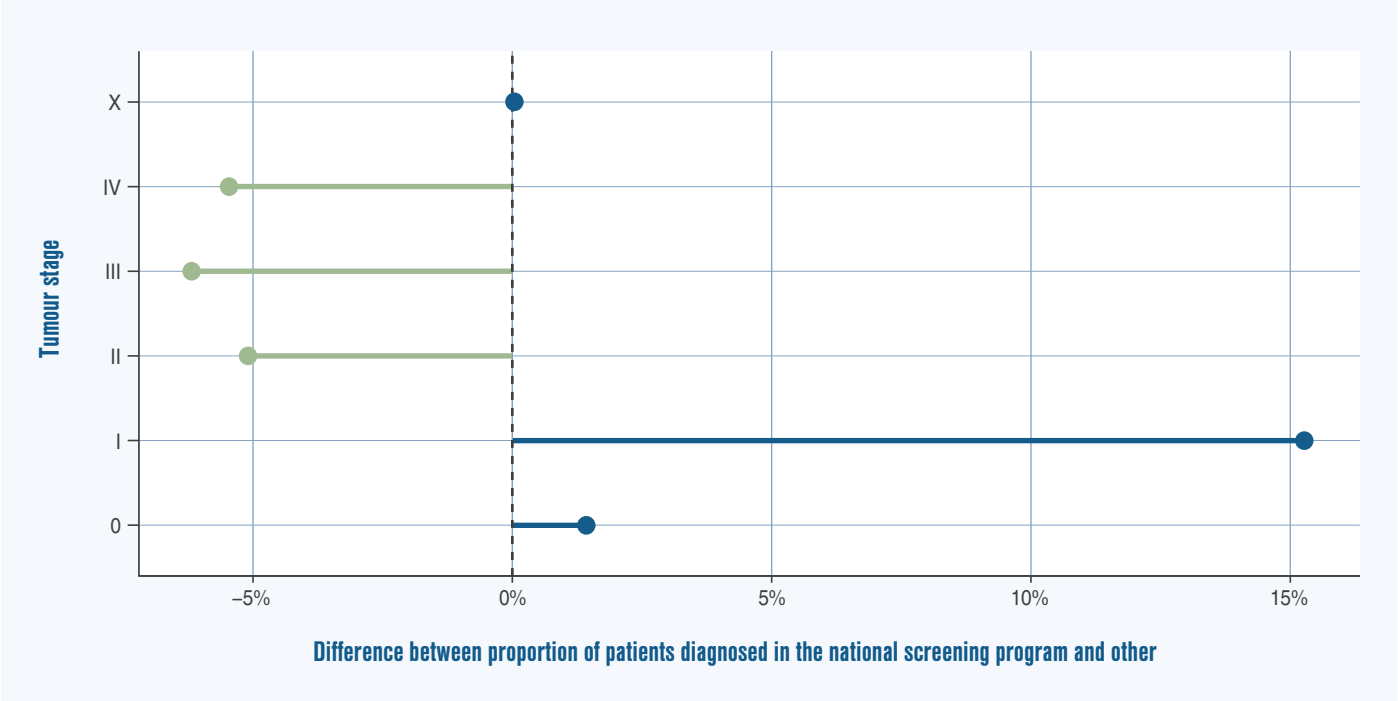
Figure 15 illustrates the differences between the proportion of patients in the two screening categories (national FOBT screening program vs non-national FOBT-screened colorectal cancers) across different tumour stages. A positive value represents a higher proportion of patients in the National FOBT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

Table 3. National FOBT screening programs vs non-national FOBT-screened colorectal cancers (2019)

	National FOBT screening program (N=493)	Non-national FOBT screening program (N=3,509)	Total (N=4,002)	p value
Tumour stage				< 0.001*
Missing	22	293	315	
0	24 (5.1%)	118 (3.7%)	142 (3.9%)	
I	174 (36.9%)	697 (21.7%)	871 (23.6%)	
II	127 (27.0%)	1,031 (32.1%)	1,158 (31.4%)	
III	121 (25.7%)	1,025 (31.9%)	1,146 (31.1%)	
IV	21 (4.5%)	319 (9.9%)	340 (9.2%)	
X	4 (0.8%)	26 (0.8%)	30 (0.8%)	

* Pearson's Chi-squared test

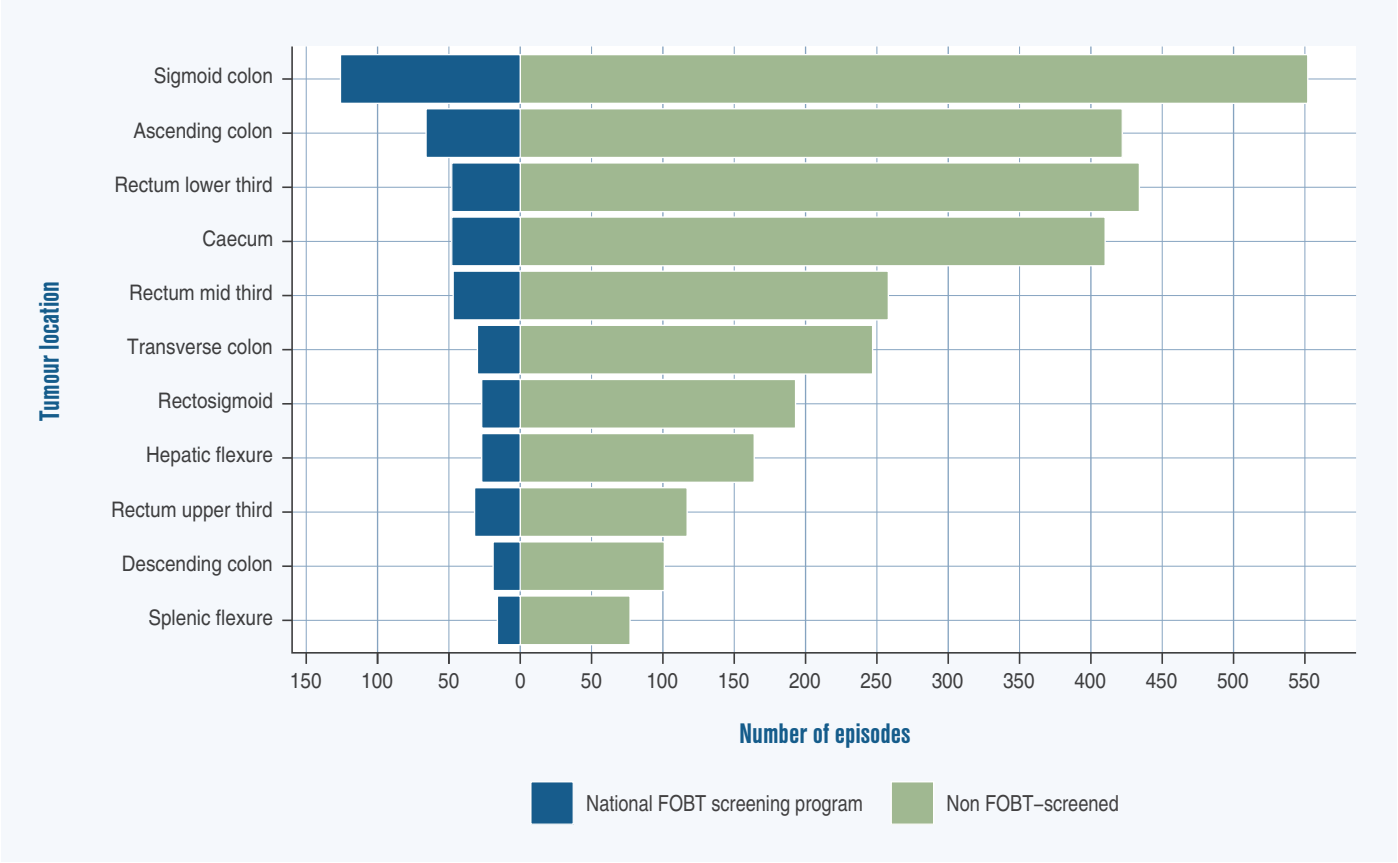
Figure 15. Difference in proportion of colorectal cancer patients diagnosed in the national FOBT screening program and outside the national FOBT-screening programs (2019)



Cancer location

The distribution of tumour site throughout the colon and rectum is similar in screened and unscreened colorectal cancers (Figure 16), reflecting a similar distribution of symptomatic and asymptomatic cancers.

Figure 16. Site of tumour of patients diagnosed through a national screening program compared to non FOBT-screened patients* (2019)



* Clinician requested FOBT is not included in this graph

4. MANAGEMENT

Primary procedure for colorectal cancer

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

1. Overall Colorectal Cancer Management
2. Colon and Rectal Cancer for Primary Procedure
3. Operative Approach
4. Specific Treatment Modalities Related to Rectal Cancer

Operative approach for colorectal cancer

The adoption of minimally invasive surgery (MIS) has progressively increased over time. MIS includes laparoscopic, hybrid, conversion of laparoscopic, robotic and taTME. In 2007 fewer than 30% of colorectal resections were undertaken with a minimally invasive approach, increasing to 76% in 2019. The type of minimally invasive approach has also changed over time, with increasing penetration of robotic resection and taTME into rectal resection.

Application of a minimally invasive approach can contribute to reduced hospital length of stay.

Colon cancer

Primary Procedures for colon cancer

Table 4. Primary procedure for patients with colon cancer (2019)

Operation	Count	Percentage
Right hemicolectomy	1,290	49%
Extended right hemicolectomy	216	8%
Left hemicolectomy	156	6%
Sigmoid colectomy	39	1%
Total colectomy	43	2%
Subtotal colectomy	102	4%
Proctocolectomy	13	<1%
High anterior resection (10.1-15 cm)	692	26%
Transverse colectomy	23	1%
Laparotomy	11	<1%
Other	38	1%
Total	2,623	100%

The distribution of primary procedure for colon cancer has not changed substantially from previous reports (Table 4)[1,2].

Operative approach for colon cancer

Figure 17. Detailed operative approach over time for colon cancer

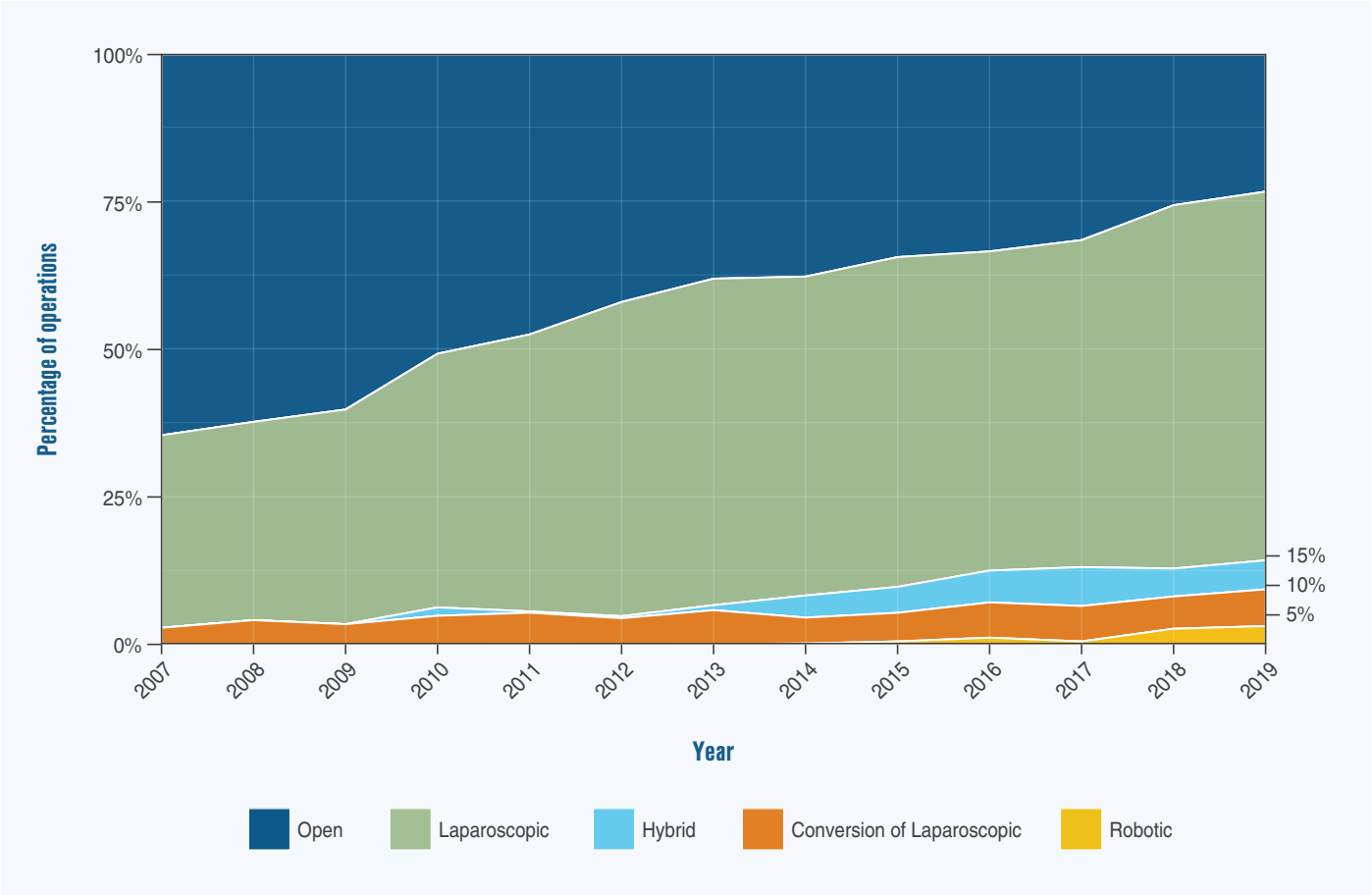
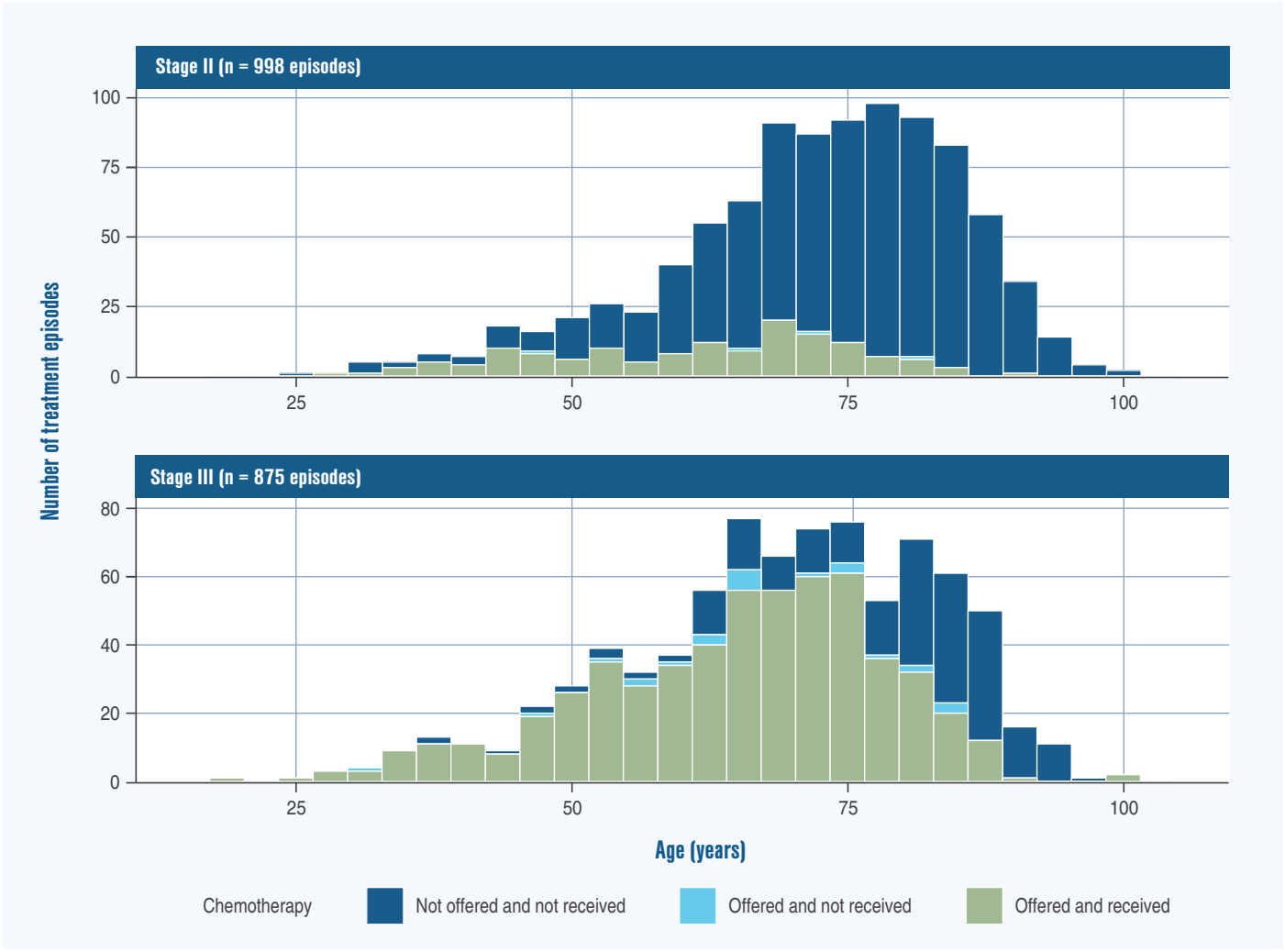


Figure 17 demonstrates the progressive shift from open resection of colon cancer to minimally invasive procedures, particularly laparoscopic surgery.

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 18 demonstrates adjuvant therapy utilisation in colon cancer patients with stage II and stage III disease. Sixteen percent of Stage II patients were offered chemotherapy. Fourteen percent of stage II and 64% of stage III patients received chemotherapy. Eight percent of Stage III patients were offered but did not receive chemotherapy.

Figure 18. Stage II and Stage III colon cancers treated with chemotherapy (2019)



Rectal cancer

Management of rectal cancer is frequently multimodality and requires multidisciplinary input, including preoperative chemoradiation in a significant percentage of patients. Quality indicators for treatment of rectal cancer include preoperative imaging with either MRI or ultrasound to determine T and N stage, to allow preoperative assessment of patients for neoadjuvant treatment, and discussion at multidisciplinary meetings.

Figures 19 & 20 demonstrate that an increasing majority of patients, increasing with time, are appropriately preoperatively staged using either MRI or ultrasound.

Figure 19. Proportion of patients with rectal cancer undergoing MRI scan as part of preoperative staging over time

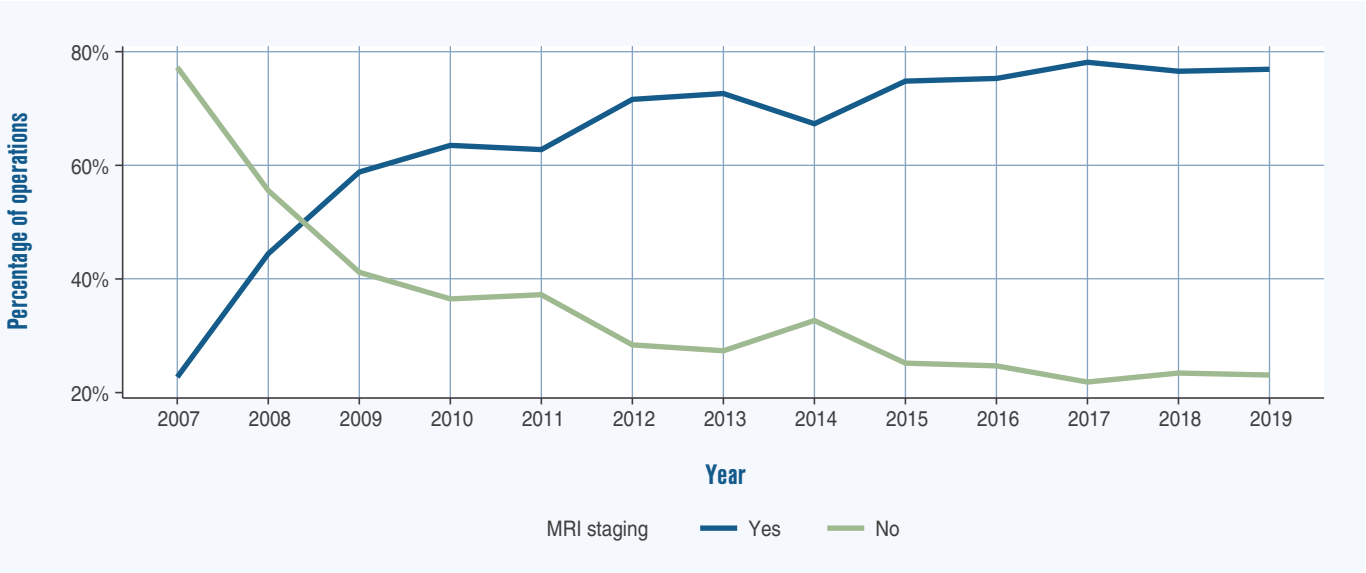
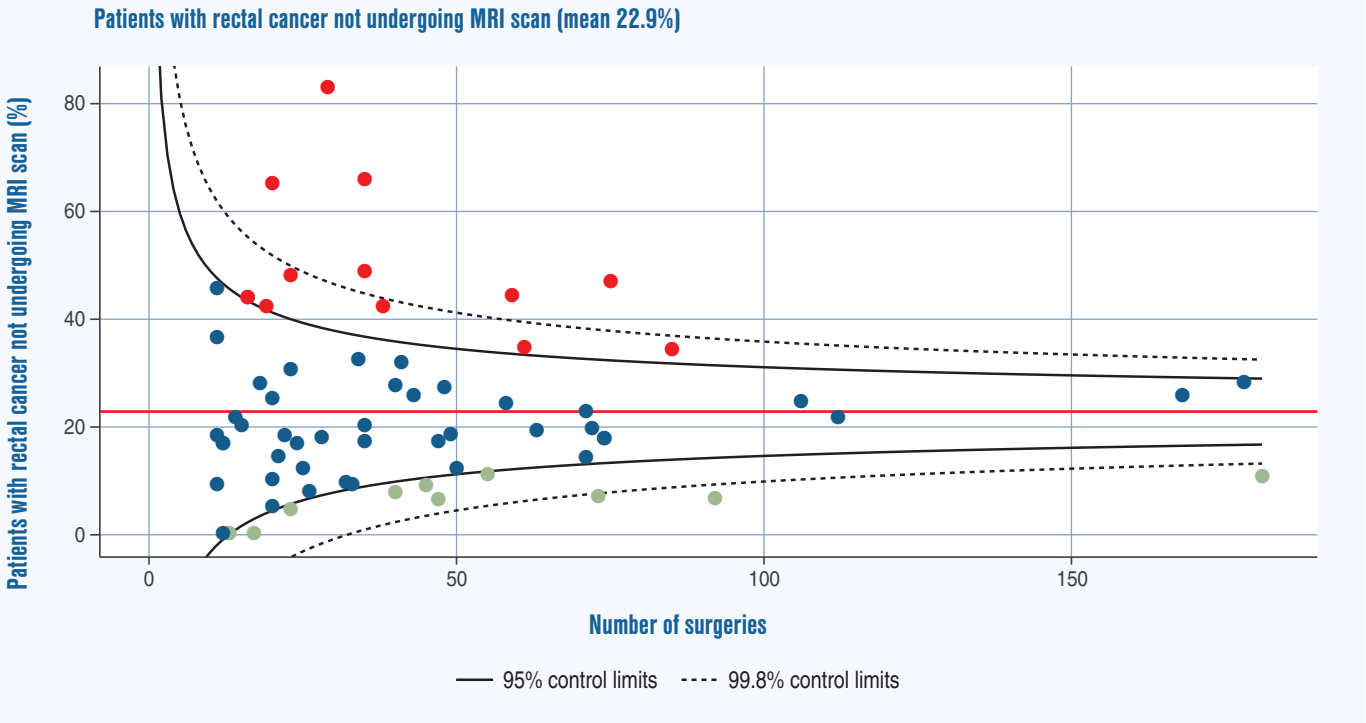


Figure 20. Patients with rectal cancer not undergoing MRI scan (unadjusted, 2017-2019)*



*Dotted curves represent two standard deviations (95% control limits) and three standard deviations (99.8% control limits).

Rectal cancers discussed at MDT meetings

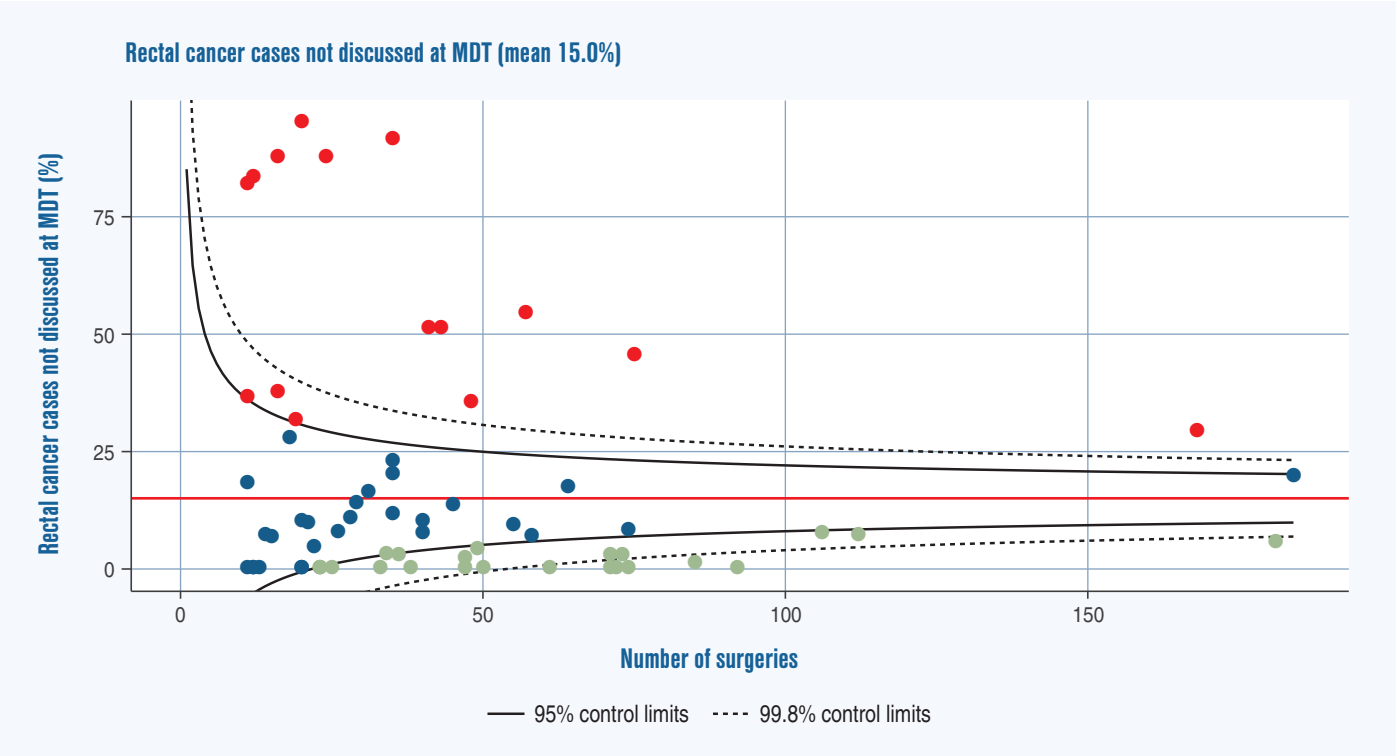
Table 5 and Figure 21 demonstrate that the vast majority of patients are discussed at multidisciplinary meetings, although some low volume treatment centres demonstrate MDT discussion rates of less than 50%.

Table 5. Rectal cancer cases discussed at MDT* (2019)

Discussed at MDT	Count	Percentage
Yes	904	86%
No	137	13%
N/A	8	1%
Total	1,049	100%

*This covers all rectal cases entered into the BCCA where MDT presentation has been reported

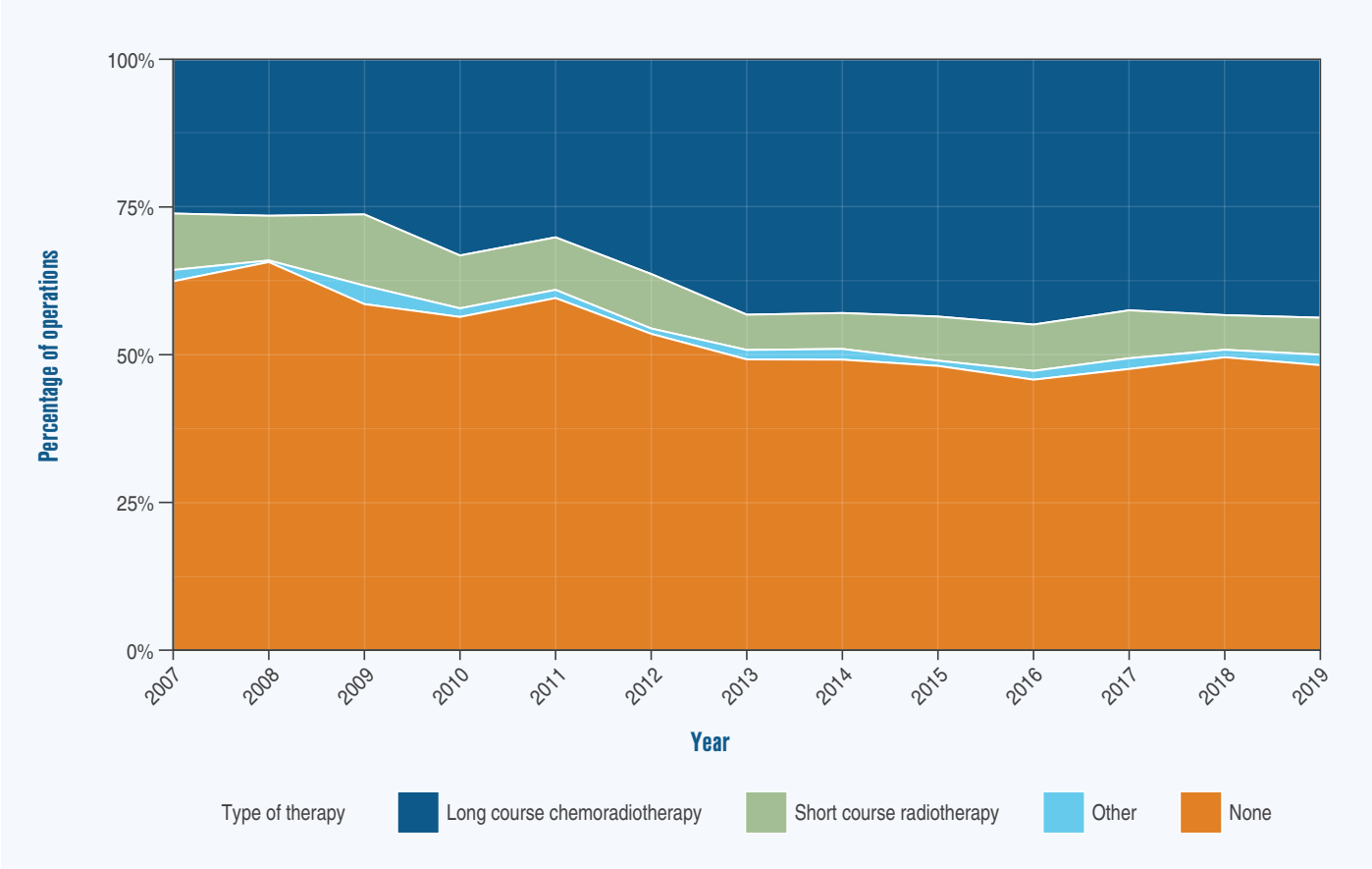
Figure 21. Rectal cancer cases not discussed at MDT (unadjusted, 2017-2019)



Neoadjuvant therapy

Figure 22 demonstrates that approximately half of all patients with rectal cancer are undergoing preoperative chemoradiation or short-course radiation therapy. This figure includes all patients deemed to have 'rectal cancer', hence, will include patients with intraperitoneal malignancies (for whom generally speaking, chemoradiation or radiation are not indicated preoperatively) and patients with early stage disease, for whom neoadjuvant treatment is not indicated also.

Figure 22. Neoadjuvant therapy use for rectal cancer and type of therapy



Primary Procedures for Rectal Cancer

Table 6. Primary procedure for patients with rectal cancer (2019)

Operation	Count	Percentage
Ultra low anterior resection (0-6 cm)	422	41%
APR*	199	19%
Low anterior resection (6.1-10 cm)	193	19%
High anterior resection (10.1-15 cm)	54	5%
Other	42	4%
Hartmanns	38	4%
TEMS/TAMIS*	38	4%
Colo-anal anastomosis	17	2%
Proctocolectomy	16	2%
Local excision	13	1%
Laparotomy	2	<1%
Total	1,034	100%

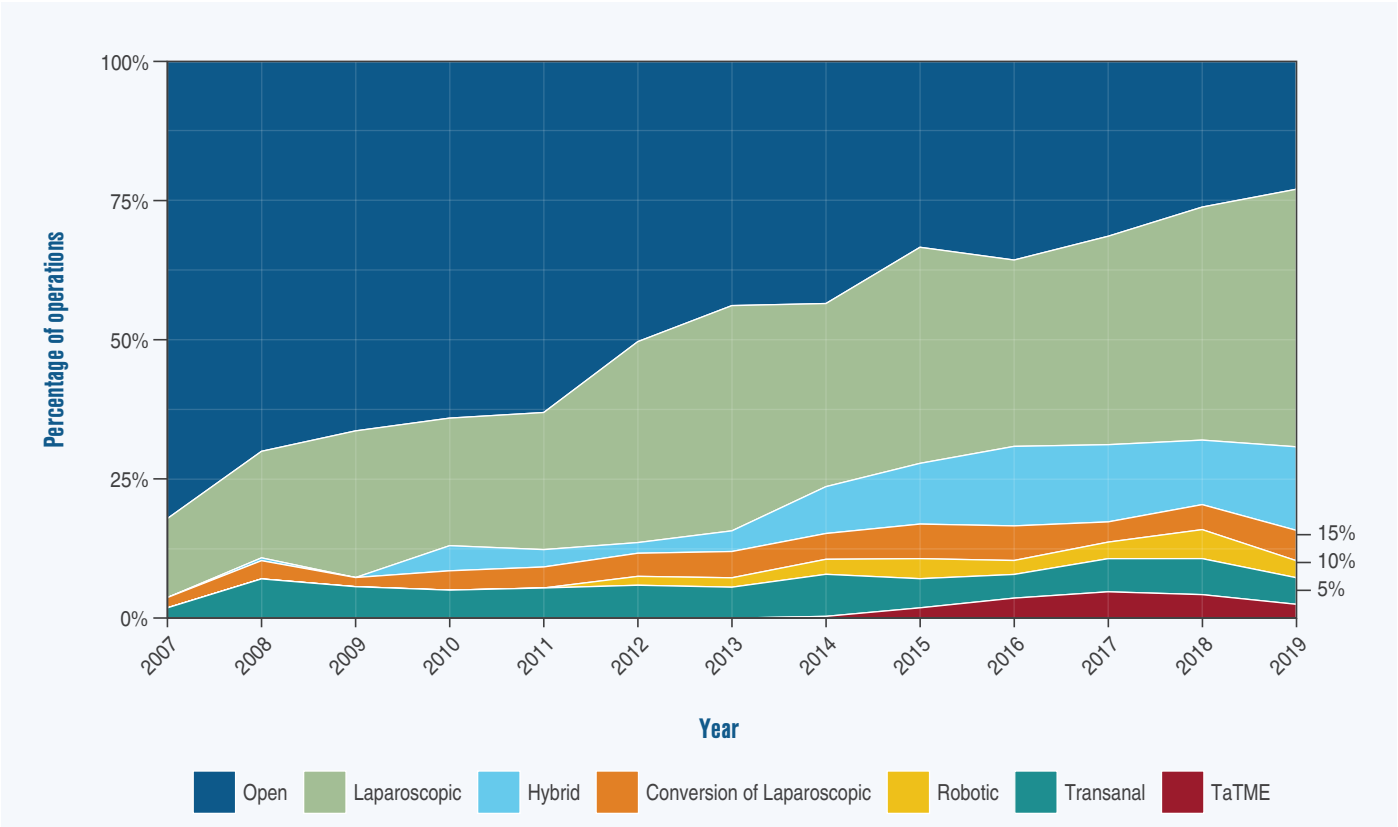
*APR (abdominoperineal resection); TEMS (transanal endoscopic micro-surgery); TAMIS (transanal minimally invasive surgery)

The distribution of primary procedure for rectal cancer has not changed substantially from previous reports (Table 6)[1].

Operative approach for rectal cancer

Figure 23 again demonstrates the progressive increase in the last decade in patients undergoing minimally invasive surgery for treatment of rectal cancer with a diminution now of open surgery as the primary modality. Laparoscopic and hybrid laparoscopic cases represent the majority of these minimally invasive procedures.

Figure 23. Detailed operative approach over time for rectal cancer



5. SURGICAL COMPLICATIONS

The data are presented in Tables 7 & 8 and Figures 24 & 25 for colon and rectum respectively. All complications are listed. The total number of patients having one or more surgical, and one or more medical complications related to surgery, are shown. The results for both are very similar to previous audit periods[1,2]. Data is self-reported and is not validated. It is possible that less severe complications, or ones that occur after discharge, like wound infections, are under reported. The rate for surgical site infection (SSI) reported here is at the very end for colorectal surgery SSI reported in the literature.

Colon cancer

The rate of patients experiencing one or more surgical complications was 17%. Overall 15% of patients had one or more "medical" complications from surgery (Table 7).

Table 7. Summary of surgical and medical complications of patients undergoing surgery for colon cancer (2019)

Complication	Count	Percentage
Surgical complications	502	17%
Abdominal / pelvic collection	61	2%
Anastomotic leak	73	2%
Enterocutaneous fistula	8	<1%
Superficial wound dehiscence	55	2%
Deep wound dehiscence	12	<1%
Wound infection	72	2%
Sepsis	43	1%
Prolonged ileus	235	8%
Small bowel obstruction	20	1%
Urinary retention	26	1%
Ureteric injury	2	<1%
Splenectomy	5	<1%
Postoperative haemorrhage	44	2%
Other surgical complications	73	2%
Medical complications	430	15%
DVT / PE	37	1%
Chest infection	113	4%
Cardiac	119	4%
Other medical complications	240	8%
n = 2,931 treatment episodes		

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

Figure 24. Colon cancer surgical and medical complications over time

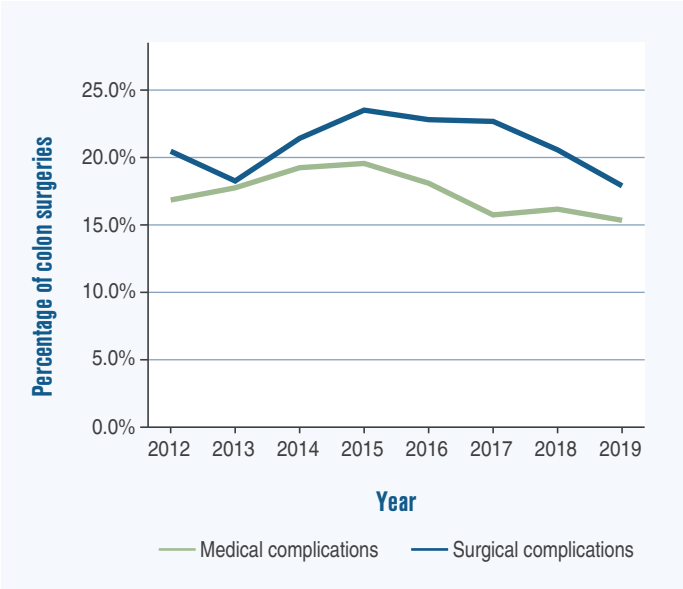
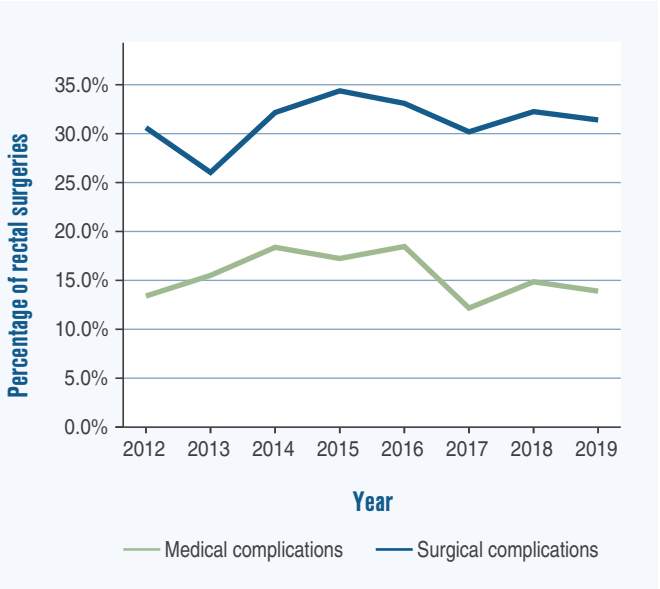


Figure 25. Rectal cancer surgical and medical complications over time



Rectal cancer

The overall rectal cancer surgical complication rate is 30% (Table 8). The anastomotic leak rate was 4% and would generally be considered consistent with good practice[7].

Table 8. Surgical and medical complications of patients undergoing surgery for rectal cancer (2019)

Complication	Count	Percentage
Surgical complications	314	30%
Prolonged ileus	128	12%
Abdominal / pelvic collection	58	6%
Urinary retention	29	3%
Wound infection	37	4%
Anastomotic leak	39	4%
Superficial wound dehiscence	38	4%
Sepsis	24	2%
Small bowel obstruction	21	2%
Postoperative haemorrhage	23	2%
Deep wound dehiscence	11	1%
Ureteric injury	3	<1%
Other surgical complications	64	6%
Enterocutaneous fistula	2	<1%
Splenectomy	2	<1%
Medical Complications	138	13%
Cardiac	37	4%
Chest infection	34	3%
DVT / PE	13	1%
Other medical complications	79	8%

n = 1,052 treatment episodes

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[8]. 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 Multidisciplinary Team Meeting (MDT) (rectal)
- MRI staging (rectal)
- Permanent stoma rate

These KPIs are reported in this chapter and chapter 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 (2017-2019) (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 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 or not 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 surgeries in Australia and New Zealand were entered into BCCA. Therefore, the data and certainly the initial reports must be interpreted with this in mind.

Inpatient mortality

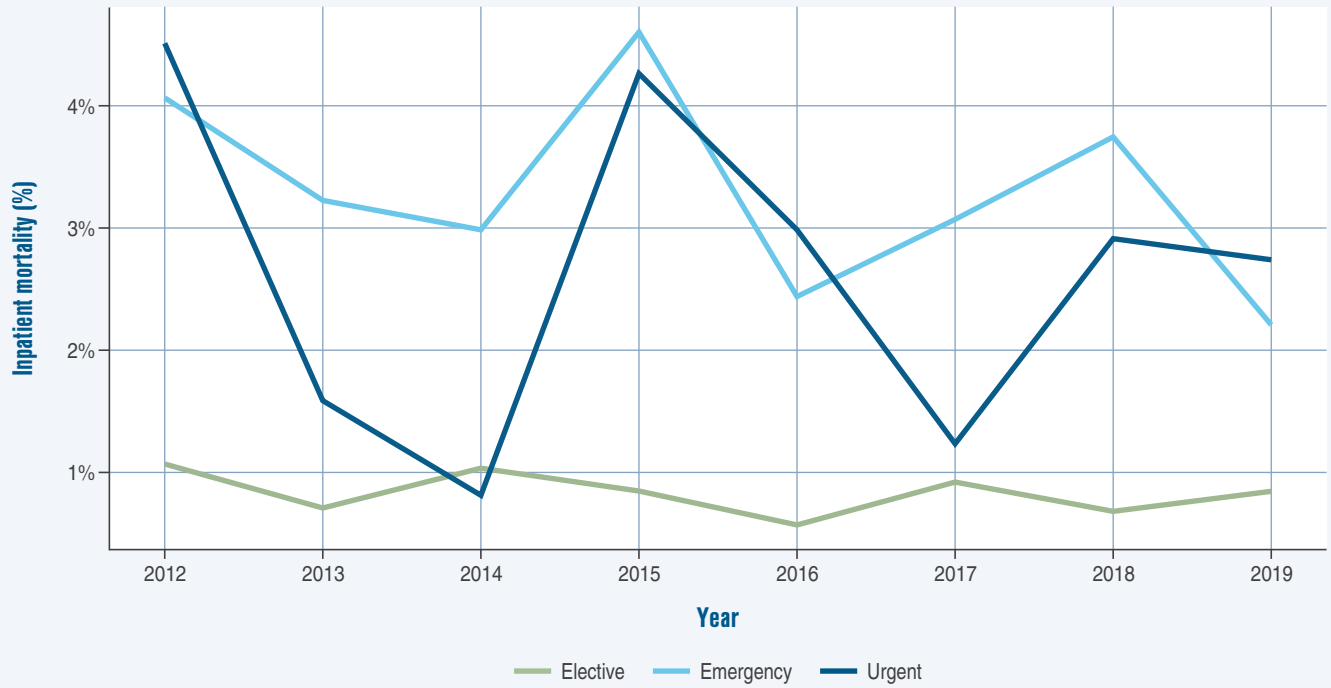
Inpatient mortality remains consistently low at 1% of reported cases (Table 9 and Figure 26). Urgency of admission is a major factor in hospital mortality with very low mortality for elective cases, but a higher mortality in urgent or emergency cases. There has been a gradual decline in mortality over the last decade.

In the 2017-2019 cohort, hospital volume remains associated with reduced inpatient mortality (Figure 27). In risk adjusted data (adjusted for ASA score, patient age at diagnosis, operative surgery, sex, and overall stage) only two sites were outliers, and both were low volume sites.

Table 9. Hospital mortality over time (Unadjusted)

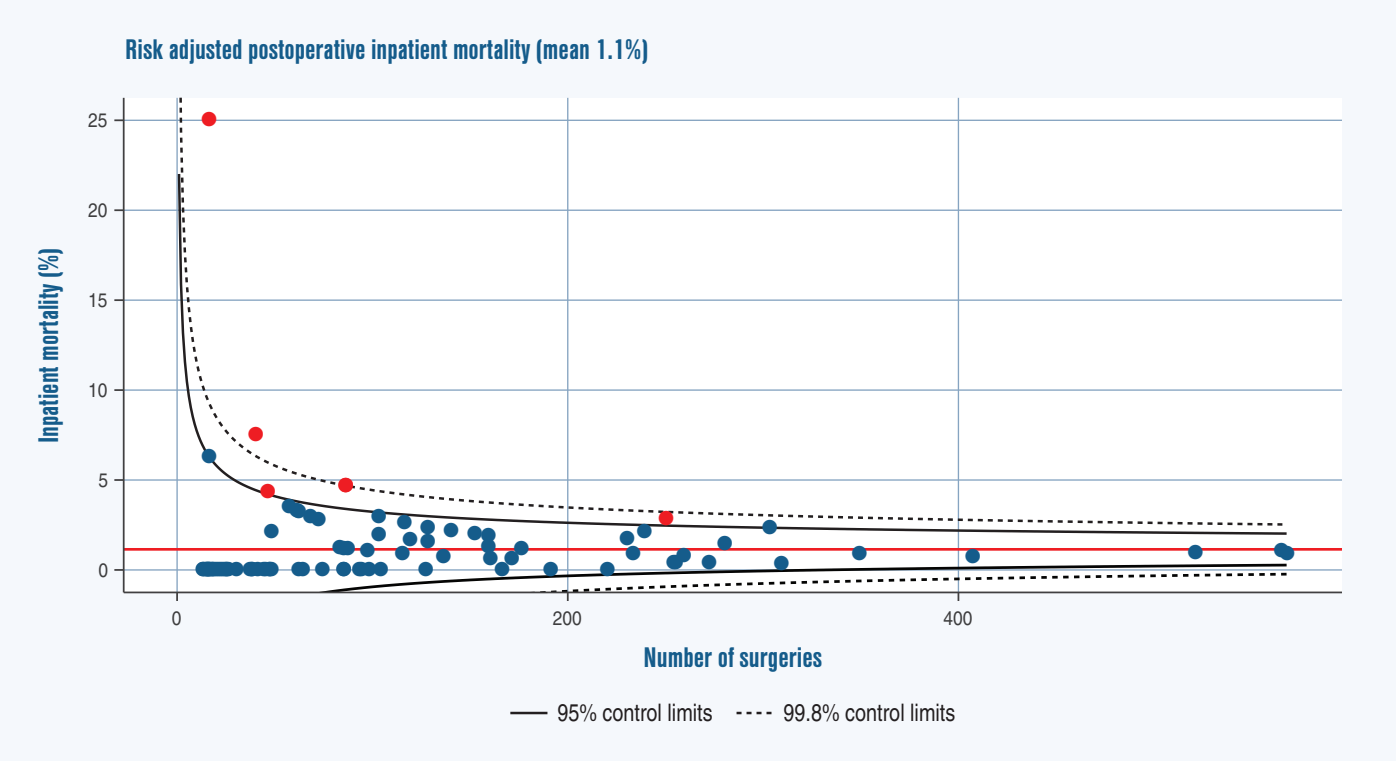
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
Treatment episodes	570	1,237	1,483	1,949	2,226	2,133	2,087	2,969	3,219	3,282	3,487	4,098	4,047	32,787
Inpatient mortality	11	16	19	21	38	31	19	34	45	29	38	43	44	388
Inpatient mortality rate	2%	1%	1%	1%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%

Figure 26. Urgency of admission and inpatient mortality rate over time



Emergency n = 2,111, Urgent n = 2,436, Elective n = 28,166, Total n = 32,713

Figure 27. Risk-adjusted post-surgical inpatient mortality by hospital (2017-2019)

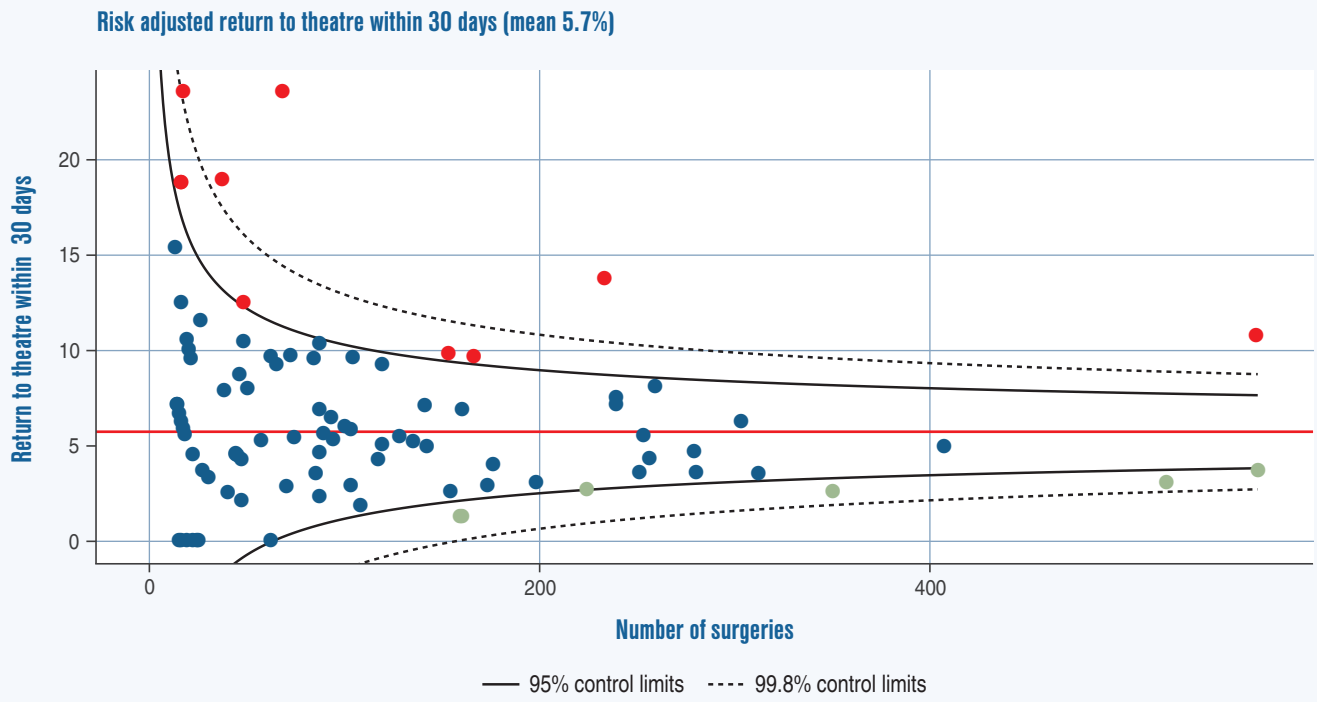


Adjusted for ASA score, patient age at diagnosis, operative urgency, sex, and overall stage
5 sites were excluded due to low completeness of the adjusting covariates and/or outcome

Return to theatre

Return to theatre within 30 days is a broad indicator of significant complications related to surgery. It is a key performance indicator and quality marker of hospital care. The mean risk adjusted rate was 5.7% (Figure 28). The most common noted reason for return to theatre was anastomotic leak.

Figure 28. Risk- adjusted return to theatre rate by hospital (2017-2019)



Adjusted for ASA score, cancer type, sex, patient age at diagnosis, and operative urgency
5 sites were excluded due to low completeness of the adjusting covariates and/or outcome

Surgical Complications

Funnel plots over the period 2017-2019 are shown below for colon (Figure 29) and rectal surgery (Figure 30) and then risk adjusted rates of overall complications (Figure 31). There are some outliers even when adjusted, however this needs to be interpreted with care. We do not have all colorectal cancer data for Australia and New Zealand. If the data was available for all operations the outliers observed here may not be outliers. Similarly, the data is self-reported and not validated. Some may be more conscientious about entering data have apparent higher complications rates than others. All surgeons should reflect on their practice as the surgeon is an independent risk factor for complications, and similarly all should ensure they are being thorough entering complications.

Figure 29. Surgical complications in colon cancer by hospital (unadjusted, 2017-2019)

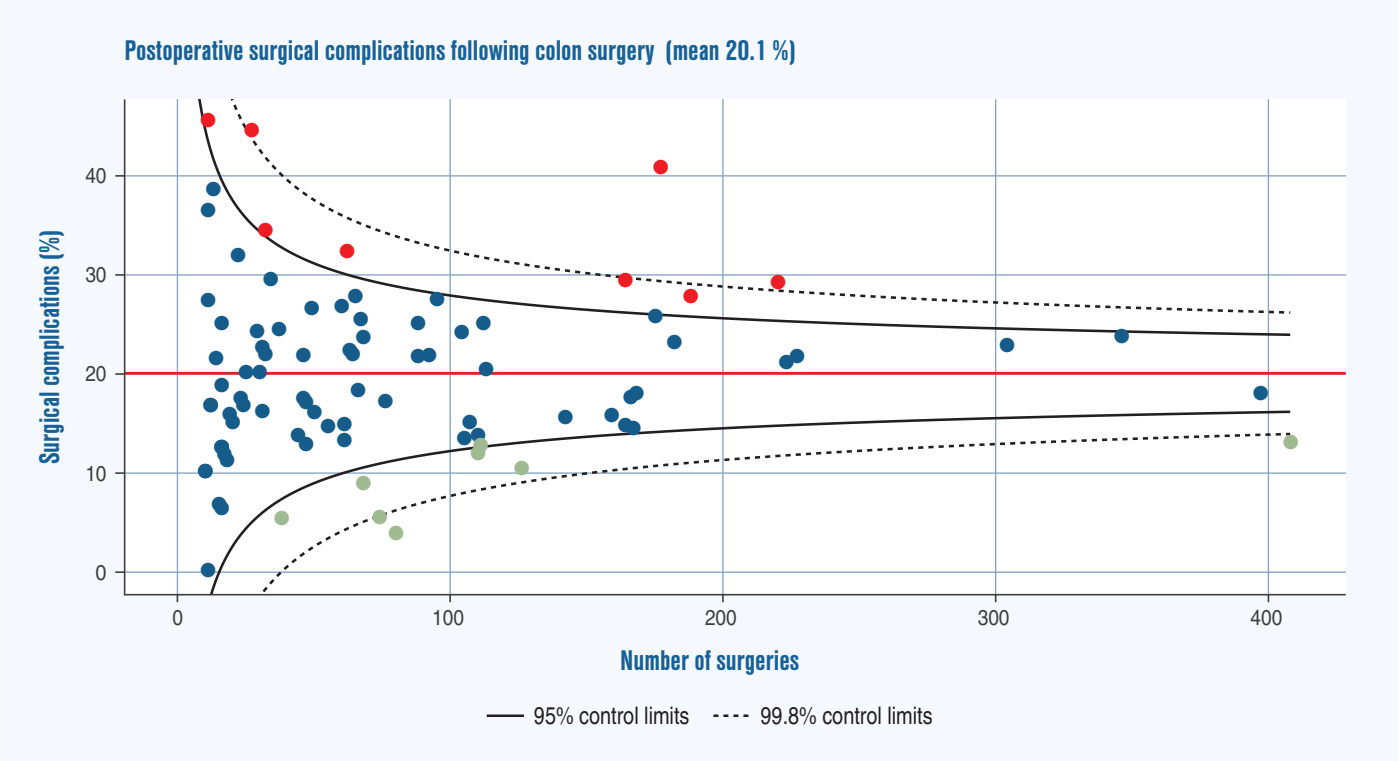


Figure 30. Surgical complications in rectal cancer by hospital (unadjusted, 2017-2019)

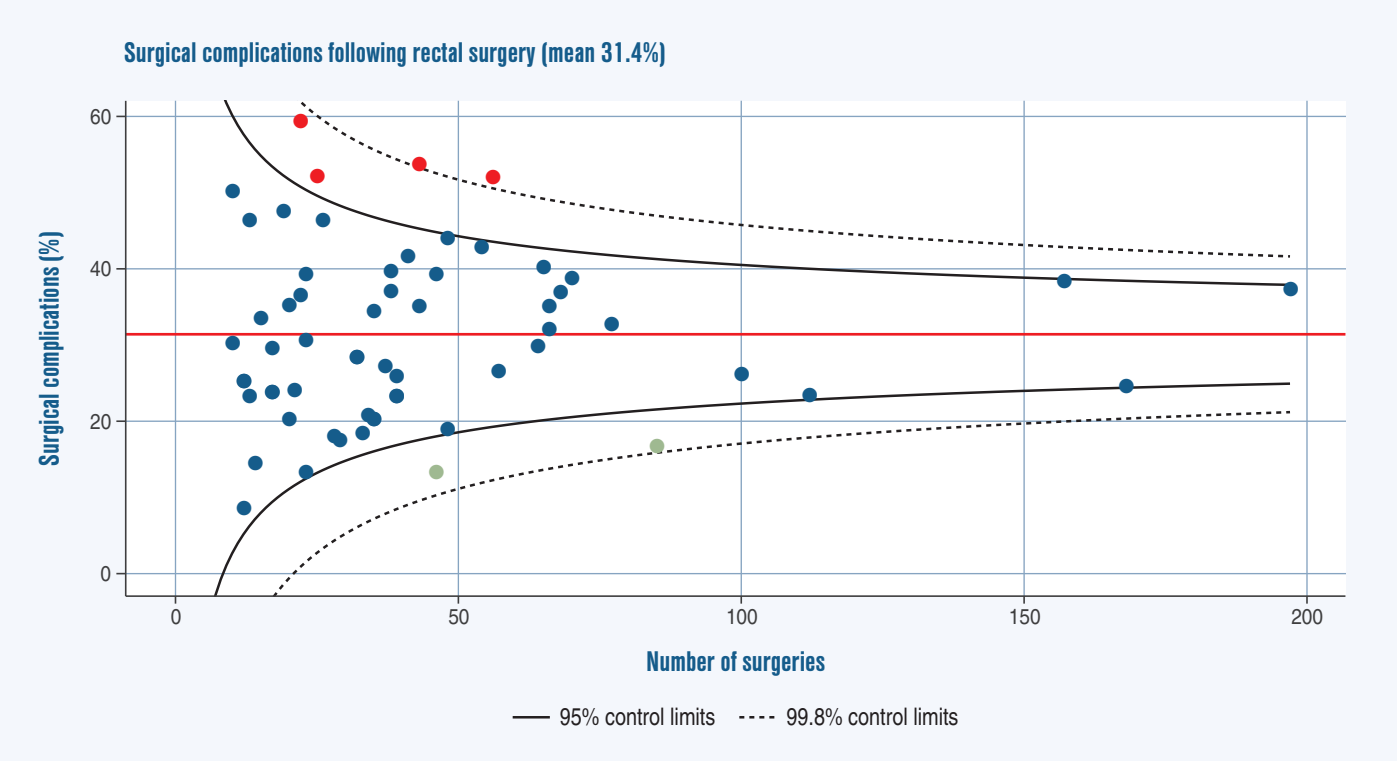
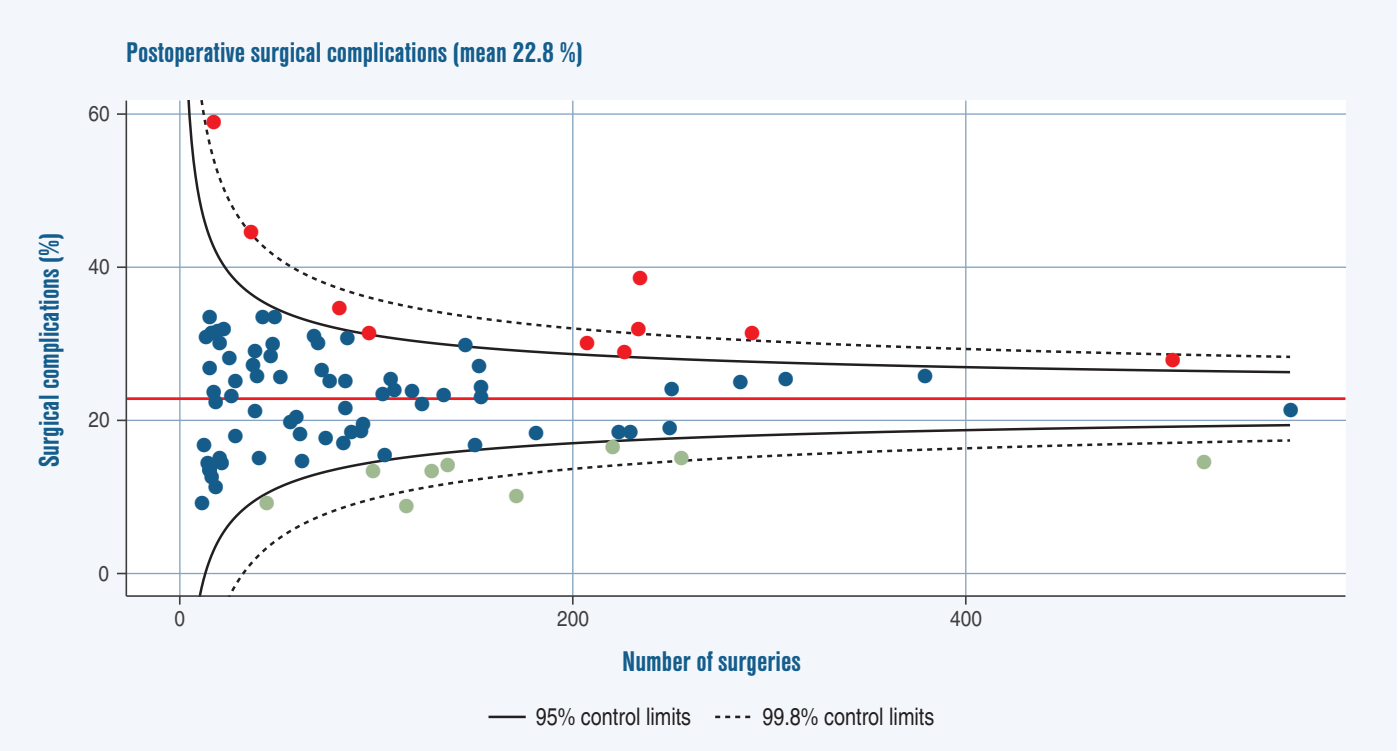


Figure 31. Risk-adjusted surgical complications for all BCCA treatment episodes (2017-2019)



Adjusted for cancer type, ASA score, sex, operative urgency, patient age at diagnosis, and overall stage
9 sites were excluded due to low completeness of the adjusting covariates and/or outcome

Anastomotic leak

Anastomotic leak is represented for the first time as a funnel plot in the BCCA annual report using data over the last 3 years (2017-2019), and it demonstrates an average anastomotic leak rate of 3.3% (Figure 32). This rate is low compared to international data which may reflect reporting bias (underreporting in the database)[9]. Anastomotic leak was risk adjusted by controlling for sex and cancer type (Figure 33), as identified by the likelihood ratio test.

Figure 32. Anastomotic leak (unadjusted, 2017-2019)

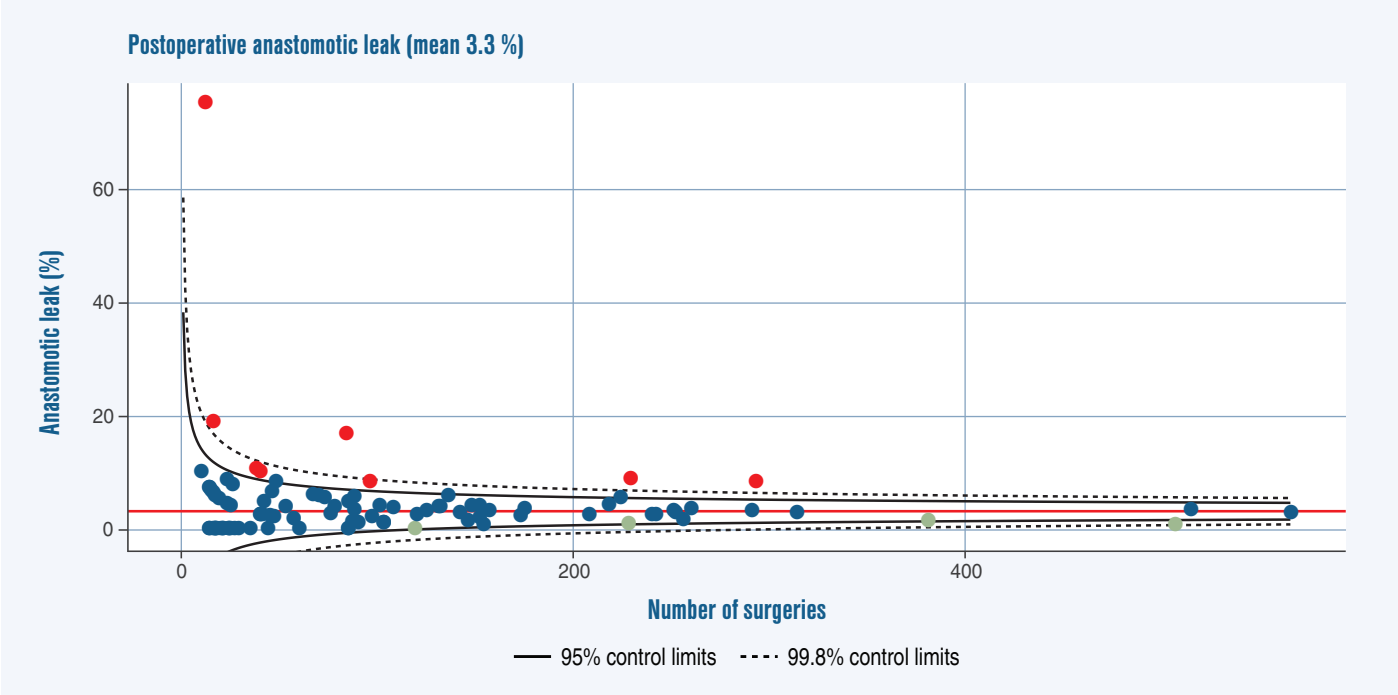
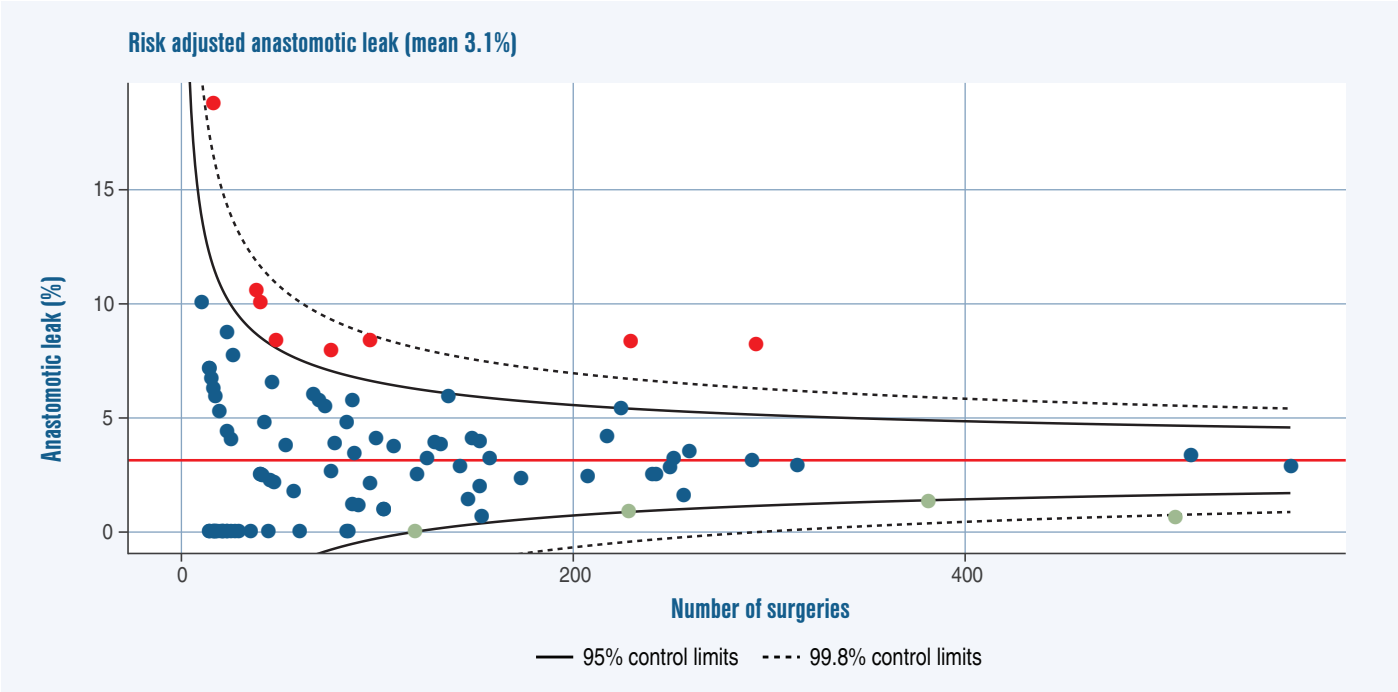


Figure 33. Risk-adjusted anastomotic leak (2017-2019)



Adjusted for sex, and cancer type
8 sites were excluded due to low completeness of the adjusting covariates and/or outcome

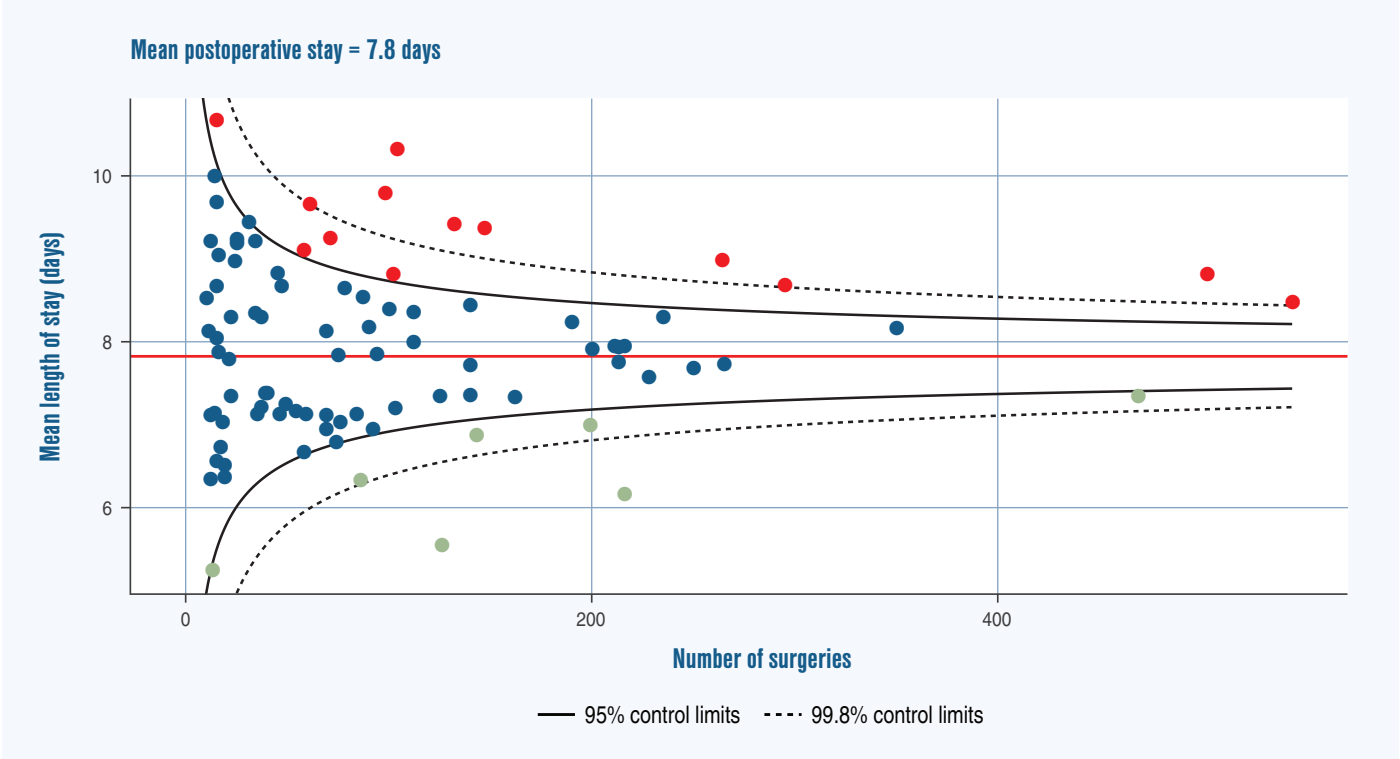
Length of hospital stay

Since 2017 the overall mean LOS has slowly decreased from 8.1 to 7.8 days (Figure 34).

The mean LOS of patients undergoing colonic surgery was 7 days and rectal surgery was 9 days. Higher stays were excluded from LOS analysis to avoid data skewing with the maximum reported LOS of 909 days.

It is likely that most contributing centres to the BCCA have an enhanced recovery program and the higher volume centres had a tendency to longer LOS. This is perhaps related to factors which the report does not adjust for such as complexity of cases and the proportion of 'out of area' patients. There are likely differences in discharge criteria (e.g. CRP measurements) and patient expectations (e.g. poorer socio-economic areas require more social support for discharge). Whilst earlier reports on enhanced recovery programs reported LOS as low as 2-3 days, in practice it would seem patients in most units are spending about a week in hospital.

Figure 34. Risk-adjusted length of hospital stay for all BCCA treatment episodes by hospital (2017-2019)



Adjusted for ASA score, cancer type, operative urgency, overall stage, patient age at diagnosis, and sex
11 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. A good lymph node harvest is presumed to allow accurate decision making and ultimately improve chances of survival. Several variables play a role in LNs yield such as 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 staging[10,11,12].

The mean number of nodes per colonic resection was 18.6 for the period 2017-2019 (Figure 35). There was little change in the overall number of lymph nodes harvested (mean of 19) when adjusted for overall stage, age at diagnosis, sex, operative urgency and ASA score (Figure 36). The data is symmetrically distributed with the majority of centres achieving a mean well above the recommended minimum LN harvest.

Figure 35. Mean number of lymph nodes examined in resected specimen by hospital (unadjusted, 2017 -2019)

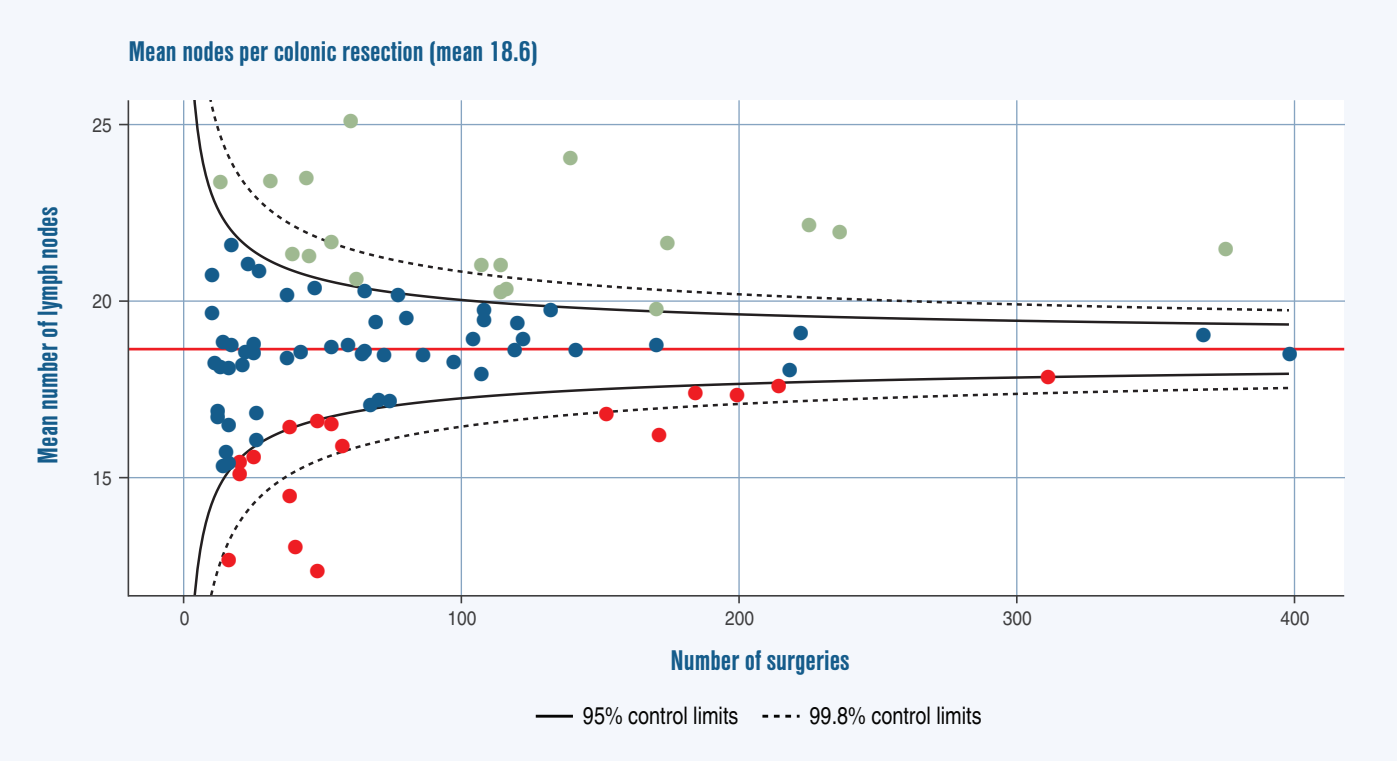
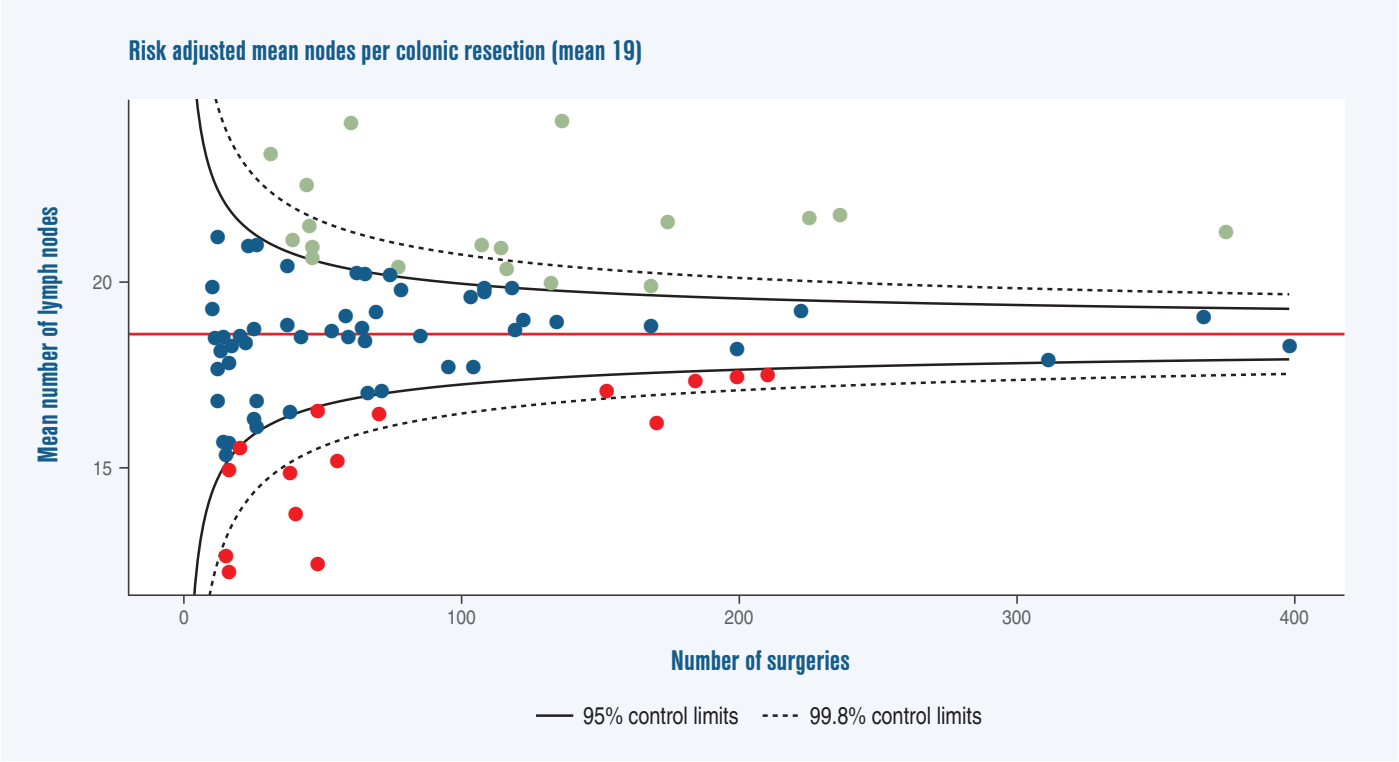


Figure 36. Risk-adjusted mean number of lymph nodes examined in resected specimen by hospital (2017 -2019)



Adjusted for overall stage, patient age at diagnosis, sex, operative urgency, and ASA score
3 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 positivity[13]. However, there are a range of surgical techniques, both well established and newer to facilitate anastomosis and minimise the requirement for permanent stoma. In the 2017-2019 cohort the mean end stoma formation rate was 22% (Figures 37 & 38) similar to that previously reported[1]. Abdominoperineal resection accounted for 19% of end stoma formation with remaining cases being Hartmann's procedures. These rates are consistent with international data[14].

Figure 37. Permanent end stoma rate by hospital for rectal cancer patients (unadjusted, 2017-2019)

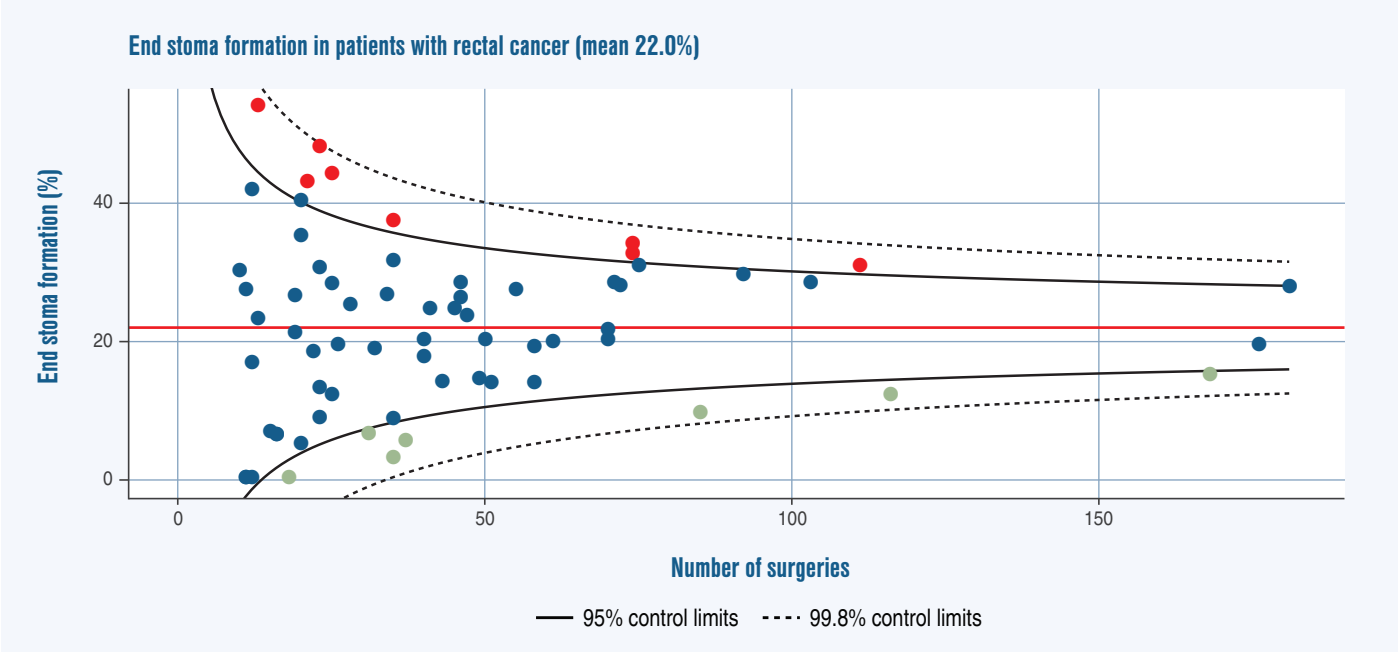
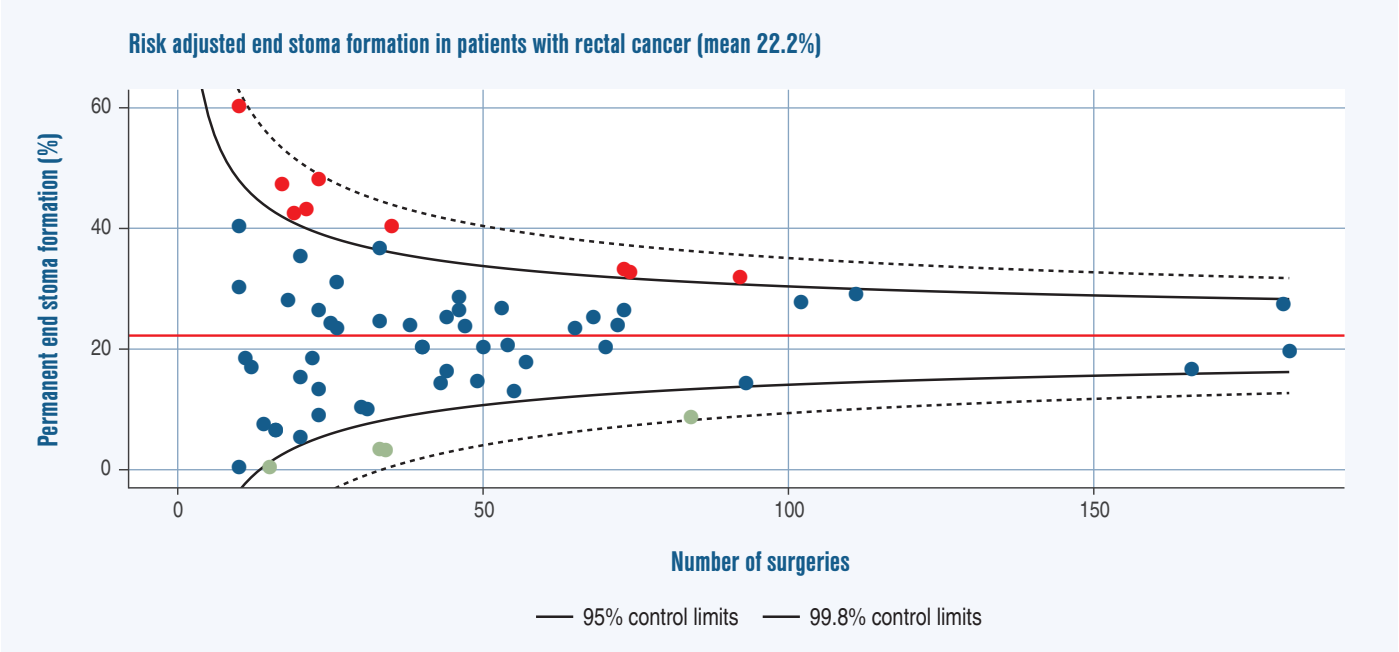


Figure 38. Risk-adjusted permanent end stoma rate by hospital for rectal cancer patients (2017-2019)



Adjusted for ASA score, overall stage, and patient age at diagnosis
3 sites were excluded due to low completeness of the adjusting covariates and/or outcome

Circumferential margin involvement

CRM is an important quality indicator for rectal cancer surgery. There is strong evidence that CRM involvement by tumour significantly increases the risk of local recurrence of the tumour. The CRM rate has progressively improved over the last decade with a lower rate of involved CRM (Figure 39). Though the aim is to minimize CRM involvement, a proportion of tumours will have an involved CRM due to the presenting extent of the tumour. Ideally this should be identified during staging on pelvic MRI and the patient receive preoperative neoadjuvant chemoradiotherapy which may down stage the tumour, reducing the CRM involvement, and potentially reduce the risk of local recurrence.

CRM is represented for the first time as a funnel plot in the BCCA annual report using data over the last 3 years (2017-2019) and it had an average overall CRM positive rate of 6.7% (Figure 40). CRM was risk adjusted by controlling for overall stage and operative urgency (Figure 41), as identified by the likelihood ratio test.

The data for 2019 demonstrates an average 4% CRM positive rate in patients who have not received neoadjuvant therapy and 8% CRM positive rate in patients who received neoadjuvant therapy, implying that the patients selected for neoadjuvant therapy are the higher risk patients with more locally extensive tumours (Table 10).

Figure 39. Circumferential margin involvement over time in rectal cancer

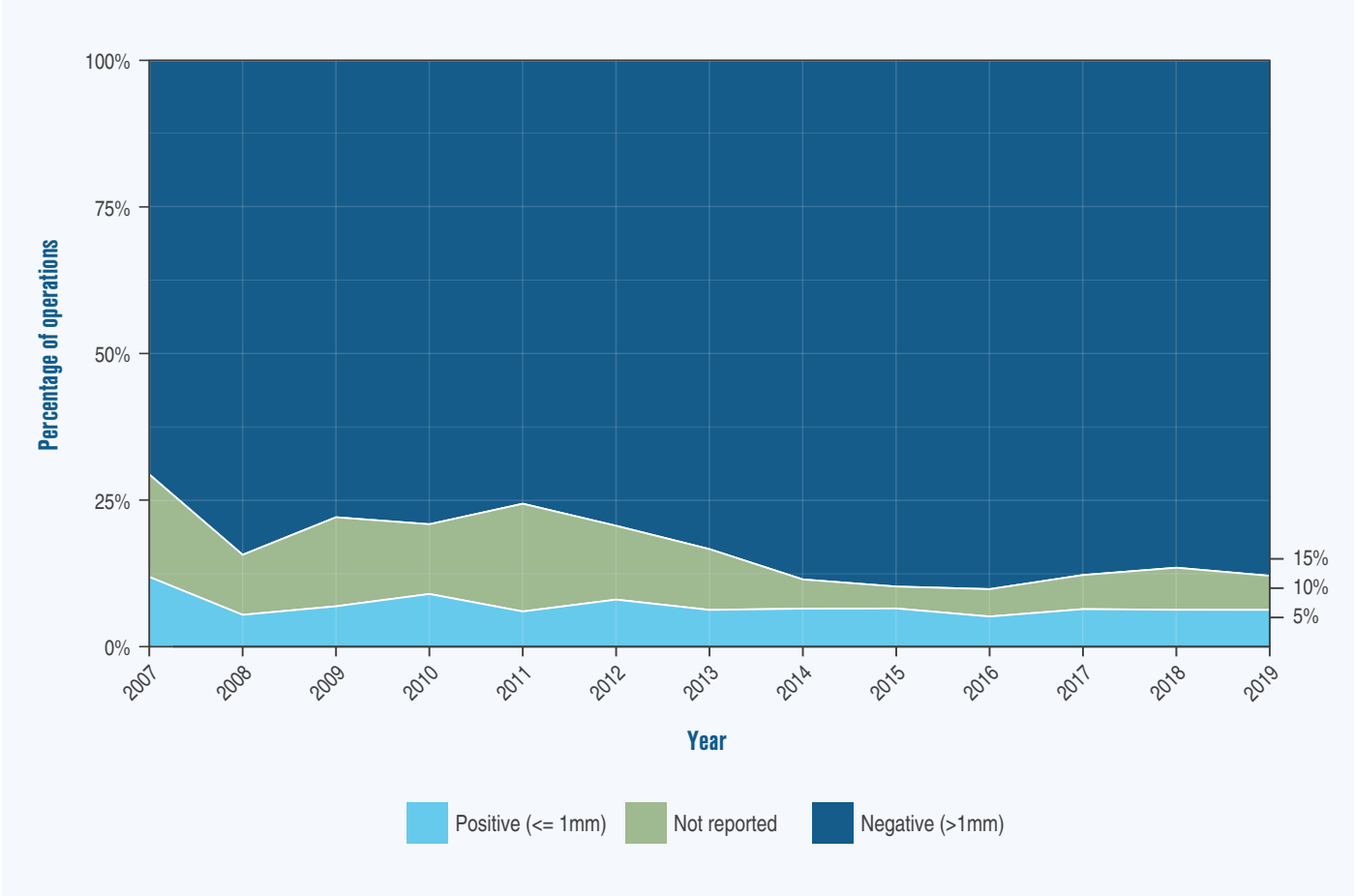


Figure 40. Postoperative positive circumferential margin involvement (unadjusted, 2017 -2019)

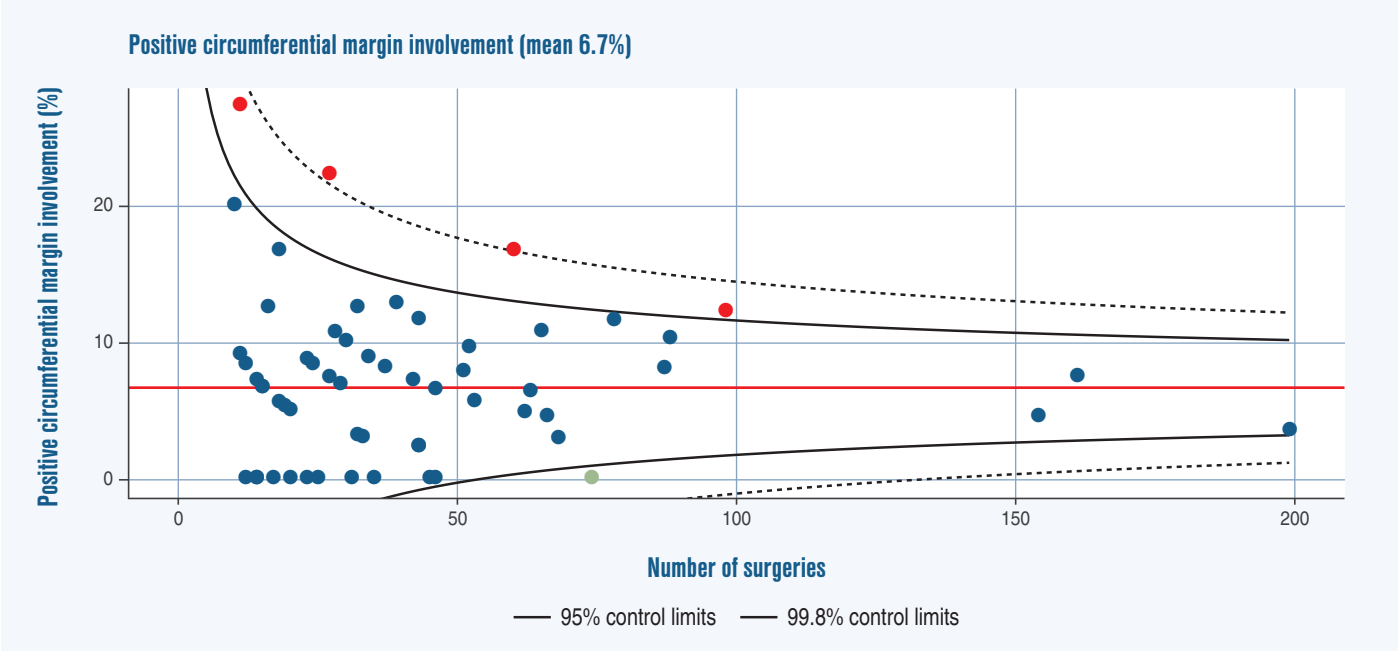
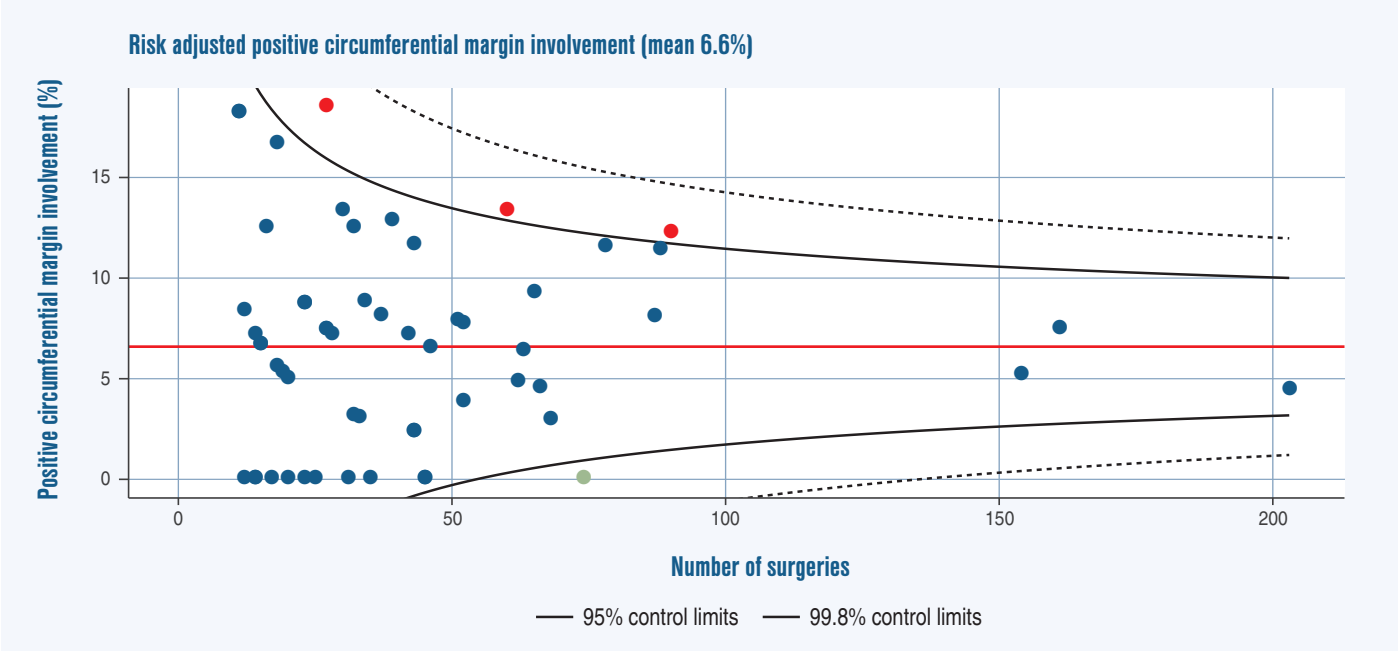


Figure 41. Risk-adjusted postoperative positive circumferential margin involvement (2017 -2019)



Adjusted for overall stage, and operative urgency
5 sites were excluded due to low completeness of the adjusting covariates and/or outcome

Table 10. Use of neoadjuvant therapy and circumferential margin involvement (2019)

	Neoadjuvant therapy not received		Neoadjuvant therapy received	
	Count	Percent	Count	Percent
Negative (> 1 mm)	345	89%	379	87%
Not reported	29	7%	20	5%
Positive (<= 1mm)	14	4%	36	8%
Total	388	100%	435	100%

7. RESEARCH, PUBLICATIONS AND PRESENTATIONS (2019)

Published research projects:

Publications:

Kong, J.C., Guerra, G.R., Lee, A., Warrier, S. k., Lynch, C., Heriot, A.G. (2019). Long-term Outcomes of Locally Advanced Rectal Cancer after neoadjuvant chemoradiotherapy: A Bi-national Colorectal Cancer Audit study. World Journal of Colorectal Surgery 8 (3) 74-78. DOI: 10.4103/WJCS.WJCS_16_19.

Bedrikovetski, S., Dudi-Venkata. N.N., Kroon, H.M., Moore, J.W., M.D., Hunter, R.A., Sammour, T. (2020). Outcomes of Minimally Invasive Versus Open Proctectomy for Rectal Cancer: A propensity-matched analysis of Binational Colorectal Cancer Audit data. Diseases of the Colon & Rectum. doi: 10.1097/DCR.0000000000001654.

Cooper, E.A, Buxey, K.N., Maslen,B.J., Muhlmann, M. (2020). Retrospective analysis of a Binational Colorectal Cancer Audit to characterize stage II colon cancer patients who were offered adjuvant chemotherapy. ANZ Journal of Surgery. doi: 10.1111/ans.15735.

Van Harten, M.J., Greenwood, E.B., Bedrikovetski, S., Dudi-Venkata, N.N., Hunter, R.A., Kroon, H.M., Sammour, T (2020). Minimally invasive surgery in elderly patients with rectal cancer: An analysis of the Binational Colorectal Cancer Audit (BCCA). European Journal of Surgical Oncology. doi.org/10.1016/j.ejso.2020.03.224

Podium Presentation:

Ahern, S., Taylor, S., Salimi, F., Earnest, A., Heriot, A.G.) Review of postoperative outcomes from the Binational Colorectal Cancer Audit on screened versus non-screened patients. 2019 NHMRC Symposium on Research Translation.

Poster presentations:

Wilkins, S., Oliva, K., Chowdhury, E., Ruggiero, B., Bennett, A., Andrews, E., Dent, O., Chapuis, P., Platell, C., Reid, C., McMurrick, P. (RACS 2019, May). Validation of the ACPGBI risk prediction model for 30-day mortality after surgery for colorectal cancer: does it apply in Australia? ANZ Journal of Surgery 89 (S1):CR043P, 32.

Wilkins, S., Oliva, K., Chowdhury, E., Ruggiero, B., Bennett, A., Andrews, E., Dent, O., Chapuis, P., Platell, C., Reid, C., McMurrick, P. (Cabrini Research Week 2019, October) Australian recalibration of risk prediction models for 30-day mortality after surgery for colorectal cancer.

Bedrikovetski, S., Dudi-Venkata. N., Kroon, H., Hunter, R., Sammour, T. (RACS 2019, May). Outcomes of minimally invasive versus open total mesorectal excision: a propensity matched analysis of prospective data from the Binational Colorectal Cancer Audit. ANZ Journal of Surgery 89 (S1):GS093P, 78.

Ng, C., Kong, J., Chakraborty, J., Gourlas, P., Slack, T., Lutton, N., Morris, B., Gillespie, C. (RACS 2019, May). The rate of anastomotic leak for right hemicolectomy during surgical training. ANZ Journal of Surgery 89 (S1):CR013, 25.

Kong, J.C., Ng, C.W., Chakraborty, J., Gourlas, P., Slack, T., Gillespie, C., Lutton, N., Morris, B. (RACS 2019, May). The incidence of colorectal cancer in younger adults using the Binational Colorectal Cancer Audit database. ANZ Journal of Surgery 89 (S1):GS126P, 86.

Smith, N., Kong, J.C., McCormick,C, Lynch, C., Heriot, A., Warrier, S. Predictive factors and clinical outcomes for non-restorative rectal cancer surgery: a binational registry study. Diseases of the Colon and Rectum 62 (6): P233, e213.

Zhu, K.J., Kong, J.C., Bell, S., Warrier, S. (ASCRS 2019, June). Trends in uptake of minimally invasive surgery for colorectal cancer resection: a binational perspective. Diseases of the Colon and Rectum 62 (6) P195, e195.

Currently Approved Projects:

1. Predicting total mesorectal excision difficulty using the Binational Colorectal Cancer Audit database.

Investigator: Mr Joseph Kong, Professor Alexander Heriot, Alison Fraser, Peter MacCallum Cancer

Status: Complete.

Publication: Submitted for publication

The aim of this project was to identify predictors of surgical difficulties as a platform to stratify patients to MIS.

2. Markers predictive of advanced stage of colorectal cancer at the time of surgery.

Investigators: Dr Ryash Vather, Dr Isabella Mor, Dr Ross Warner, The Tweed and John Flynn Hospitals.

Status: Complete.

Publication: Submitted for publication.

The objectives of this project is to provide baseline information on the stage at which colorectal cancers present in Australasia; identify patient, demographic and tumour factors that predict more advanced stages of cancers at presentation; and to determine the bearing of advanced colorectal cancer on short-term post-operative outcomes.

3. Review of postoperative outcomes from the Binational Colorectal Cancer Audit on screened versus non-screened patients

Investigators: Professor Susannah Ahern, Dr Sasha Taylor, Monash University.

Status: Complete. Podium presentation at the 2019 NHMRC Symposium on Research Translation.

Publication: Submitted for publication.

The objective of this project is to compare the post-operative outcomes of patients diagnosed with colon and rectal cancer who participated in the Australian National Bowel Cancer Screening Program (NBCSP) versus those who were diagnosed through other means, and to consider patient and cancer characteristics that may impact on these outcomes.

4. The effect of BMI on the LN harvest yield in the four different colorectal cancer resection approaches: review of BCCA database.

Investigators: Associate Professor Christopher Byrne, Dr Ju Yong Cheong, Royal Prince Alfred Hospital.

Status: Approved. Accepted for podium presentation at RACS Annual Scientific Congress (ASC) 2020, Melbourne, Australia.

The aim of this study was to determine one specific aspect of oncological resection quality, the lymph node harvesting. The study aimed to determine whether open, laparoscopic or robotic approaches have superior lymph node harvesting, and how this differs in with patient BMI.

5. Short-term postoperative and oncological outcomes for open and minimally invasive rectal resections through total mesorectal excision (TME) in elderly: analysis of the binational colorectal cancer audit (BCCA) data.

Investigators: Associate Professor Tarik Sammour, Dr Hidde Kroon, Royal Adelaide Hospital.

Status: Complete. Accepted for poster presentation at RACS ASC 2020, Melbourne, Australia.

Publication: Accepted for publication by the European Journal of Surgical Oncology.

The objective of this project is to analyse a large cohort of patients as recorded in the BCCA database to identify differences in short-term postoperative and oncological outcomes in elderly patients following MIS or open rectal cancer surgery.

6. Predictors for Stoma Formation in Rectal Cancer Surgery in Australia and New Zealand: Analysis of the Binational Colorectal Cancer Audit

Investigators: Associate Professor Tarik Sammour, Dr Hidde Kroon, Royal Adelaide Hospital.

Status: Complete . Accepted for poster presentation at RACS ASC 2020, Melbourne, Australia.

Publication: Submitted for publication.

The objective of this project is to analyse the BCCA data on rectal cancer surgery to identify the current practice of stoma formation in Australia and New Zealand by comparing short-term postoperative outcomes for the different surgical options and identifying preoperative and intraoperative predictors for stoma formation.

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

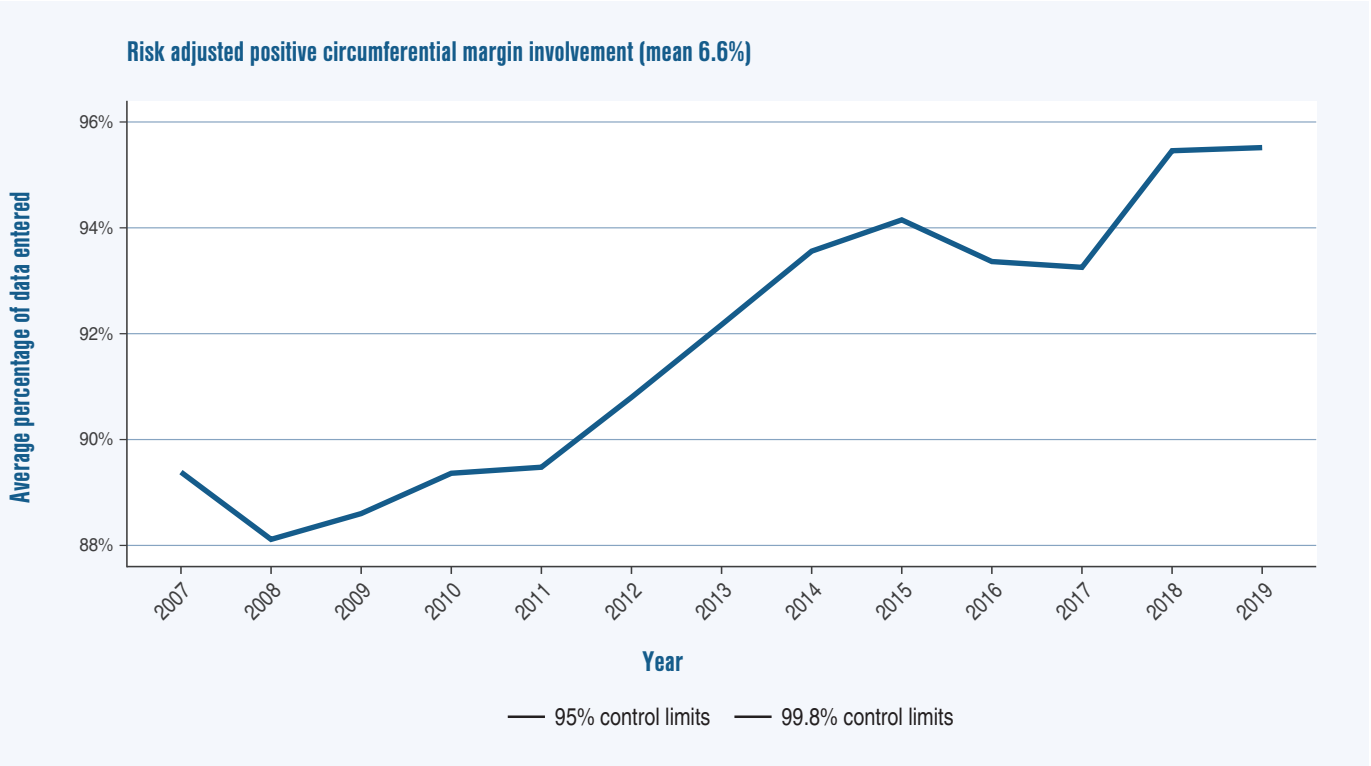
8. QUALITY ASSURANCE

Data completion

There is a spectrum of data completeness over time and on review of 29 key data elements we observe that data completion has improved over time. We believe the online system (launched in February 2010 for Colorectal Cancer Audit (CRC Audit) and in December 2013 for BCCA) has facilitated improved data completeness as evidenced in Figure 42. Due to the nature of data being updated retrospectively we see a dip in data completion in 2016 and slight fluctuation for the most recent period.

BCCA recommends for participating sites to undergo regular check of data submitted. This can be done by cross-checking site data extracts every few weeks at MDTs.

Figure 42. Mean percentage of data completion over time across 29 key BCCA Items



The 29 key data elements are: 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.

9. FUTURE DIRECTIONS

In 2019/20 several projects were implemented to further expand and improve the BCCA Database. Monash Helix were contracted to update and modernise the database fields and underlying infrastructure, with plans to upgrade reporting modules and enhance data uploading. This work will continue going forward. Continuing Professional Development (CPD) credit has been automated for participating clinicians through the RACS CPD portal. An updated website has been launched, with plans to further develop functionality including easier data access for participating clinicians. Additional funding sources were secured, though this remains a challenge for the registry going forward.

In 2020, further work is planned to credit participating clinicians and hospitals, expand and facilitate registry research output, add Patient Reported Outcome Measures (PROMs) modules, maximise case capture and develop data linkage projects.

APPENDIX A – REGISTRY PERSONNEL

BCCA Steering Committee membership 2019

Mr Andrew Hunter (Chair)
Dr Damien Peterson (CSSANZ)
Mr Ian Faragher (Colon and Rectal Surgery Section, RACS)
Mr Andrew Hughes (GSA) since early 2018
Mr Grant Coulter (NZAGS)
Professor John Zalcberg (Interested Clinician)
Mr John Stubbs (Consumer Representative)
Professor Alexander Heriot (Chair BCCA Operations Committee) until October 2019
Dr Philip Smart (Chair BCCA Operations Committee) since October 2019

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 2019

Professor Alexander Heriot (Victoria)(Chair) until October 2019
Dr Philip Smart (Victoria)(Chair) since October 2019
Professor Christopher Reid (DEPM)
Ms Angela Brennan (DEPM)
Professor Susannah Ahern (DEPM)
Professor Paul McMurrick (Victoria) (CRC Audit)
Associate Professor Chris Byrne (New South Wales)
Dr Elizabeth Murphy (South Australia)
Professor Cameron Platell (Western Australia)
Associate Professor Mark Thompson-Fawcett (New Zealand)
Dr Sze-Lin Peng (New Zealand)
Dr Anthony Ciccocioppo (South Australia)
Dr Greg Nolan since February 2019 (Queensland)
Dr Aymen Al-Timimi (Queensland) since March 2019
Mr John Lengyel (New Zealand) since April 2019

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), surgeons who regularly undertake surgery for colorectal cancer providing a broad geographic binational representation and other co-opted members as required.

APPENDIX B –GLOSSARY

AIHW – Australian Institute of Health and Welfare

AJCC – American Joint Committee on Cancer

APR – Abdominoperineal Resection

ASA – American Society of Anaesthesiologists Classification

ASC – Annual Scientific Congress

ASCRS - The American Society of Colon and Rectal Surgeons Annual Scientific Meeting

BCCA – Binational Colorectal Cancer Audit

CME – Continuing Medical Education

CPD – Continuing Professional Development

CRM – Circumferential Resection Margin

CRP – C-Reactive Protein

CRC Audit – Colorectal Cancer Audit (Extended dataset managed by Associate 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

PROMs – Patient Reported Outcome Measures

RACS – Royal Australasian College of Surgeons

SD – Standard Deviation

SSI - surgical site infection

TAMIS – Transanal Minimally Invasive Surgery

TaTME – Transanal Total Mesorectal Excision

TEMS – Transanal Endoscopic Micro-surgery

TE – Treatment Episodes

TNM – is a Tumour staging system

APPENDIX C – BCCA PARTICIPATING HOSPITALS

State	Hospital
NSW	Bankstown Hospital
NSW	Calvary Riverina
NSW	Chris O'Brien Lifehouse
NSW	Concord Repatriation General Hospital
NSW	Gosford Private Hospital
NSW	Gosford Public Hospital
NSW	Hurstville Private Hospital
NSW	John Hunter Hospital
NSW	Kareena Private 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 Public Hospital
NSW	Royal Prince Alfred Hospital
NSW	St George Hospital
NSW	St Vincent's Hospital Lismore
NSW	The Tweed Hospital
NSW	Wagga Wagga Base Hospital
NSW	Westmead Public Hospital
NSW	Wollongong Hospital
NT	Royal Darwin 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	North Shore Hospital
NZ	Rotorua Hospital
NZ	St George's Hospital
NZ	Taranaki Base Hospital
NZ	Tauranga Hospital
NZ	Timaru Hospital
NZ	Wanganui Hospital
NZ	Whangarei Hospital
QLD	Allamanda Private Hospital
QLD	Cairns Base Hospital
QLD	Gold Coast University Hospital
QLD	Ipswich Hospital
QLD	John Flynn Private Hospital
QLD	Noosa Hospital
QLD	North West Private Hospital
QLD	Pindara Private Hospital
QLD	Princess Alexandra Hospital
QLD	QEII Jubilee Hospital
QLD	Robina Hospital
QLD	Royal Brisbane and Women's Hospital
QLD	Sunnybank Private Hospital
QLD	Sunshine Coast University Hospital
QLD	The Sunshine Coast Private Hospital
QLD	The Wesley Hospital
SA	Calvary North Adelaide
SA	Calvary Wakefield
SA	Flinders Medical Centre
SA	Lyell McEwin Hospital
SA	Royal Adelaide Hospital
SA	St Andrew's Hospital
SA	The Queen Elizabeth Hospital
TAS	Calvary Lenah Valley
TAS	Hobart Private Hospital
TAS	Launceston General Hospital
VIC	Alfred Hospital
VIC	Angliss Hospital
VIC	Austin Hospital
VIC	Bairnsdale Regional Health Service
VIC	Ballarat Base Hospital
VIC	Box Hill Hospital
VIC	Cabrini Hospital
VIC	Dandenong Hospital
VIC	Epworth Eastern Hospital
VIC	Epworth Freemasons Hospital
VIC	Epworth Geelong Hospital
VIC	Epworth Richmond Hospital
VIC	Footscray Hospital
VIC	Frankston Hospital
VIC	Maroondah Hospital
VIC	Peter MacCallum Cancer Centre
VIC	St John of God Ballarat Hospital
VIC	St Vincent's Hospital
VIC	The Northern Hospital
VIC	The Royal Melbourne Hospital
VIC	Warringal Private Hospital
WA	Fiona Stanley Hospital
WA	Hollywood Private Hospital
WA	St John of God Murdoch
WA	St John of God Subiaco

APPENDIX D – BCCA PARTICIPATING CLINICIANS

Sarah Abbott
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Semisi Aiono
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Nagham Al-Mozany
Aymen Al-timimi
Vinna An
Janet Ansell
Thomas Arthur
Ratna Aseervatham
Andrew Audeau
Alisha Azmir
Richard Babor
Patrick Bade
Vikram Balakrishnan
Hasitha Balasuriya
Walid Barto
Nigel Barwood
Cori Behrenbruch
Stephen Bell
Tilan Beneragama
Pia Bernardi
Daniel Bills
David Bird
David Blomberg
Les Bokey
Richard Bradbury
Ian Bradford
Tim Bright
Katherine Broughton
Richard Brouwer
Andrew Bui
Adele Burgess
Kenneth Buxey
Chris Byrne
Peter Carne
John Cartmill
Joy Chakraborty
Raaj Chandra
Frank Chen
John Chen
Anthony Cheng
Ju Yong Cheong
Stephanie Chetrit
Henry Cheung
Grace Chew
Simon Chew
Heng-Chin Chiam
Martin Chin
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Jin Hee Cho
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Anthony Ciccocioppo
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Phil Harris
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Ian Hayes
Julian Hayes
Nigel Henderson
Alexander Heriot
Peter Hewett
Angus Hibberd
Henry Hicks
Brian Hodgkins
Russell Hodgson
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Mike Hunter
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Sanjay Kariappa
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Anil Keshava
Robert Knox
Karl Kodeda
Cherry Koh
Joe Kong
Daniel Kozman
Mathew Kozman
Kelvin Kwok
Stephen Kyle
Francis Lam
Ray Lancashire
John Lancaster
Michael Landmann
Yee Chen Lau
Chris Lauder
Matthew Lawrence
Peter Lee
Matthew Leeman
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John Lengyel
Mark Lewis
Jennifer Liang
James Lim
David Lloyd
Kenneth Loon
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Tarik Sammour
Mark Sanders
Chaminda Saranasuriya
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David Schoemaker
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Prashant Sharma
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Parry Singh
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Stewart Skinner
Tim Slack
Philip Smart
Michelle Smigielski
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Julian Speight
Luigi Sposato
Havish Srinath
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Bree Stephensen
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Bruce Stewart
Peter Stewart
Andrew Still
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Ashish Taneja
Stephen Tang
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Yeng Kwang Tay
David Taylor
Elitha Taylor
William Teoh
Michelle Thomas
Mark Thompson-Fawcett
James Toh
Darren Tonkin
Eric Torey
Catherine Turner
Hamish Urquhart
Rene Van Den Bosch
Raphael Varghese
Carolyn Vasey
Ryash Vather
Michael Von Papen
Chris Wakeman
Marina Wallace
Michael Warner
Ross Warner
Satish Warrier
David Wattchow
Maree Weston
Anna Wilkes
Kasmira Wilson
Robert Winn
Alex Wong
Shing Wong
John Woodfield
Rod Woods
Phil Worley
Deborah Wright
Marina Yeow
Justin Yeung
Jonathan Yong
Christopher Young
Assad Zahid
Katherine Zhu

APPENDIX E – LIST OF FIGURES

APPENDIX F – LIST OF TABLES

APPENDIX G – REFERENCES

1. Dr Hayat Dagher, Associate Professor Susannah Ahern, Dr Farhad Salimi, Associate Professor Arul Earnest, Associate Professor Chris Byrne, Dr Elizabeth Murphy, Mr Mark Thompson-Fawcett, Associate Professor Paul McMurrick, Professor Cameron Platell, Ms Angela Brennan, Professor Chris Reid, Dr Philip Smart, Ms Sze-Lin Peng, Dr Aymen Al- Timimi, Professor Pierre Chapuis, Mr Mark Doudle, Dr Greg Nolan, Dr Anthony Ciccocioppo, Professor Alexander Heriot. The Binational Colorectal Cancer Audit Report 2019, May 2019, pages 58.

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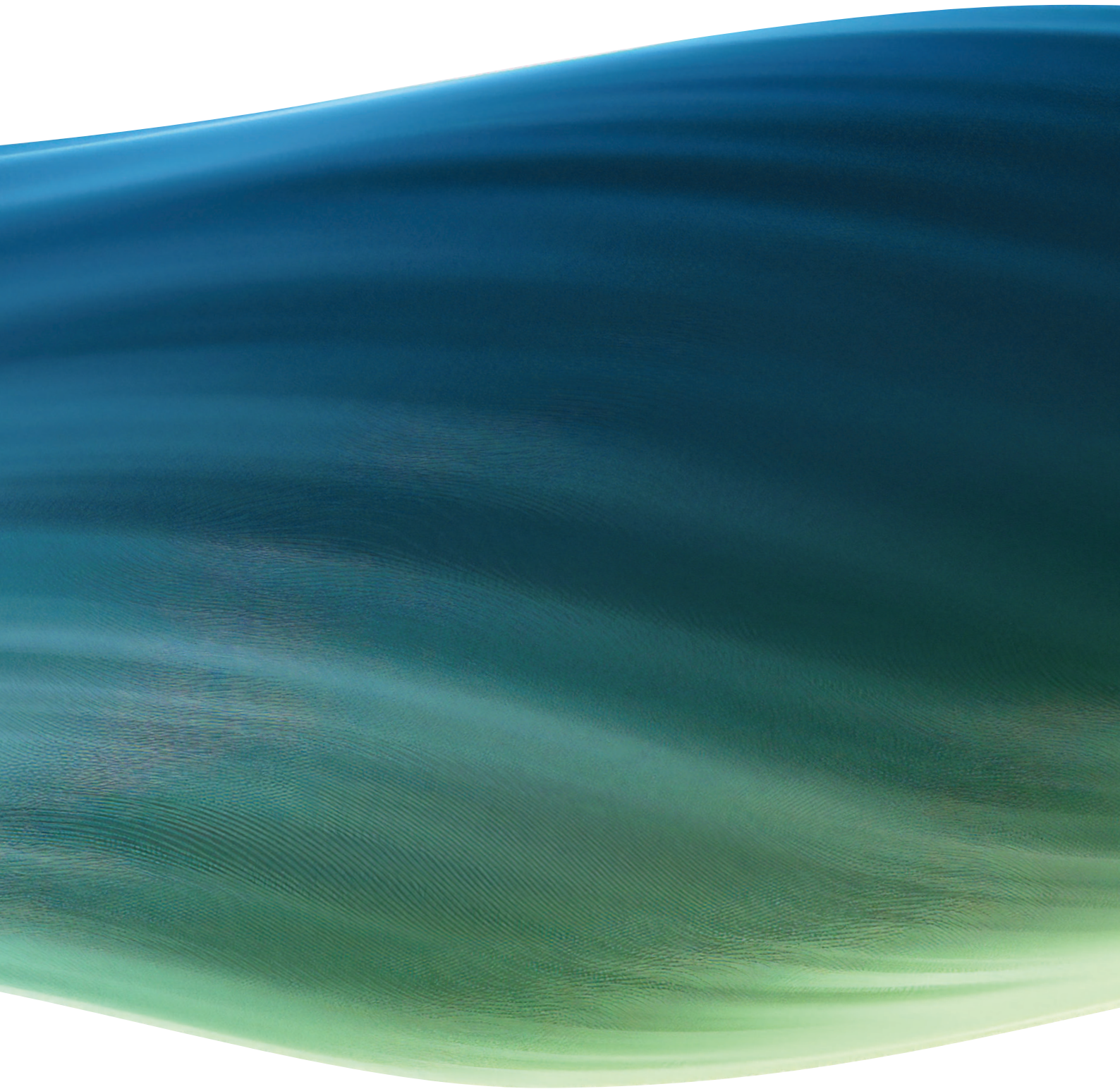

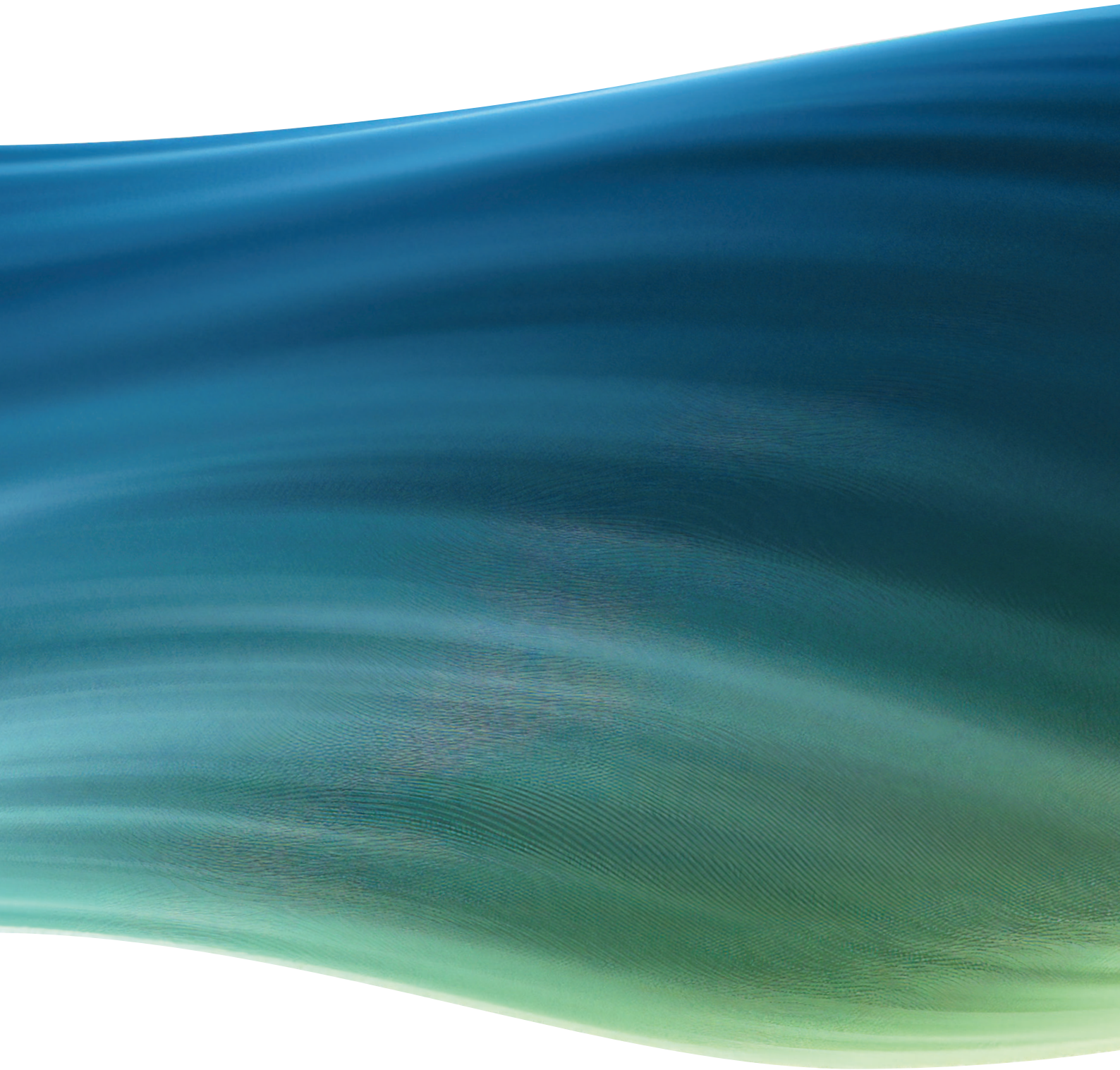

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