2022

Cancer Surgery Quality in Manitoba

CancerCare Manitoba
ActionCancerManitoba

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A Message from Dr. Sri Navaratnam, President and CEO, CancerCare Manitoba

CancerCare Manitoba (CCMB) is the provincial cancer authority responsible for setting strategic priorities and long-term planning towards cancer control in our province, as outlined in the Roadmap to Cancer Control for Manitoba. CancerCare Manitoba provides clinical services from screening and early detection to treatment to supportive and end-of-life care. This is achieved through careful planning for the delivery of excellence in all cancer services throughout Manitoba, working in partnership with our health partners.

CancerCare Manitoba also holds the responsibility, as the provincial cancer authority, to develop cancer standards for the province, to ensure that individuals with cancer, regardless of where they live in the province, will receive the same standard of treatment in a timely manner. This includes cancer surgery standards to ensure standardized quality cancer surgery for all Manitobans.

Surgery plays an important role in the cancer journey. Approximately one-half of Manitobans diagnosed with cancer undergo a surgical procedure at some point during their journey. Thus, developing standards for quality cancer surgery is a critical piece towards cancer control. 'Increasing compliance with cancer surgical standards throughout Manitoba' is one of the objectives of Priority 3 of the Roadmap which calls for evidence-based, high-quality cancer services.

This report focuses on the surgical quality for breast, colorectal, lung, prostate, and ovarian cancer from 2015 to 2020. It was prepared under the guidance of CCMB's disease site leads and will provide feedback directly to surgeons to achieve the goal of standardized quality cancer surgery in Manitoba. This report is also aligned with the Canadian Partnership Against Cancer's Mobilizing Evidence for Surgical Quality Improvement project, which worked towards national surgical quality improvement for all cancer patients across the country.

As the President and CEO of CancerCare Manitoba, I am very pleased with the progress made by the Surgical Oncology group at CancerCare Manitoba in building relationships and providing education to surgeons in all our health regions. I express my appreciation and thanks to Dr. Pamela Hebbard, Lead for Surgical Oncology at CancerCare Manitoba, for her leadership, all disease site lead surgeons who championed this assessment, and the scientists and epidemiologists who supported this project. Together, we are very pleased to present this second Cancer Surgery Quality Report.

CancerCare Manitoba is committed to its Vision of "A world free of cancer." Through our continued efforts in cancer surgery assessment, recording data, building relationships and providing education towards standardized cancer surgery quality, we will be able to provide the best cancer services to all Manitobans toward achieving this vision.

Sincerely,

Dr. Sri Navaratnam MBBS PhD FRCPC
President and Chief Executive Officer, CancerCare Manitoba
Professor, Department of Internal Medicine, Rady Faculty of Health Sciences, University of Manitoba

A Message from Dr. Pamela Hebbard, Department of Surgical Oncology

It is my pleasure to be a part of the team reviewing cancer surgery quality in Manitoba. I would like to extend my gratitude to the many epidemiologists, health services scientists, and surgeon champions who have brought their skill together to create a high quality and pertinent report.

Cancer surgery touches the lives of many Manitobans and spans centres across the entire province. It is the most diverse part of cancer care delivery, happening day in and day out in over a dozen hospitals in all health regions of the province by a variety of surgical specialties. This decentralized model of care is essential to the health of Manitobans, making critical cancer and non-cancer surgery available in both small and large communities. It is also a feat for us to track and oversee such a complex and busy system.

This report is a crucial look at where and how cancer surgery happens – who is doing it, who is receiving it, and how good we are at delivering it. No healthcare system can be perfect, but the best ones examine their patients' needs and the system's quality. We must endeavor to provide continual improvement and refinement of healthcare delivery for all Manitobans.

The reader will take note that no surgical system is without patient complications. Thankfully, most are minor and easily treated. As well, most are inherent in the technical risk of the procedure, not a fault or negligence of the surgeon or system. Still, we do not know what we can improve upon if we do not first measure our status. The data presented here are without judgment but can be used by surgeons and healthcare administrators to look at provincial performance against formal and informal standards. Equally, the volume and complexity of surgery measured here can be used by administrators to plan for appropriate cancer surgery capacity in the years ahead.

Finally, I want to thank the many surgeons who are on the front lines, day after day, caring for patients. Your dedication and passion are the driving force in our healthcare system. Your skill and empathy have touched many more patients than we could ever measure.

Sincerely,

Pamela Hebbard MD FRCSC
Lead, Surgical Oncology, CancerCare Manitoba and Provincial Cancer Surgery Network, Shared Health Manitoba

About CancerCare Manitoba

CancerCare Manitoba (CCMB) is the provincially mandated cancer agency tasked with providing cancer services to the people of Manitoba. CCMB is responsible for providing care, treatment, and support across the entire cancer service spectrum – from prevention, early detection, diagnosis, treatment and care, and palliation or end of life care.

With the valued support of stakeholders such as Manitoba Health, CCMB works and collaborates closely with partners to bring the best cancer care to Manitobans. Our partners include Manitoba's regional health authorities, the University of Manitoba's College of Medicine in the Faculty of Health Sciences, Shared Health Services, and funding agencies, in particular the CancerCare Manitoba Foundation and the Canadian Partnership Against Cancer.

CCMB has two locations in Winnipeg, located at the Health Sciences Centre and St. Boniface General Hospital. Through partnerships with the Winnipeg Regional Health Authority (WRHA), CCMB specialists work in concert with colleagues at six sites in Winnipeg, including the Leukemia/Bone Marrow Transplant Program and Radiosurgery Program at the Health Sciences Centre.

Outside of Winnipeg, through partnerships with four rural Regional Health Authorities, CCMB provides community-based cancer services through the Community Cancer Program Network (CCPN). The CCPN has 16 locations across the province, and provides cancer support services through a community resource center in a 17th community, bringing care closer to home for those that live in rural Manitoba.

In partnership with Prairie Mountain Health, the Western Manitoba Cancer Centre offers residents of Brandon and western Manitoba access to a state-of-the-art facility that provides radiation therapy as well as chemotherapy and support services.

In addition to serving the province of Manitoba, CCMB provides services for populations in the adjacent jurisdictions of Northwestern Ontario, Nunavut, and Saskatchewan.

CancerCare Manitoba currently employs over 1000 staff members and about 60 physician specialists, and has an annual operating budget (including drugs) of close to $200M.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the following individuals whose contribution made it possible to produce this report:

Leadership and colleagues at CancerCare Manitoba for their valuable input:

- Dr. Sri Navaratnam MBBS, FRCPC, PhD, President and Chief Executive Officer
- Dr. Donna Turner PhD, Chief of Population Oncology
- Ms. Sheila Fukumura CTR, Manager, Manitoba Cancer Registry

Editing and preparation of final report:

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- Kristen Lucyshyn, Publication Specialist
- Diane Lawless, Publication Coordinator

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EXECUTIVE SUMMARY

This report describes the quality of surgical care provided in Manitoba for people diagnosed with breast, colorectal, lung, ovarian, or prostate cancer between 2015 and 2020 using administrative health and Manitoba Cancer Registry data.

Key Findings

Breast Cancer Surgery

- Most breast cancer patients (70.6%) had breast conserving surgery, 20.8% had a mastectomy without immediate reconstruction, and 8.6% had a mastectomy with immediate reconstruction.
- Very few breast cancer patients who had surgery had an in-hospital post-operative complication (1.5%).
- Six percent of breast cancer patients who had surgery were readmitted to hospital within 30 days of surgery.
- The percentage of breast cancer patients who received surgery within 30 days after a surgical consult ranged from 63.5% in the Winnipeg Regional Health Authority to 100.0% in the Interlake-Eastern Regional Health Authority.
- The percentage of patients diagnosed with breast cancer who received surgery in their regional health authority of residence increased from 68.0% in 2015 to 75.5% in 2020.
- Five percent of breast cancer patients had an axillary lymph node dissection within a year of diagnosis without pathological evidence of nodal metastatic disease.
- Sixteen percent of breast cancer patients required a re-excision within a year of breast conserving surgery.

Colorectal Cancer Surgery

- Most colon (67.8%) and rectal (75.8%) cancer patients had surgery in the Winnipeg Regional Health Authority.
- Twenty-five percent of colon and 21.8% of rectal cancer surgery patients had at least one in-hospital post-operative complication.
- The median length of post-operative hospital stay was 7 days for colon cancer patients and 8 days for rectal cancer patients.
- The percentage of colon and rectal cancer patients who stayed in hospital for more than 60 days after surgery was 1.2%.
- Seventeen percent of rectal cancer patients and 12.1% of colon cancer patients were readmitted to hospital.
- Most colon (83.1%) and rectal (73.2%) cancer patients had surgery in their regional health authority of residence.
- The percentage of colon and rectal cancer patients who had surgery within one year of diagnosis and had at least 12 lymph nodes removed and pathologically examined remained consistent over time.

- Most colon cancer patients had colon cancer surgery using an open approach (63.0%) versus a laparoscopic approach (37.1%), but the use of laparoscopic surgery has increased over time from 27.3% in 2015 to 45.0% in 2020.
- A positive circumferential resection margin was seen in 6.8% of rectal cancer surgery patients.
- The percentage of colorectal cancer patients who had a liver resection for stage IV disease was 21%.
- The median wait time between the last biopsy date and the first resection date among colon cancer surgery patients was 34 days.

Lung Cancer Surgery

- Twenty-three percent of non-small cell lung cancer (NSCLC) patients had surgery.
- Most (91.1%) had surgery in the Winnipeg Regional Health Authority. Nine percent were conducted in Prairie Mountain Health.
- Sublobar resections (47.7%) and lobectomies (40.8%) were the most common surgical procedures.
- Video-Assisted Thoracoscopic Surgery increased from 59.0% in 2015 to 75.7% in 2020.
- At least one in-hospital complication was observed in 17.5% of NSCLC patients who had surgery.
- The median post-operative length of stay among NSCLC patients was 4 days.
- Among NSCLC patients who had surgery, 8.1% were readmitted to hospital within 30 days of surgery.
- Surgery was performed on 26.8% of NSCLC patients ≥75 years of age compared to 73.2% of NSCLC patients 20 to 74 years of age.
- Three percent of NSCLC patients who had a resection died within 90 days after surgery.
- Fifty-two percent of NSCLC patients in the Winnipeg Regional Health Authority and 51.6% in Prairie Mountain Health had an anatomic resection.

Ovarian Cancer Surgery

- Eighteen percent of ovarian cancer patients had an in-hospital, post-operative complication following surgery.
- Infections (35.9%) and ilei (21.4%) were the most common complications.
- The median length of stay between surgery and discharge was 4 days.
- Ten percent were readmitted to hospital within 30 days following surgery.
- The majority (98.4%) had surgery performed by a gynecologic oncologist.
- Forty-eight percent of patients had primary debulking, 21.5% had interval debulking, and 13.2% had chemotherapy as their first treatment. Seventeen percent had no treatment.
- The median number of days between the last surgical consult date and the first treatment (surgery or chemotherapy) date varied from 41 days in 2015 to 52 days in 2020.

Prostate Cancer Surgery

- Four percent of prostate cancer patients had a post-operative complication.
- The median length of stay between surgery and discharge was 4 days.
- Readmission to hospital within 30 days of surgery occurred for 5.8% of prostate cancer patients.
- The percentage of prostate cancer patients who had 1-7 lymph nodes removed was 33.7% in the Winnipeg Regional Health Authority and 68.8% in Prairie Mountain Health.
- The percentage of prostate cancer patients who had 8 or more lymph nodes removed was 64.6 % in the Winnipeg Regional Health Authority and 27.3% in Prairie Mountain Health.
- Seven percent of prostate cancer patients received Androgen Deprivation Therapy prior to surgery.
- Fifty-six percent of prostate cancer patients who had surgery had extraprostatic extension.
- The median number of days between biopsy and surgery was 160 days.

CHAPTER 1. INTRODUCTION

Why was this report created?

This is the second report examining the quality of cancer surgery in Manitoba. The goal of the report is to continuously monitor and improve cancer surgical quality to ensure that Manitobans receive the best surgical care possible.

What is in this report?

This report focuses on surgeries conducted for the treatment of breast, colorectal, lung, ovarian, and prostate cancers diagnosed between January 1, 2015 and December 31, 2020. Surgeries conducted to treat cancers diagnosed in this period occurred between January 1, 2015 and March 31, 2021. Please note that the 2021 treatment data included in this report are incomplete as treatment information was unavailable for some individuals diagnosed in 2020 at the time of analysis. This report used data from the Manitoba Cancer Registry, the Manitoba Hospital Discharge Abstracts Database, and the Manitoba Medical Claims Database to identify and assess cancer surgeries.

This report is organized into seven chapters. Chapters one and two include background information and describe how the indicators were selected and analyzed. Chapters three to seven describe the findings for each cancer site.

Background

Cancer

It is estimated that 43% of Canadians will be diagnosed with cancer in their lifetime.[1] Although the overall rate of cancer has declined over the past decade, the number of individuals diagnosed each year with cancer has been increasing because of the growing and aging population.[2] The number of people living with and beyond cancer continues to increase which has important implications for planning health care and supportive services.[3]

In Manitoba, it is estimated that 7,200 individuals will be diagnosed with cancer and 2,900 will die from cancer in 2022.[2] The most frequently diagnosed cancers include lung, breast, colorectal, and prostate cancers.[2] Surgery is an integral part of the treatment for these cancers and along with ovarian cancer, are the focus of this report.

Cancer Surgery

Surgery is often the only way to cure cancer and prevent a cancer-related death. Approximately half of Manitobans diagnosed with cancer undergo a surgical procedure at some point during their cancer journey. Therefore, delivering high-quality surgical oncology care, eliminating barriers to care for underserved populations, measuring performance against established benchmarks, and working collaboratively with health care providers to continue to enhance surgical quality are important priorities for Manitoba and Canada.[4,5]

In Manitoba, cancer-related surgeries are performed in all regional health authorities with over 5,000 operations conducted annually. Cancer-related surgical procedures are performed by a variety of surgical specialties. Within each specialty (e.g. general surgery, urology, etc.), there are some cancer procedures that are germane to the specialty while others are done by subspecialists – surgeons with additional training in complex cancer surgery. Surgeons are supported by an interdisciplinary team including nurses and anesthesiologists. The surgical procedure performed varies and is influenced by the type of cancer, stage of disease, and patient preference. Procedures specific to each cancer site are further described in the corresponding chapters.

Cancer surgery and the COVID-19 pandemic

The coronavirus (COVID-19) pandemic in March of 2020 led to the reorganization of health services to provide care for COVID-19 patients, keep individuals and communities safe, and protect the ability of the health care system to respond to rapidly changing circumstances. These reorganization measures included the prioritizing or delay of cancer surgery within disease sites at the discretion of treating physicians due to a reduction in operation room availability.[6] Surgery was initially impacted to a greater degree than other forms of cancer treatment because surgical resources, including staff, ventilators, personal protective equipment, and hospital rooms for patient recovery, were redirected to address COVID-19 needs.[7] Additionally, some patients may have elected to postpone their surgery and/or begin neo-adjuvant systemic therapy. We know that there was a 43% decrease in cancer surgical resections in April 2020 and that the number of surgical resections remained below what was expected in the absence of the COVID-19 pandemic until July 2020.[7] Although there appears to be a gradual recovery in the rate of surgery in the fall of 2020, this report includes individuals who were diagnosed with cancer after the start of the pandemic. Hence, surgery rates and outcomes, particularly from April to July 2020, may have been impacted by the pandemic.

In this report, we have indicated when an outlier data point may reflect an impact from COVID-19. Variances in 2020 data may also be due to limited follow-up time.

Indicators

This report includes descriptive and key performance indicators.

Descriptive indicators

Descriptive indicators describe the surgery or patient population. Descriptive indicators do not measure quality directly but contribute to our understanding of surgical cancer treatment in Manitoba.

Key performance indicators

Key performance indicators measure the quality of healthcare delivery and health outcomes. Key performance indicators are standardized, measurable using high quality data, and are based on evidence and standards of care.

CHAPTER 2. METHODS

How were indicators selected?

The descriptive and key performance indicators presented in this report were selected using a multi-step iterative process. First, a comprehensive literature review was conducted and reviewed by surgeon site-leads. Appropriate indicators were selected by the surgeons. Indicators not identified in the initial review were recommended. The proposed indicators were evaluated to determine whether or not data were available and if a calculation of the indicator was feasible in Manitoba. A final list of descriptive and key performance indicators was identified and comprehensive indicator definitions were developed and reviewed by the project team.

What cancers are included in this report?

Manitoba residents 20 years of age and older who were diagnosed with invasive breast, colorectal, ovarian, or lung cancer and residents 35 years of age and older diagnosed with prostate cancer between 2015 and 2020 were included. Treatment data from 2021 may be incomplete as treatment information was not available for some individuals diagnosed in 2020 at the time of analysis. Women diagnosed with ductal carcinoma in situ (DCIS) breast cancer are also included in select indicators. Surgeries had to occur within one year of diagnosis in order to be included. Select colorectal surgical procedures were included if they occurred up to one year prior to a pathological diagnosis.

Data sources

The Manitoba Cancer Registry was used to identify individuals diagnosed with cancer, date of diagnosis, area of residence, cancer type and morphology, and cancer surgery. The Manitoba Health Population File was used to determine dates of provincial health coverage and the population denominator. The Medical Claims Database was used to identify surgical consult and procedure dates. The Discharge Hospital Abstracts Database was used to determine cancer surgery, length of hospital stay, and post-operative complications.

Analyses

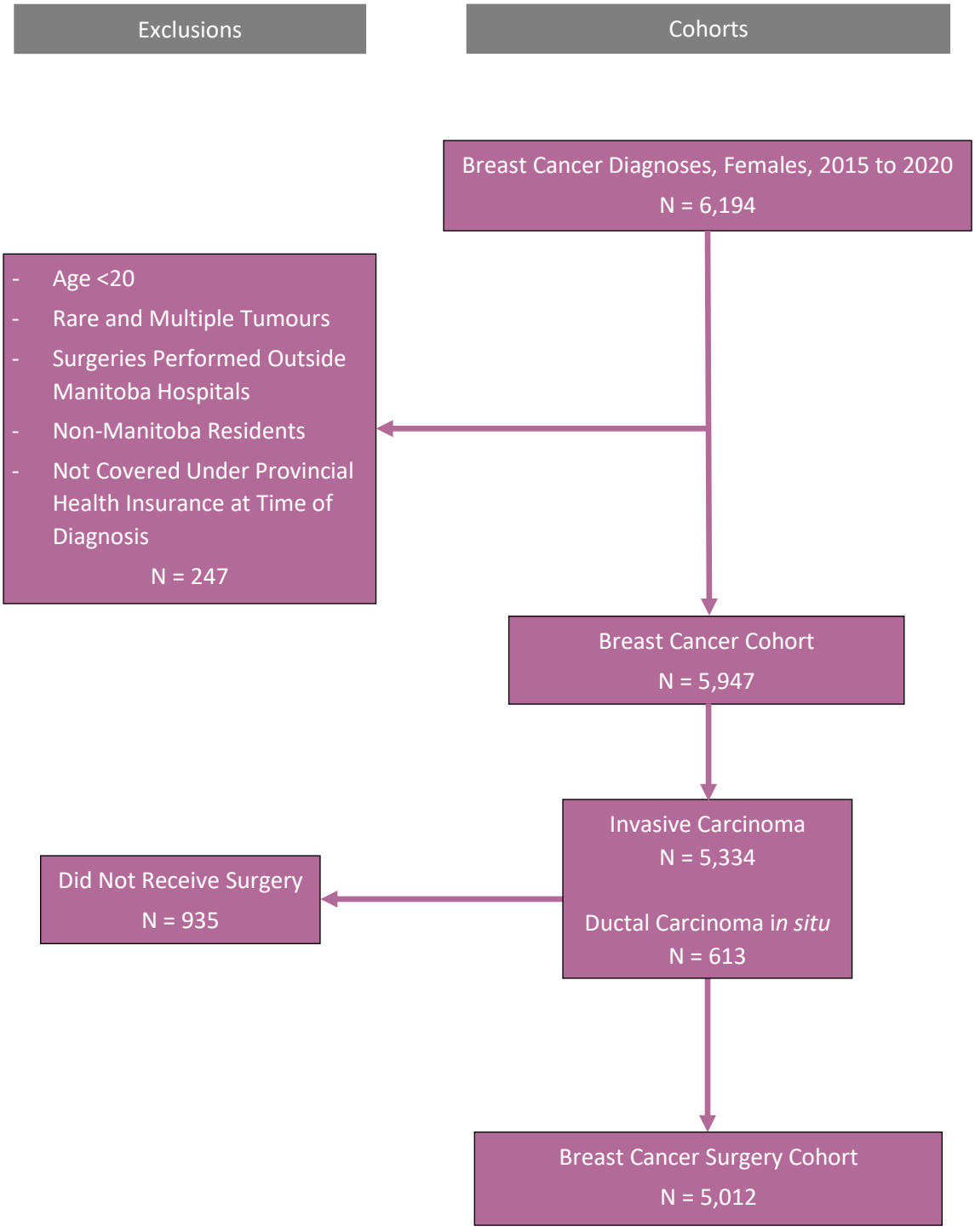
Descriptive analyses (e.g., percentages, median, and range) were performed for each indicator as applicable. The technical appendix provides further details about indicator definitions and analysis.

CHAPTER 3. BREAST CANCER

Key Findings

- In 2020, 961 individuals were diagnosed with breast cancer in Manitoba.
- Between 2015 and 2020,
  - The percentage of breast cancer patients who had surgery remained stable over time with small increases from year-to-year. A decrease was observed in 2020 due to incomplete treatment data for 2020 diagnoses and the impact of COVID-19 pandemic restrictions. In 2019, 86.9% of patients diagnosed with breast cancer had surgery and 87.3% had surgery in the Winnipeg Regional Health Authority.
  - Seventy-one percent of breast cancer patients had breast conserving surgery, 20.8% had a mastectomy without immediate reconstruction, and 8.6% had a mastectomy with immediate reconstruction.
  - Very few breast cancer patients who had surgery had an in-hospital post-operative complication (1.5%). Of those who had a complication, bleeding was the most common complication (57.1%) followed by respiratory complications (13.1%).
  - The median length of stay between surgery and discharge was 0 days for breast conserving surgery (a day surgery), 1 day for mastectomy without immediate reconstruction, and 3 days for mastectomy with immediate reconstruction.
  - Six percent of breast cancer patients who had surgery were readmitted to hospital within 30 days of surgery.
  - The percentage of breast cancer patients who had surgery within 30 days after surgical consult ranged from 63.5% in the Winnipeg Regional Health Authority to 100.0% in the Interlake-Eastern Regional Health Authority.
  - The percentage of patients diagnosed with breast cancer who had surgery in their regional health authority of residence increased from 68.0% in 2015 to 75.5% in 2020.
  - Five percent of breast cancer patients had an axillary lymph node dissection within a year of diagnosis without pathological evidence of nodal metastatic disease. This ranged from 4.1% in the Winnipeg Regional Health Authority to 25.0% in the Interlake-Eastern Regional Health Authority.
  - Sixteen percent of breast cancer patients required a re-excision within a year of breast conserving surgery. This ranged from 10.0% in the Interlake-Eastern Regional Health Authority to 28.3% in Southern Health-Santé Sud.

Breast Cancer and Cancer Surgery Cohorts



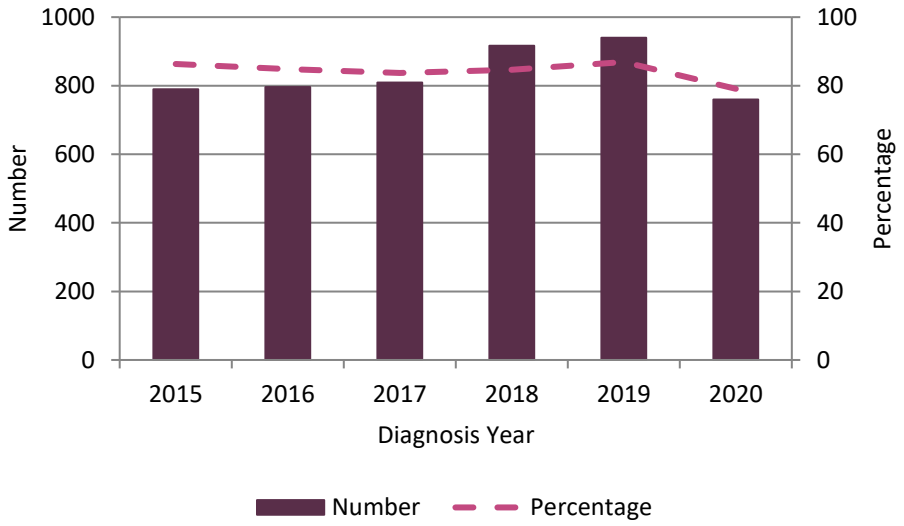
Descriptive Indicators

Table 3. 1 Number of individuals diagnosed with breast cancer

Diagnosis Year	Invasive Carcinoma	Ductal Carcinoma *in situ*	Total
2015	810	105	915
2016	848	91	939
2017	860	107	967
2018	973	110	1083
2019	964	118	1082
2020	879	82	961

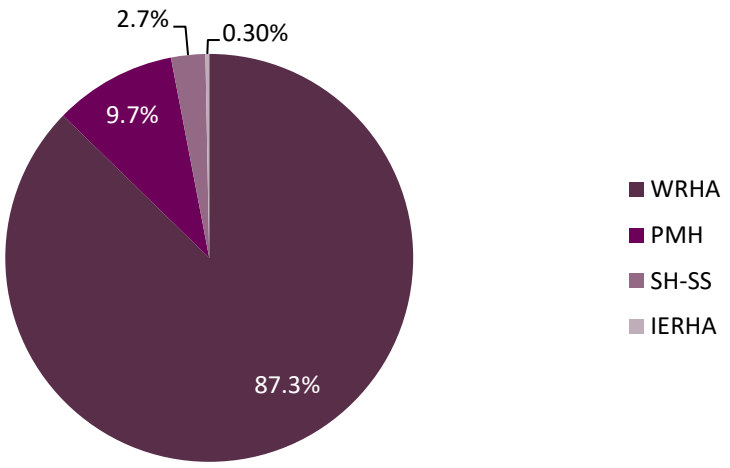
In 2020, the number of individuals diagnosed with breast cancer decreased likely due to the impact of the COVID-19 pandemic on cancer screening and other health care services.

Figure 3. 1 Number and percentage of breast cancer patients who had surgery



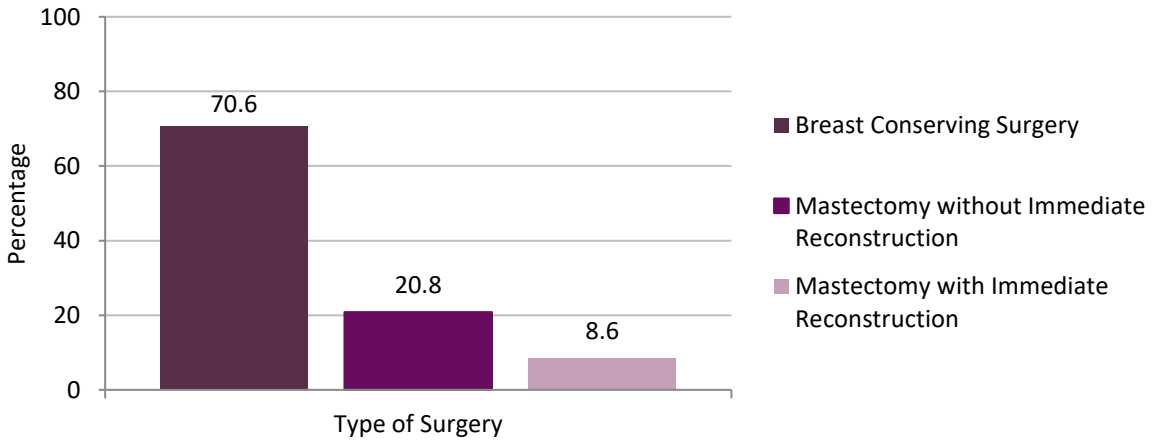
Between 2015 and 2020, the percentage of breast cancer patients who had surgery remained stable. A decrease was seen in 2020 due to incomplete treatment data for 2020 diagnoses and the impact of COVID-19 pandemic restrictions.

Figure 3. 2 Percentage of breast cancer patients who had surgery by regional health authority of surgery, 2015 to 2020



Between 2015 and 2020, most breast cancer patients (87.3%) had surgery in the Winnipeg Regional Health Authority.

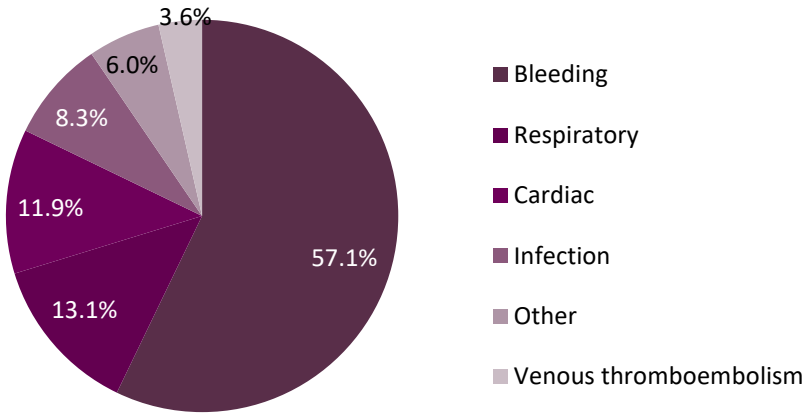
Figure 3. 3 Percentage of breast cancer patients who had surgery by type of surgery, 2015 to 2020



Between 2015 and 2020, 70.6% of breast cancer patients had breast conserving surgery, 20.8% had mastectomy without immediate reconstruction, and 8.6% had mastectomy with immediate reconstruction.

Surgical Quality Indicators

Figure 3. 4 Percentage of in-hospital post-operative complications experienced by breast cancer patients by complication type, 2015 to 2020



Post-Operative Complications

Between 2015 and 2020, 1.5% of breast cancer patients who had surgery had an in-hospital post-operative complication. Bleeding was the most common complication (57.1%) followed by respiratory complications (13.1%). A complete list of complications can be found in Appendix 3.1.

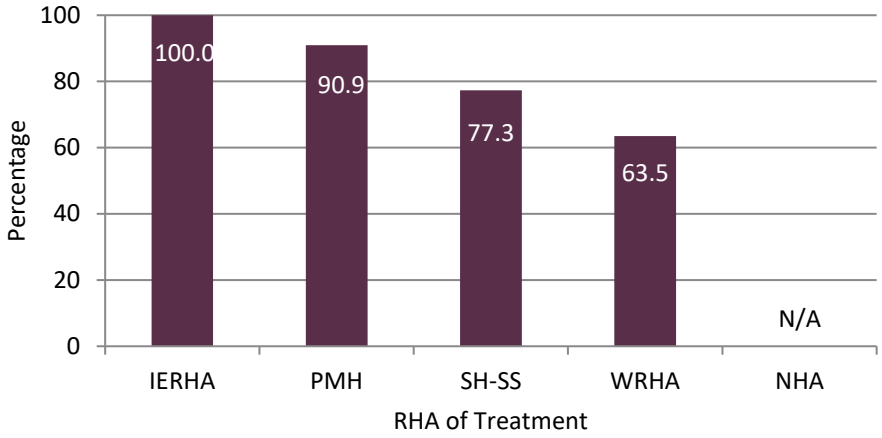
Post-Operative Length of Stay

The median length of stay (from 2015 to 2020) between the dates of surgery and discharge differed by type of surgery and was 0 days for breast conserving surgery (day surgery), 1 day for mastectomy without immediate reconstruction, and 3 days for mastectomy with immediate reconstruction.

Hospital Readmissions

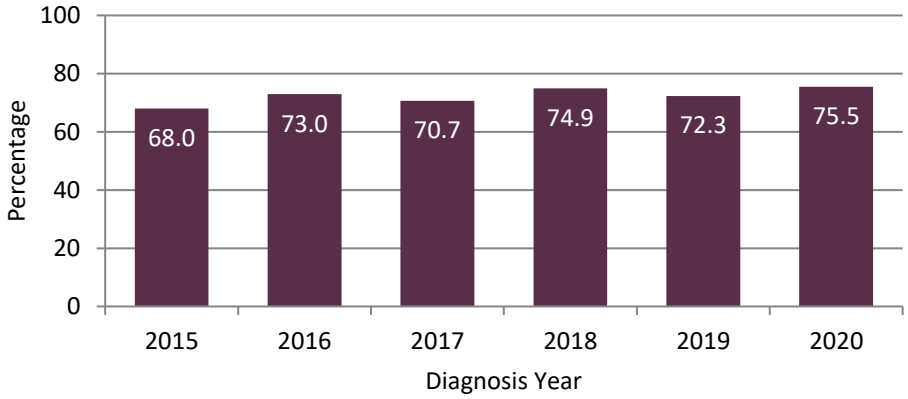
Between 2015 and 2020, 5.6% of breast cancer patients who had surgery were readmitted to hospital within 30 days of surgery.

Figure 3. 5 Percentage of invasive breast cancer patients who had a resection within 30 days of surgical consult by regional health authority (RHA) of treatment, 2015 to 2020



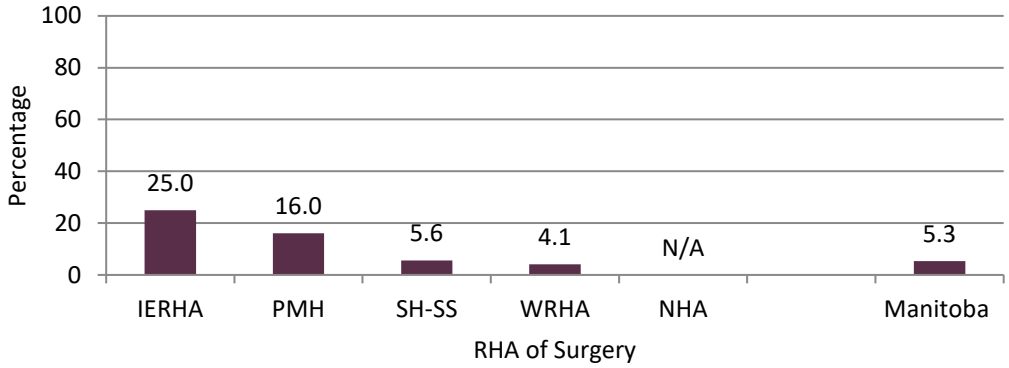
Between 2015 and 2020, the percentage of breast cancer patients who had surgery within 30 days after a surgical consult ranged from 63.5% in the Winnipeg Regional Health Authority to 100% in the Interlake-Eastern Regional Health Authority.

Figure 3. 6 Percentage of breast cancer patients who had surgery in their regional health authority of residence



The percentage of patients diagnosed with breast cancer who had surgery in their regional health authority of residence increased from 68.0% in 2015 to 75.5% in 2020.

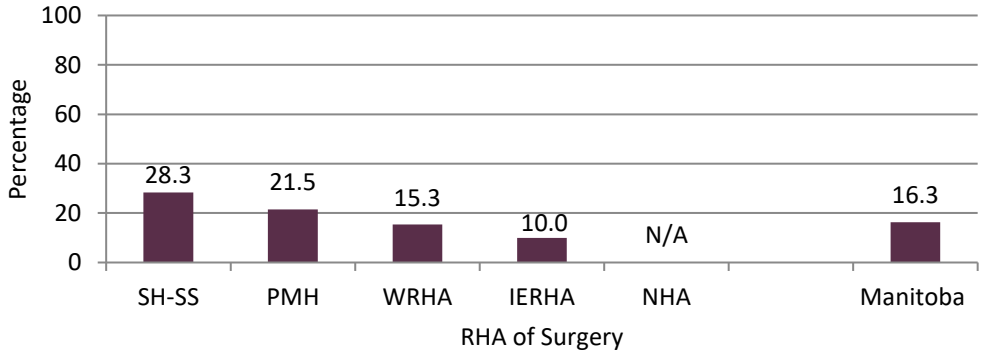
Figure 3. 7 Percentage of invasive breast cancer patients who had axillary clearance in the absence of positive nodes by regional health authority (RHA) of surgery, 2015 to 2020



Between 2015 and 2020, 5.3% of breast cancer patients with no positive lymph nodes had an axillary lymph node dissection. The percentage by Regional Health Authority of surgery ranged from 4.1% in the Winnipeg Regional Health Authority to 25.0% in the Interlake-Eastern Regional Health Authority.

Patients who had neoadjuvant chemotherapy were excluded from this analysis.

Figure 3. 8 Percentage of breast cancer patients who had a re-excision within one year of breast conserving surgery by regional health authority (RHA) of surgery, 2015 to 2020



Between 2015 and 2020, 16.3% of breast cancer patients had a re-excision within one year of breast conserving surgery. The percentage ranged from 10.0% in the Interlake-Eastern Regional Health Authority to 28.3% in Southern Health-Santé Sud.

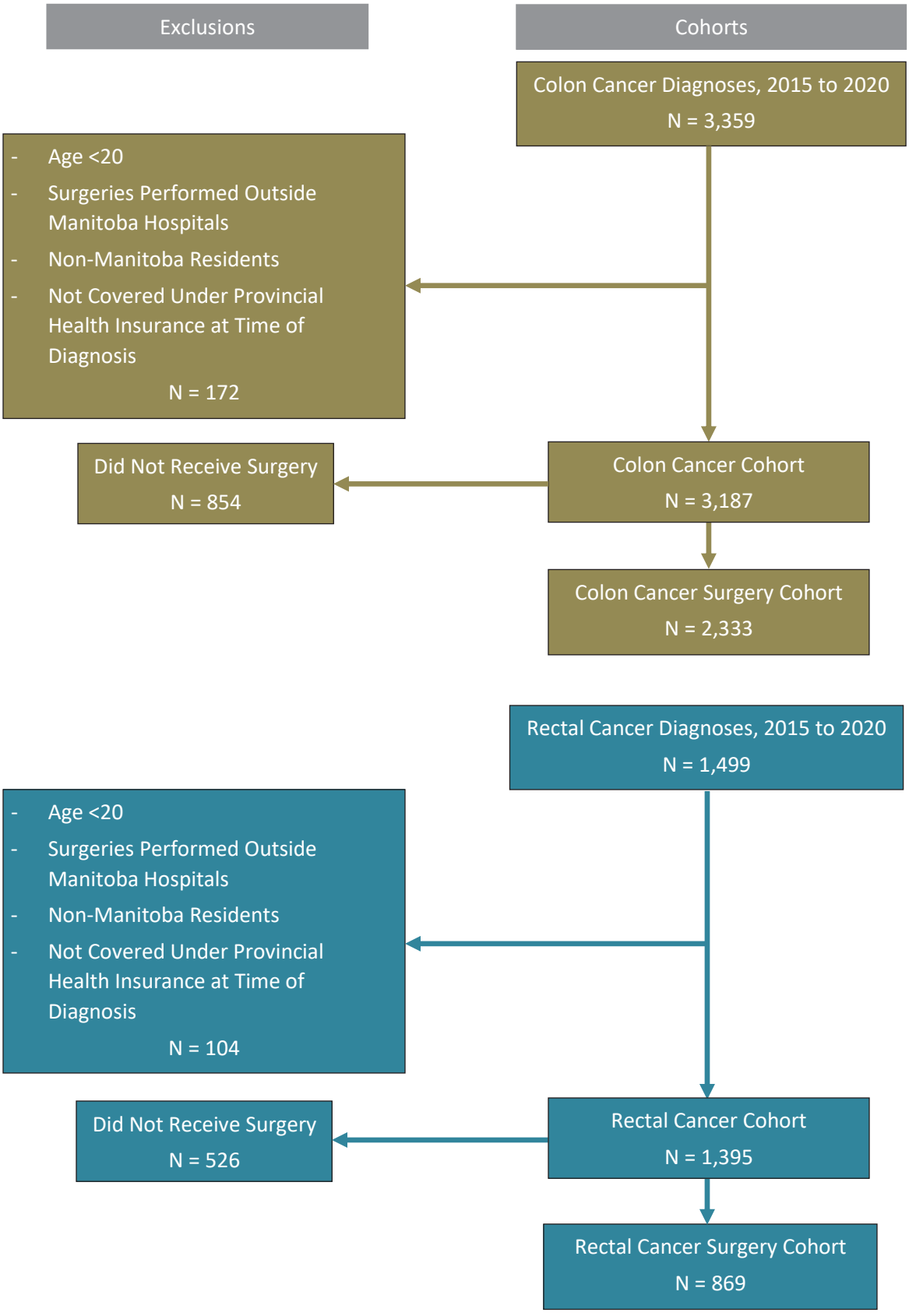
CHAPTER 4. COLORECTAL CANCER

Key Findings

- In 2020, 478 individuals were diagnosed with colon cancer and 219 individuals were diagnosed with rectal cancer.
- Between 2015 and 2020,
  - Seventy-three percent of individuals diagnosed with colon and 62.2% of individuals diagnosed with rectal cancer had surgery. The percentage was lower in 2020 for rectal cancer patients (52.5%) due to the impact of COVID-19 on the health care system, incomplete data, and changes in treatment paradigms.
  - Most colon (67.8%) and rectal cancer patients (75.8%) had surgery in the Winnipeg Regional Health Authority.
  - Eighty-nine percent of colon cancer patients had a resection with no stoma and 49.1% of rectal cancer patients had a resection with a reversible stoma.
  - Twenty-five percent of colon and 21.8% of rectal cancer surgery patients had at least one in-hospital post-operative complication. The most common complication was infection (43.8% of complications in colon cancer surgery patients and 39.2% of complications in rectal cancer surgery patients).
  - The median length of post-operative hospital stay for colon cancer surgery patients was 7 days. This varied by surgical approach; the median was 8 days for patients who had open surgery compared to 5 days for those who had laparoscopic surgery.
  - The median length of post-operative hospital stay for rectal cancer patients was 8 days.
  - The percentage of colon and rectal cancer patients who stayed in hospital for more than 60 days after surgery was 1.2%.
  - Seventeen percent of rectal cancer patients were readmitted to hospital compared to 12.1% of colon cancer patients.
    - The percentage of patients diagnosed with colon cancer who were readmitted to the hospital was highest in 2017 (20.7%) and decreased to 10.0% in 2020 which may be related to COVID-19 pandemic restrictions.
    - In 2020, fewer rectal cancer patients (8.8%) were readmitted to hospital which may be related to COVID-19 pandemic restrictions.
  - Most colon (83.1%) and rectal (73.2%) cancer patients had surgery in their regional health authority of residence. This ranged from 100% in the Winnipeg Regional Health Authority to 19.8% and 8.9% for colon and rectal cancer, respectively, in the Northern Health Region.
  - The percentage of colon and rectal cancer patients who had surgery within one year of diagnosis and at least 12 lymph nodes removed and pathologically examined remained consistent over time.
  - Most colon cancer patients had surgery using an open (63.0%) versus laparoscopic approach (37.1%). Laparoscopic surgery has increased from 27.3% in 2015 to 45.0% in 2020.

- A positive circumferential resection margin was seen in 6.8% of rectal cancer surgery patients. This varied by regional health authority of surgery with the highest percentage in Prairie Mountain Health (9.4%).
- The percentage of colorectal cancer patients who had a liver resection for stage IV disease was 21%.
- The median wait time between the last biopsy date and the first resection among colon cancer surgery patients was 34 days. This varied by regional health authority of surgery from 11 days in the Northern Health Region to 48 days in the Interlake-Eastern Regional Health Authority.

Colorectal Cancer and Cancer Surgery Cohorts



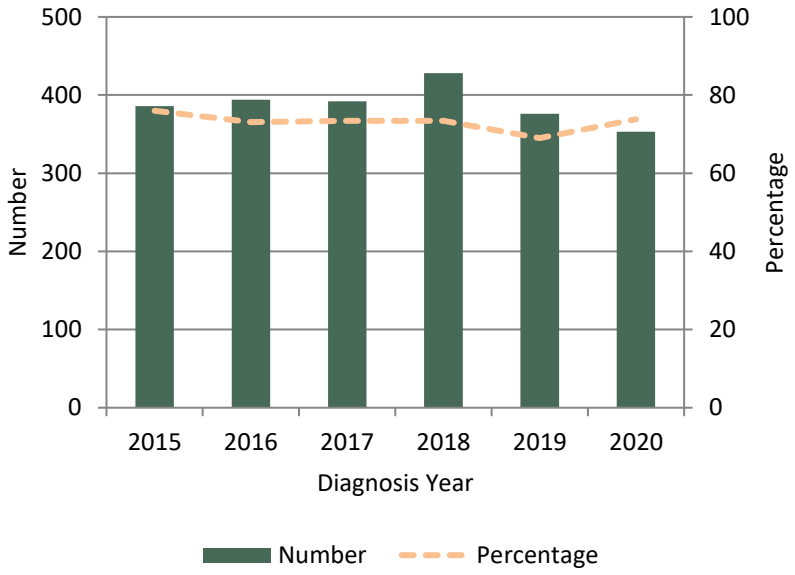
Descriptive Indicators

Table 4. 1 Number of individuals diagnosed with colon or rectal cancer

Diagnosis Year	Colon Cancer	Rectal Cancer	All
2015	508	256	764
2016	539	252	791
2017	534	219	753
2018	583	219	802
2019	545	230	775
2020	478	219	697

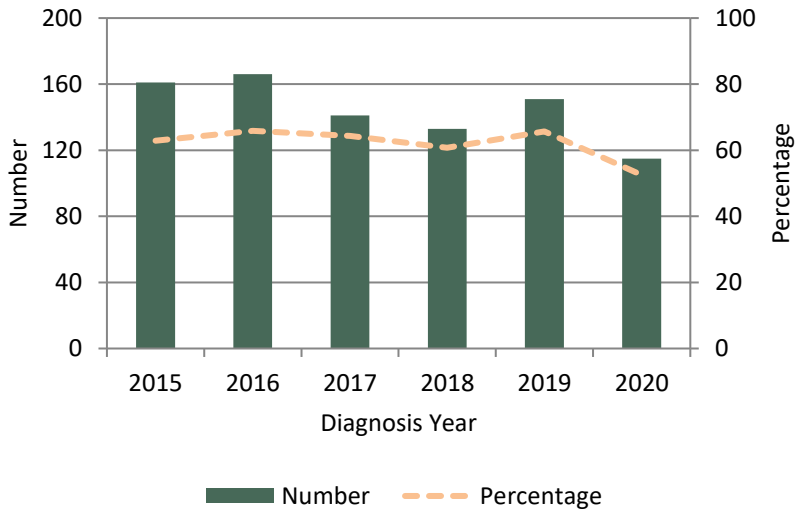
In 2020, 478 individuals were diagnosed with colon cancer and 219 individuals were diagnosed with rectal cancer.

Figure 4. 1 Number and percentage of colon cancer patients who had surgery



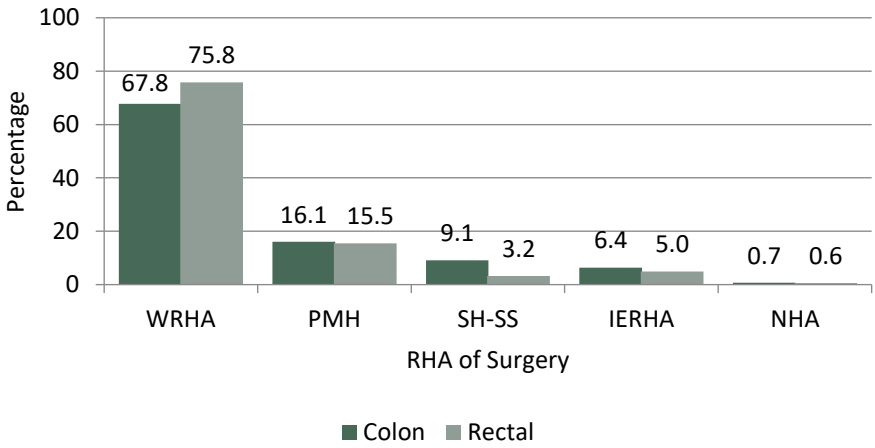
Between 2015 and 2020, 73.1% of Manitobans who were diagnosed with colon cancer had surgery.

Figure 4. 2 Number and percentage of rectal cancer patients who had surgery



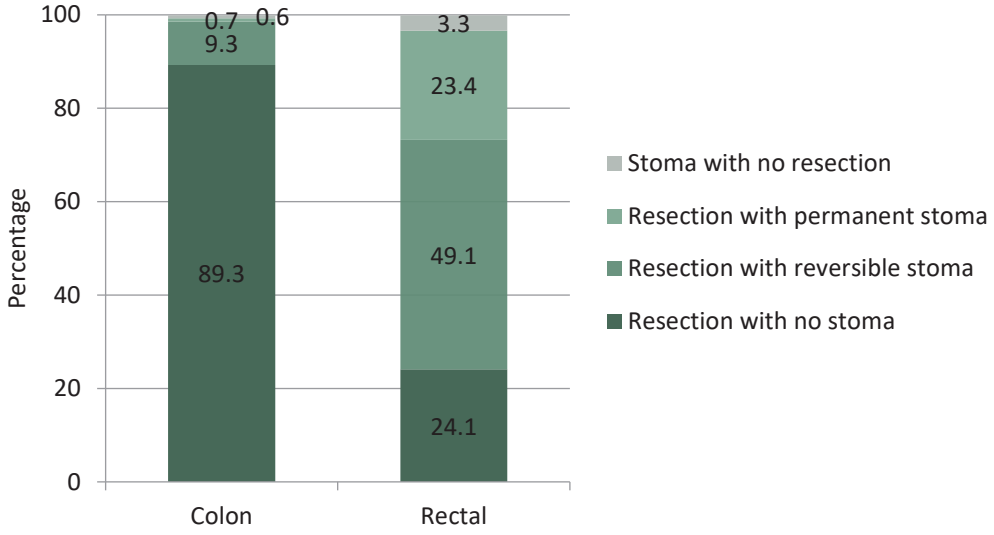
Between 2015 and 2020, 62.2% percent of Manitobans diagnosed with rectal cancer had surgery. The percentage was lower in 2020 (52.5%) due to changes to rectal cancer treatment and the impact of COVID-19 on the health care system.

Figure 4. 3 Percentage of colon and rectal cancer patients who had surgery by regional health authority (RHA) of surgery, 2015 to 2020



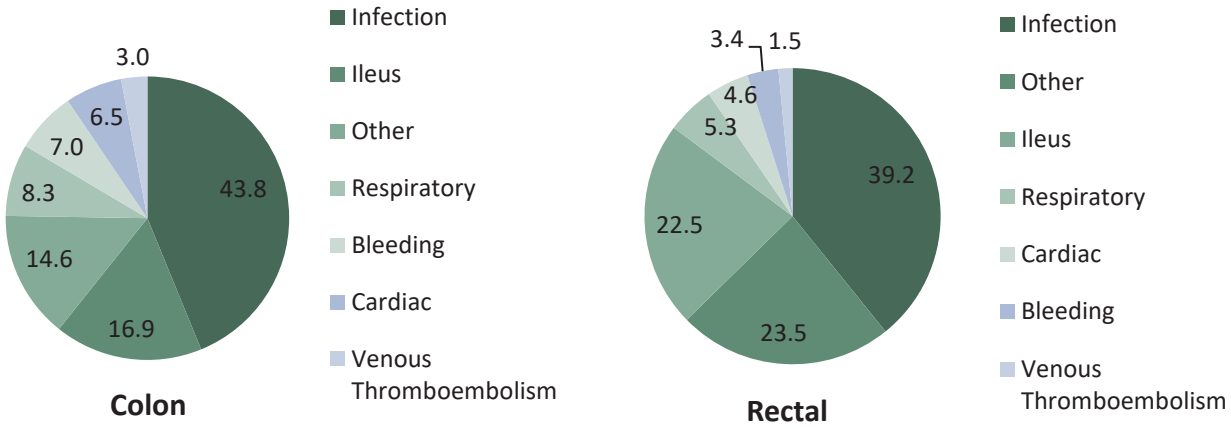
Between 2015 and 2020, 67.8% of colon cancer patients and 75.8% of rectal cancer patients had surgery in the Winnipeg Regional Health Authority.

Figure 4. 4 Percentage of colon and rectal cancer patients who had surgery by type of surgical procedure, 2015 to 2020



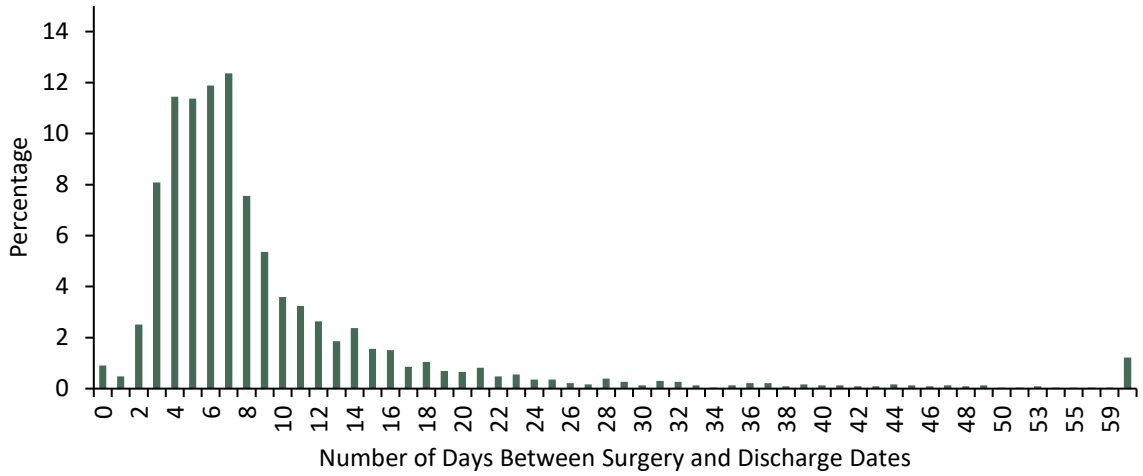
Between 2015 and 2020, 89.3% of colon cancer patients had a resection with no stoma, 9.3% had a resection with a reversible stoma, and 1.3% had either a resection with a permanent stoma or a stroma with no resection. 24.1% of rectal patients had a resection with no stoma, 49.1% had a resection with a reversible stoma, 23.4% had a resection with a permanent stoma, and 3.3% had a stoma with not resection.

Figure 4. 5 Percentage of in-hospital post-operative complications experienced by colon and rectal cancer patients by complication type, 2015 to 2020



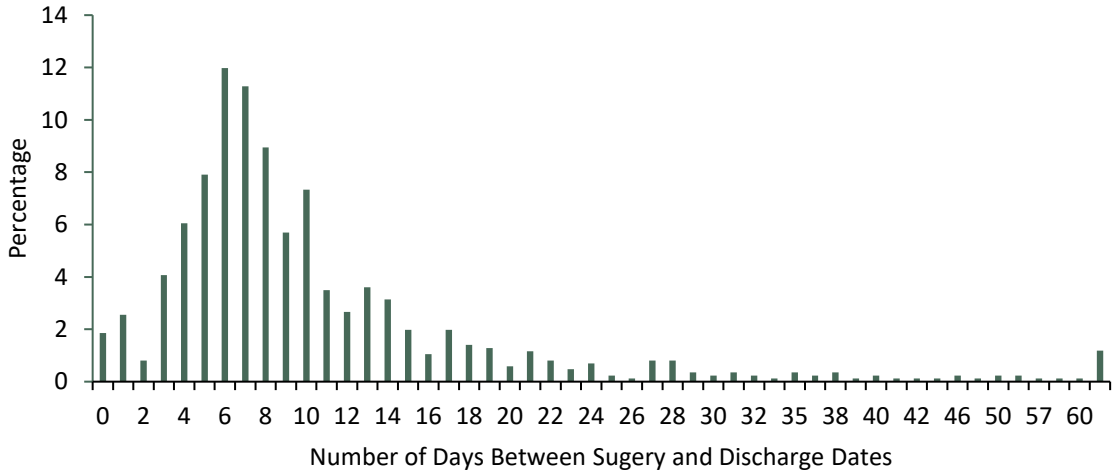
Between 2015 and 2020, 24.7% of colon and 21.8% of rectal cancer surgery patients had at least one in-hospital post-operative complication. The most common complication was infection. A complete list of post-operative complications can be found in Appendices 4.1 a and 4.1 b.

Figure 4. 6 Post-operative length of stay among colon cancer surgery patients, 2015 to 2020



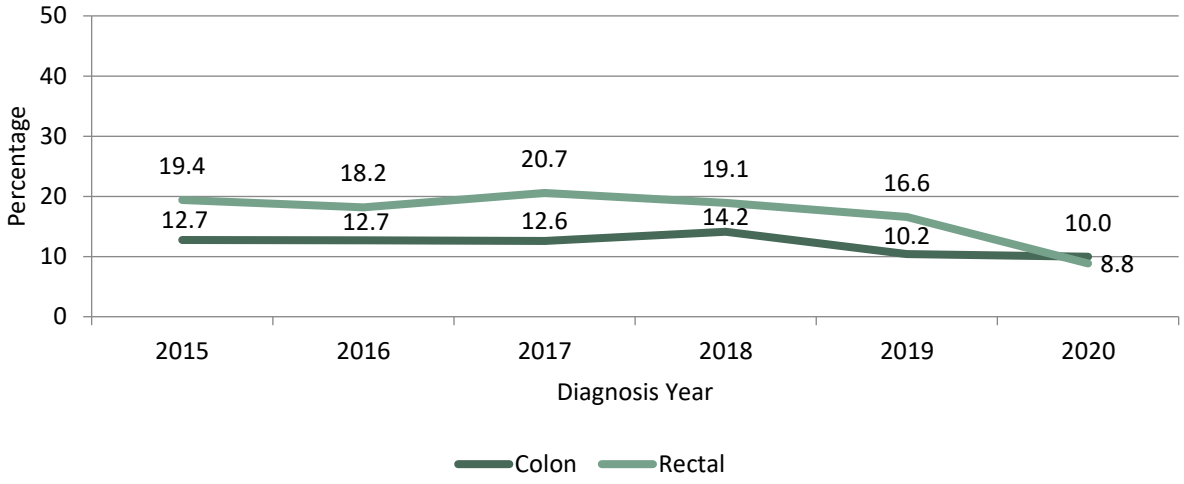
Between 2015 and 2020, the median length of post-operative hospital stay for colon cancer surgery patients was 7 days. The median length of stay was 8 days for patients who had open surgery and 5 days for those who had laparoscopic surgery. Only 1.2% of patients stayed in hospital for more than 60 days after surgery.

Figure 4. 7 Post-operative length of stay among rectal cancer surgery patients, 2015 to 2020



Between 2015 and 2020, the median length of post-operative hospital stay among rectal cancer surgery patients was 8 days. The median length of stay was 9 days for patients who had open surgery and 5 days for those who had laparoscopic surgery. Only 1.2% of patients stayed in hospital for more than 60 days after surgery.

Figure 4. 8 Percentage of colon and rectal cancer patients who were readmitted to hospital within 30 days of surgery, 2015 to 2020

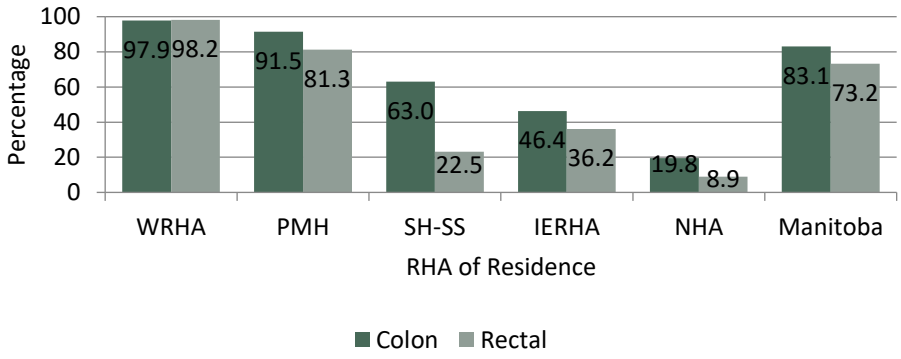


Between 2015 and 2020, 17.4% of rectal cancer patients and 12.1% of colon cancer patients were readmitted to hospital. The percentage of patients diagnosed with colon cancer who were readmitted to the hospital was highest in 2017 (20.7%) and decreased to 10.0% in 2020 which may be related to COVID-19 pandemic restrictions.

In 2020, fewer rectal cancer patients (8.8%) were readmitted to hospital within 30 days after surgery which may be related to COVID-19 pandemic restrictions.

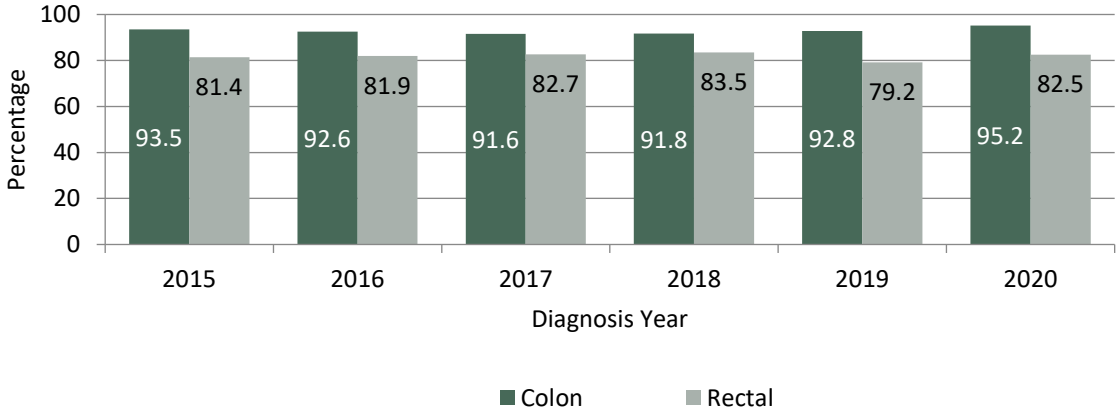
Surgical Quality Indicators

Figure 4. 9 Percentage of colon and rectal cancer patients who had surgery in the same regional health authority in which they were diagnosed, by regional health authority (RHA) of residence, 2015 to 2020



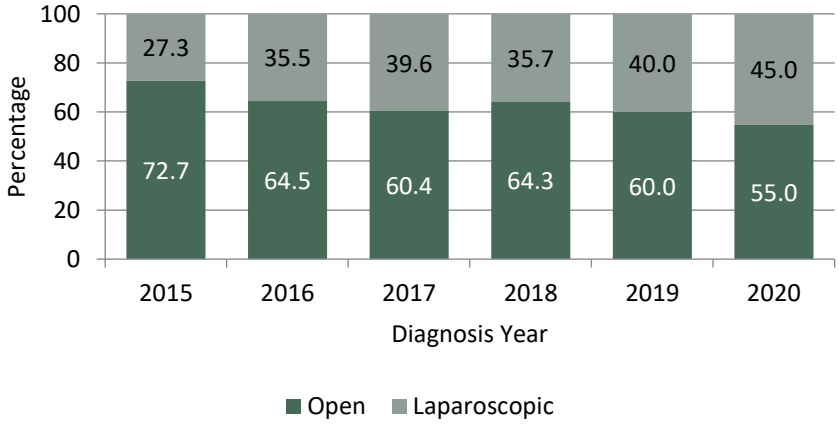
Between 2015 and 2020, 83.1% of colon cancer patients and 73.2% of rectal cancer patients received their diagnosis and surgery in their regional health authority of residence. This ranged from close to 100% in the Winnipeg Regional Health Authority to 19.8% and 8.9% for colon and rectal cancer, respectively, in the Northern Health Region.

Figure 4. 10 Percentage of colon and rectal cancer patients who had surgery and at least 12 lymph nodes removed and examined by diagnosis year



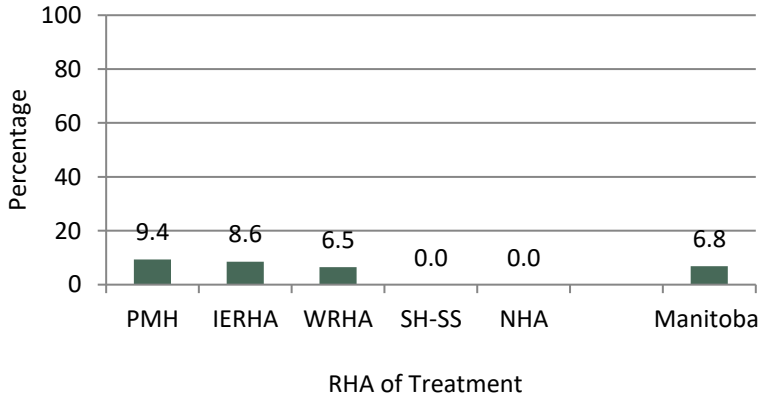
Between 2015 and 2020, the percentage of colon and rectal cancer patients who had surgery within one year of diagnosis and had at least 12 lymph nodes removed and pathologically examined remained consistent (greater than 91.6% for colon cancer patients and greater than 79.2% for rectal cancer patients).

Figure 4. 11 Percentage of colon cancer patients who had surgery by surgical approach and diagnosis year



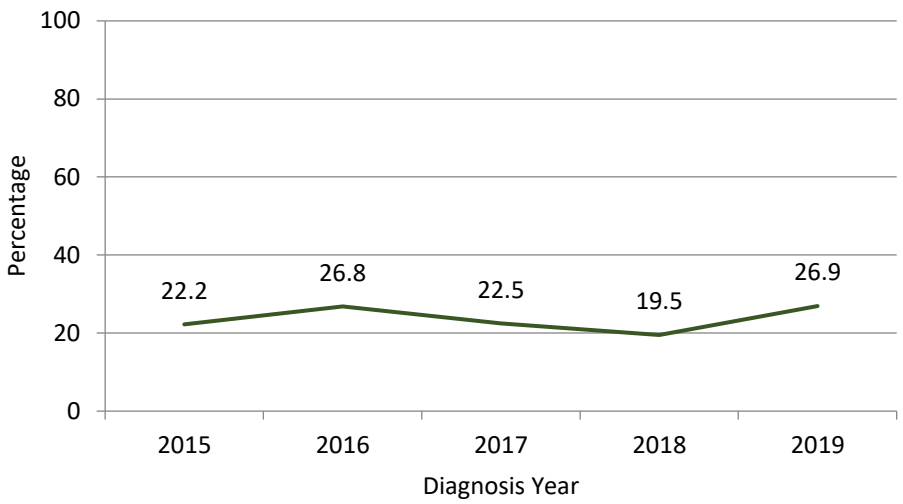
Between 2015 and 2020, 63.0% of Manitobans who had colon cancer surgery had an open approach and 37.1% had a laparoscopic resection. The use of laparoscopic surgery increased from 27.3% in 2015 to 45.0% in 2020.

Figure 4. 12 Percentage of stage II or III rectal cancer surgery patients with a positive circumferential resection margin by regional health authority (RHA) of treatment, 2015 to 2020



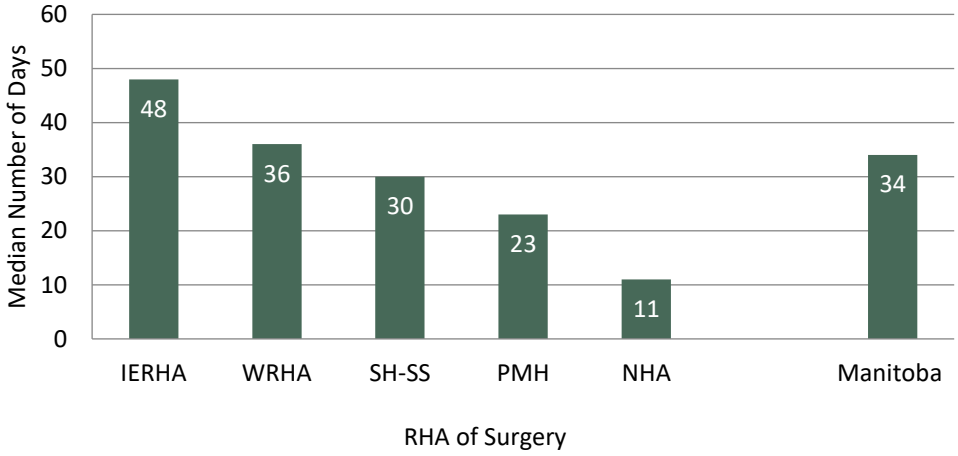
Between 2015 and 2020, 6.8 % of rectal cancer surgery patients had a resection resulting in a positive circumferential resection margin. The percentage varied by regional health authority of treatment from 0% in the Northern Health Region and Southern Health-Santé Sud to 9.4% in Prairie Mountain Health.

Figure 4. 13 Percentage of stage IV colorectal cancer patients who had a liver resection, 2015 to 2019



Between 2015 and 2020, 21% of Manitobans diagnosed with stage IV colorectal cancer had a liver resection. At the time of analysis, 2020 data were not available for this metric.

Figure 4. 14 Median number of days between last biopsy date and first resection among colon cancer patients by regional health authority (RHA) of surgery, 2015 to 2020



The median wait time between the last biopsy date and first resection among colon cancer surgery patients was 34 days. The wait time varied by regional health authority of surgery from 48 days in the Interlake-Eastern Regional Health Authority to 11 days in Northern Health Region.

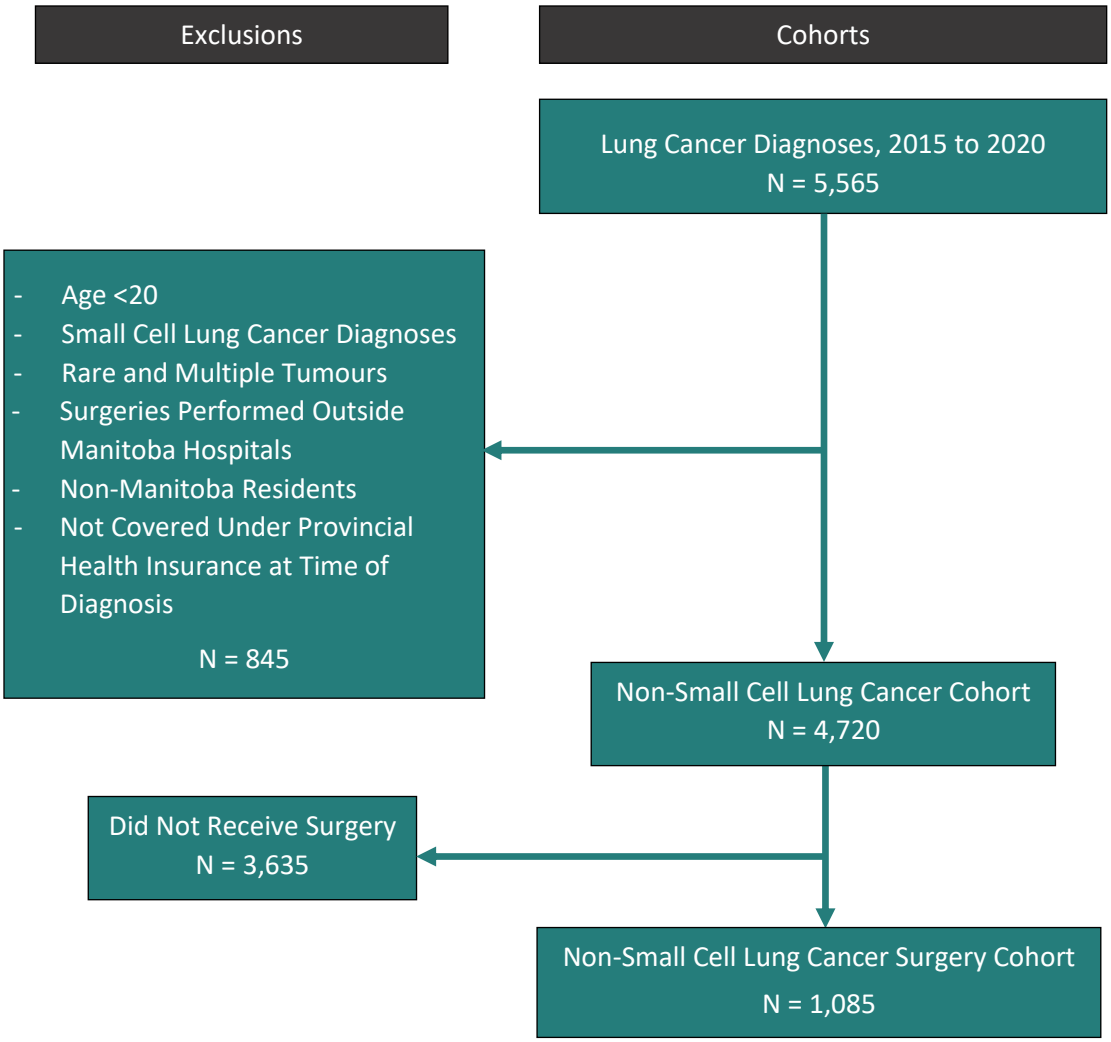
Colon cancer patients who had neo-adjuvant chemotherapy were excluded.

CHAPTER 5. LUNG CANCER

Key Findings

- In 2020, 787 individuals were diagnosed with non-small cell lung cancer (NSCLC).
- Between 2015 and 2020,
  - Twenty-three percent of patients diagnosed with NSCLC had surgery.
  - Most patients (91.1%) had surgery in the Winnipeg Regional Health Authority. The remaining (8.9%) surgeries were conducted in Prairie Mountain Health.
  - Sublobar resections (47.7%) and lobectomies (40.8%) were the most common types of surgery provided to NSCLC patients.
  - Video-Assisted Thoracoscopic Surgery in NSCLC patients increased from 59.0% in 2015 to 75.7% in 2020.
  - At least one in-hospital complication was observed in 17.5% of NSCLC patients who had surgery. Infections (41.4%) and respiratory complications (27.7%) were the most common complications.
  - The median post-operative length of stay among NSCLC patients was 4 days. The percentage of patients who stayed in hospital more than 60 days after surgery was 0.5%.
  - Among NSCLC patients who had surgery, 8.1% were readmitted to hospital within 30 days of surgery.
  - Surgery was performed on 26.8% of NSCLC patients ≥75 years of age compared to 73.2% for patients between 20 and 74 years of age.
  - Three percent of NSCLC patients who had a resection died within 90 days after surgery.
  - The percentage of NSCLC patients that received an anatomic resection was 52.4% in the Winnipeg Regional Health Authority and 51.6% in Prairie Mountain Health.

Lung Cancer and Cancer Surgery Cohorts



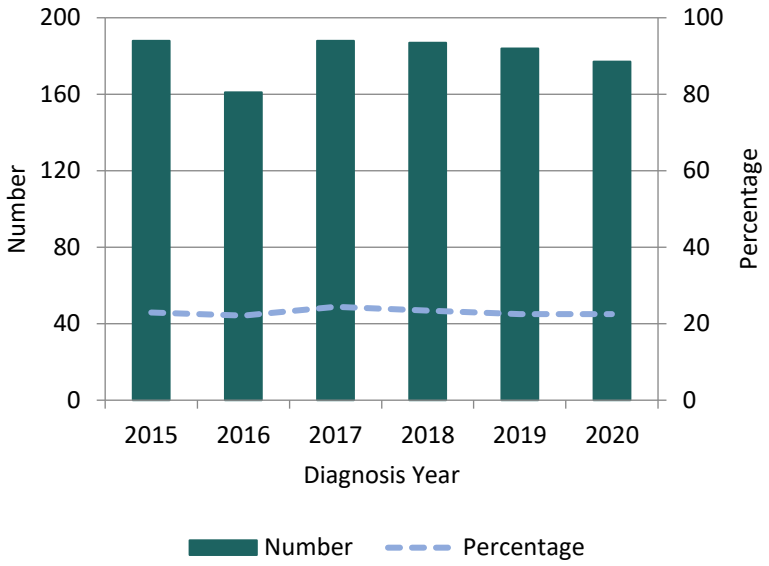
Descriptive Indicators

Table 5. 1 Number of individuals diagnosed with non-small cell lung cancer

Diagnosis Year	Total
2015	820
2016	728
2017	770
2018	799
2019	816
2020	787

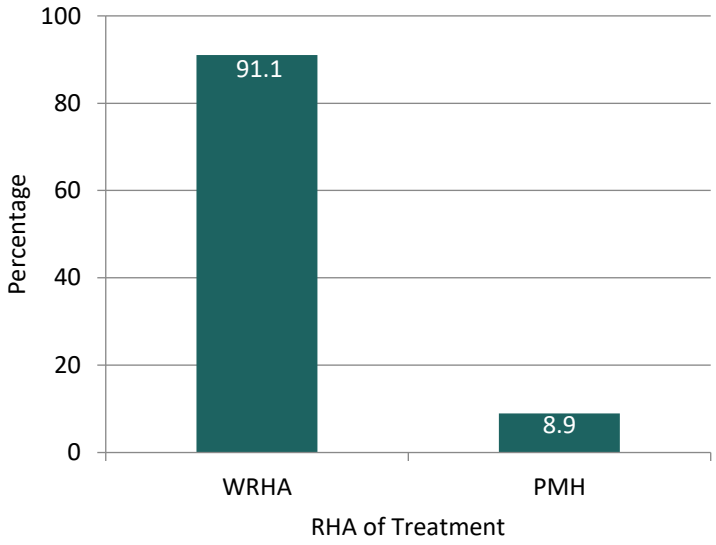
In 2020, 787 individuals were diagnosed with non-small cell lung cancer (NSCLC). Many patients with lung cancer do not have surgery. Reasons for not having surgery include cancer stage which reduces surgery effectiveness and patient comorbidities such as reduced lung function from smoking and very advanced age which makes surgery unsafe. Hence, 177 individuals diagnosed with NSCLC in 2020 received surgery.

Figure 5. 1 Number and percentage of non-small cell lung cancer patients who had surgery



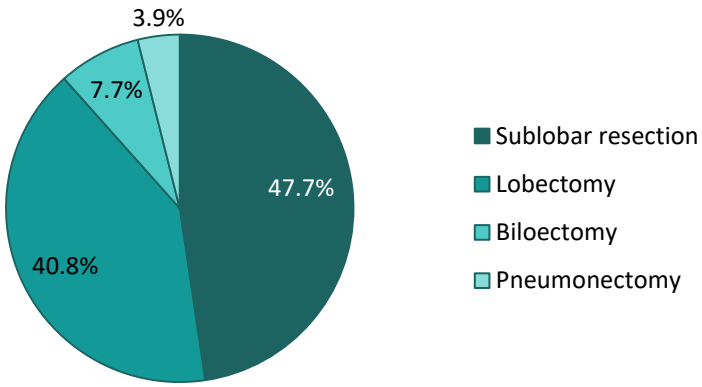
Between 2015 and 2020, 23.0% of patients diagnosed with NSCLC had surgery.

Figure 5. 2 Percentage of non-small cell lung cancer patients who had surgery by regional health authority (RHA) of treatment, 2015 to 2020



Most (91.1%) NSCLC patients had surgery in the Winnipeg Regional Health Authority. The remaining 8.9% had surgery in Prairie Mountain Health.[a]

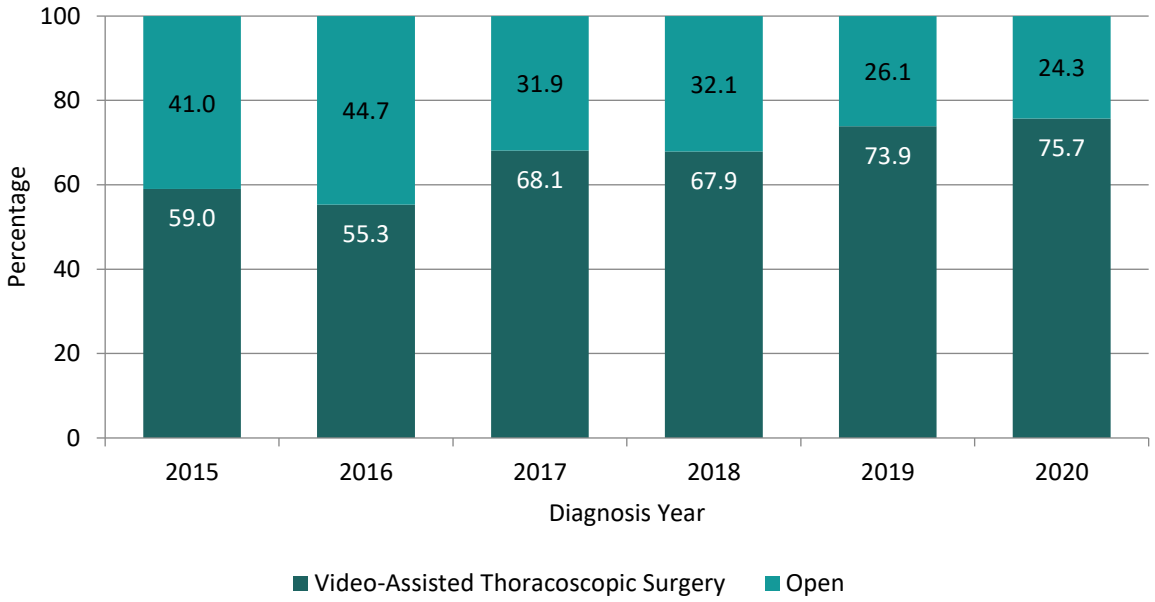
Figure 5. 3 Percentage of non-small cell lung cancer patients who had surgery by type of surgery, 2015 to 2020



Sublobar resections (47.7%) and lobectomies (40.8%) were the most common surgeries for NSCLC patients.

[a] As of 2020, Prairie Mountain Health no longer performs lung cancer surgeries.

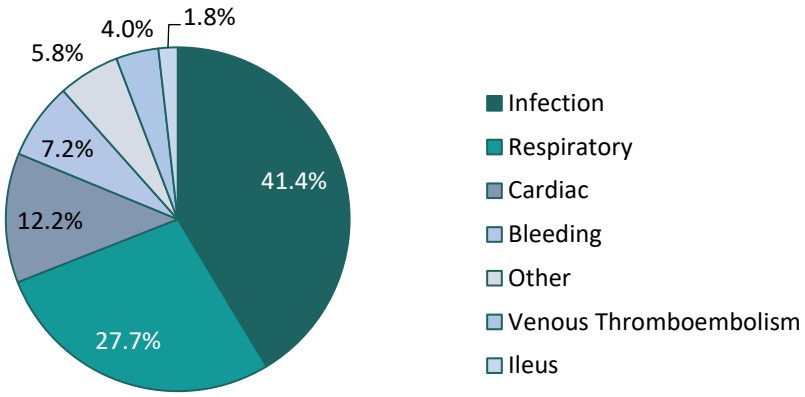
Figure 5. 4 Percentage of non-small cell lung cancer patients who had surgery by surgical approach



The use of Video-Assisted Thoracoscopic Surgery (VATS) in NSCLC patients increased from 59.0% in 2015 to 75.7% in 2020.

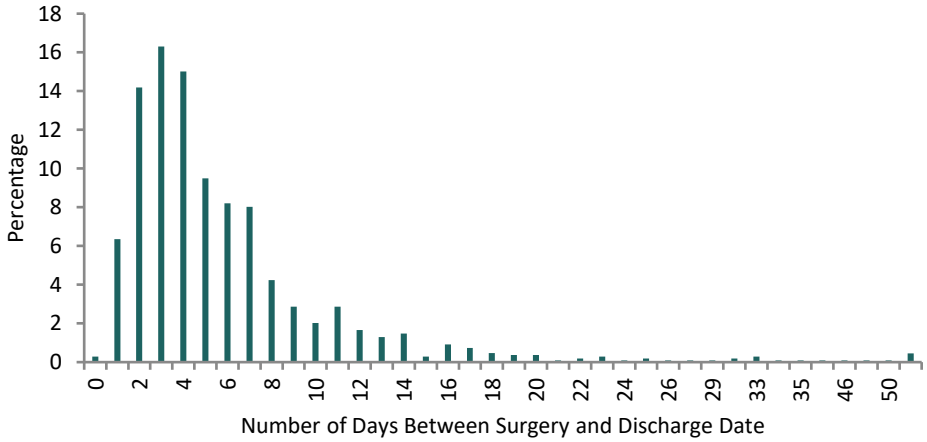
Surgical Quality Indicators

Figure 5. 5 Percentage of in-hospital post-operative complications experienced by non-small cell lung cancer patients by complication type, 2015 to 2020



Between 2015 and 2020, 17.5% of NSCLC patients who had surgery had at least one in-hospital post-operative complication. Infections (41.4%) and respiratory complications (27.7%) were the most common complications. A complete list of post-operative complications can be found in Appendix 5.1.

Figure 5. 6 Post-operative length of stay in non-small cell lung cancer patients, 2015 to 2020

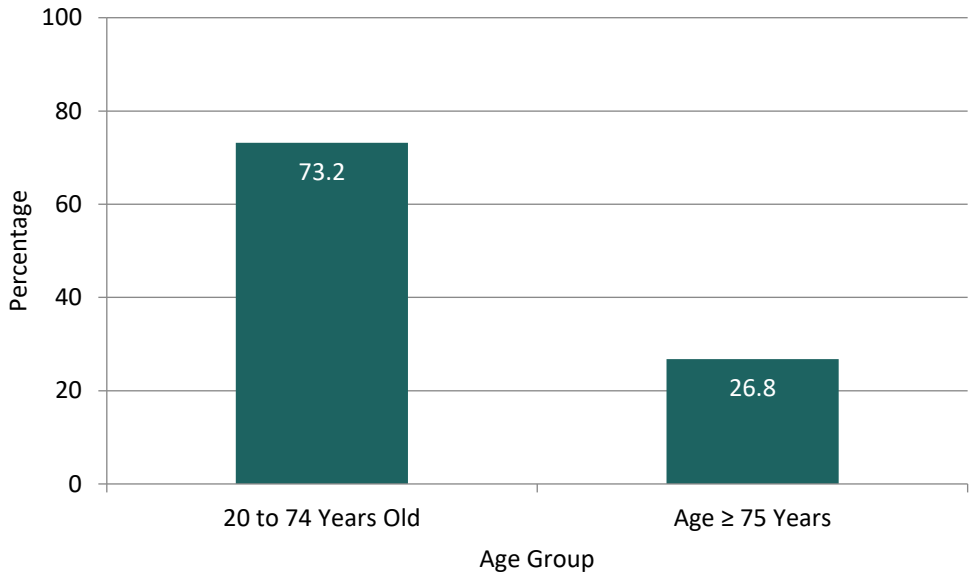


The median post-operative length of stay among NSCLC patients was 4 days. The percentage of patients who stayed in hospital more than 60 days after surgery was 0.5%.

Hospital Readmissions

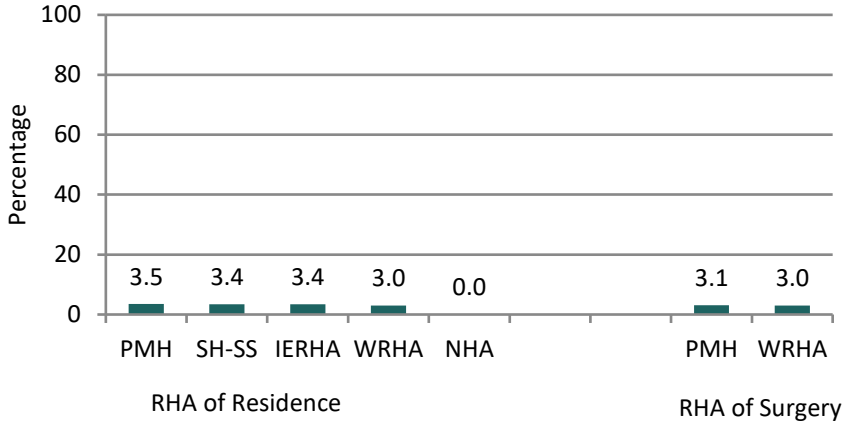
Between 2015 and 2020, 8.1% of NSCLC patients who had surgery were readmitted to hospital within 30 days.

Figure 5. 7 Percentage of non-small cell lung cancer patients who had surgery by age group, 2015 to 2020



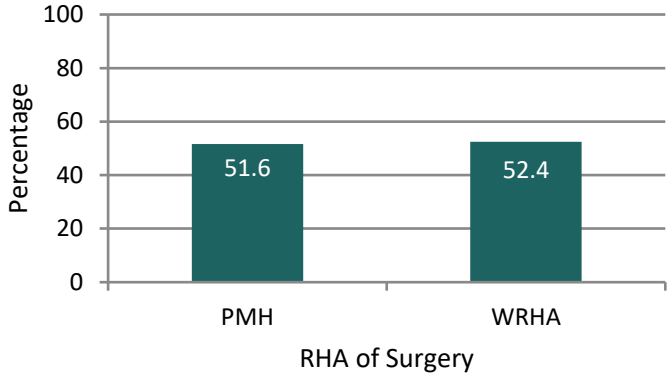
Between 2015 and 2020, 26.8% of patients aged 75 years and over had lung cancer surgery compared to 73.2% of patients aged 20 to 74 years.

Figure 5. 8 Percentage of non-small cell lung cancer surgery patients who died within 90 days of surgery by regional health authority (RHA) of residence and regional health authority of surgery, 2015-2020



Between 2015 and 2020, 0.0% to 3.5% of NSCLC patients who had a resection died within 90 days of surgery. Of the surgeries conducted within the Winnipeg Regional Health Authority and Prairie Mountain Health, 3.0% and 3.1% of NSCLC patients died within 90 days of surgery, respectively.

Figure 5. 9 Percentage of non-small cell lung cancer surgery patients who had an anatomic resection by regional health authority (RHA) of surgery, 2015-2020



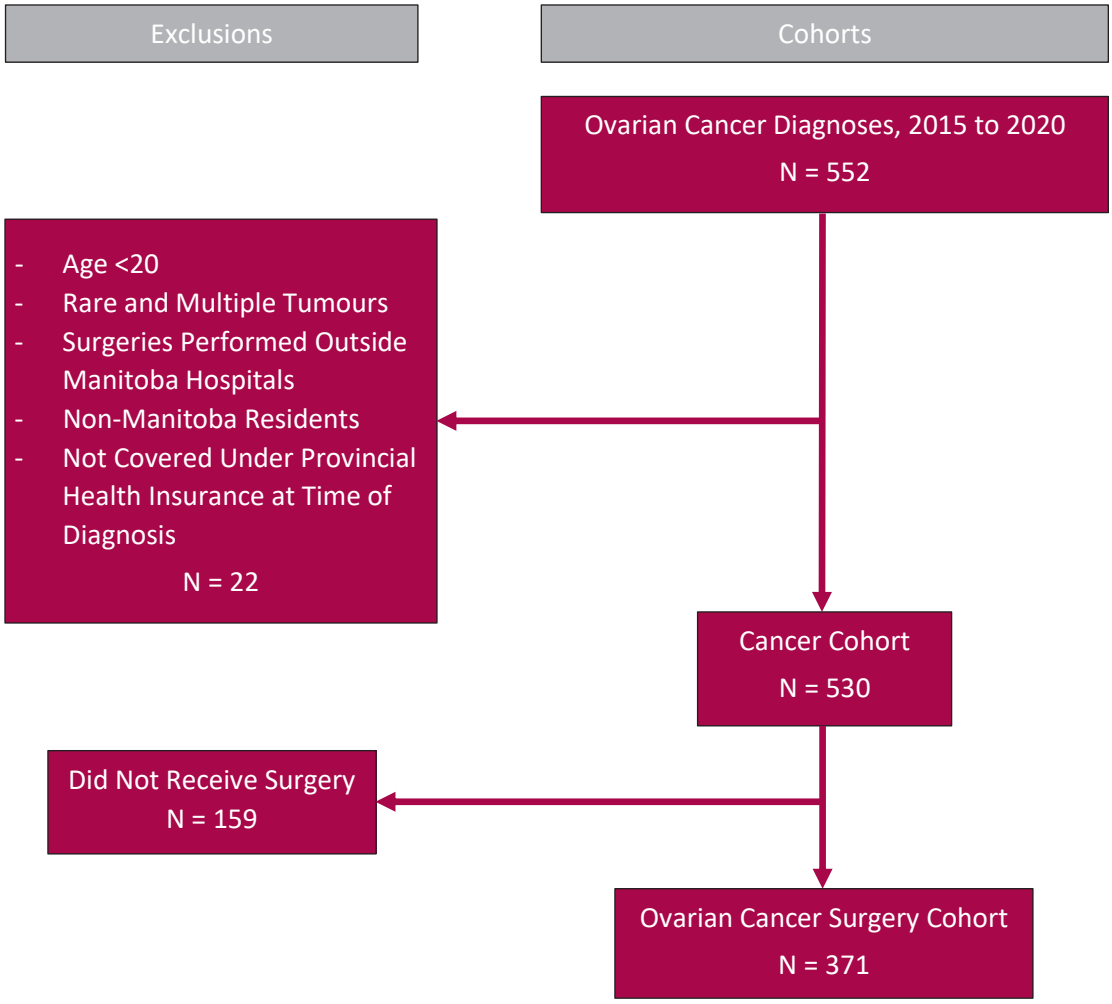
Anatomic resections such as lobectomy and segmentectomy have superior patient outcomes. However, eligibility depends on stage at diagnosis and fitness for surgery. In the Winnipeg Regional Health Authority and Prairie Mountain Health, 52.4% and 51.6% of lung cancer patients diagnosed between 2015 and 2020 received an anatomic resection.

CHAPTER 6. OVARIAN CANCER

Key Findings

- In 2020, 102 individuals were diagnosed with ovarian cancer in Manitoba.
- The percentage of ovarian cancer patients who had surgery ranged from 65.1% in 2016 and 2019 to 75.8% in 2017.
- Most surgeries (95.7%) were conducted in the Winnipeg Regional Health Authority.
- Between 2015 and 2020,
    - Eighteen percent of ovarian cancer patients had an in-hospital, post-operative complication following surgery.
    - Infections (35.9%) and ilei (21.4%) were the most common complications.
    - The median length of stay between surgery date and discharge was 4 days.
    - Ten percent of ovarian cancer patients were readmitted to hospital within 30 days following surgery.
    - In concordance with national guidelines, the majority (98.4%) of patients had surgery performed by a gynecologic oncologist.
    - One half of patients (48.5%) had primary debulking, 21.5% had interval debulking, and 13.2% had chemotherapy as their first treatment. Seventeen percent of patients (16.8%) had no treatment.
    - The median number of days between the date of the last surgical consult and the first treatment (surgery or chemotherapy) varied from 41 days in 2015 to 52 days in 2020.

Ovarian Cancer and Cancer Surgery Cohorts



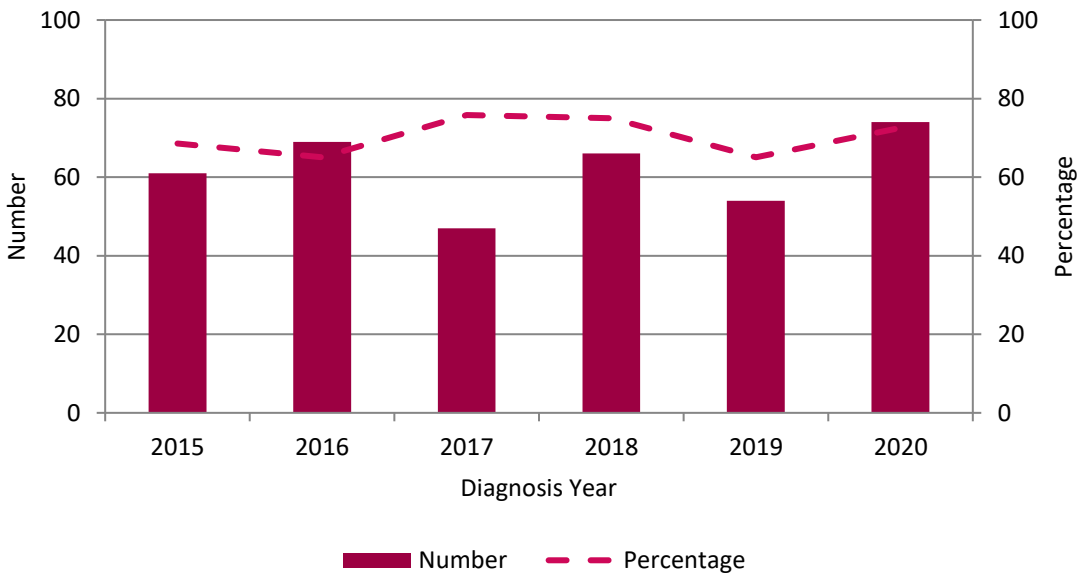
Descriptive Indicators

Table 6. 1 Number of individuals ≥20 years old diagnosed with ovarian cancer

Diagnosis Year	Total number diagnosed
2015	89
2016	106
2017	62
2018	88
2019	83
2020	102

The number of individuals who were diagnosed with ovarian cancer varied from 62 in 2017 to 102 in 2020.

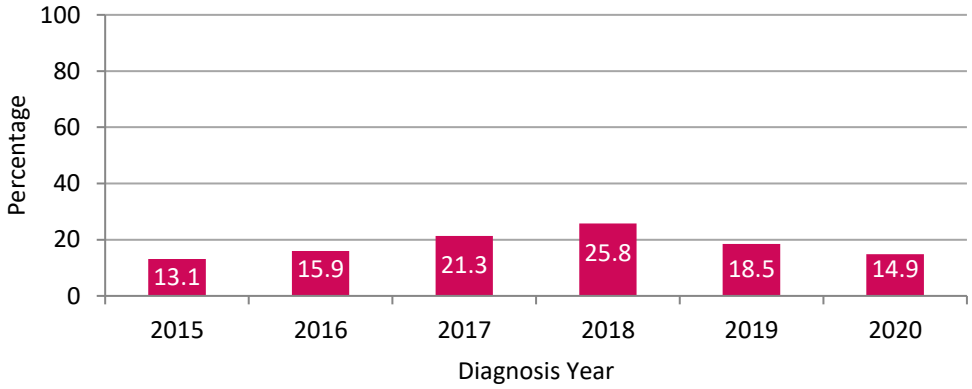
Figure 6. 1 Number and percentage of ovarian cancer patients who had surgery



The percentage of ovarian cancer patients who had surgery ranged from 65.1% in 2016 and 2019 to 75.8% in 2017. Most (95.7%) of surgeries were conducted in the Winnipeg Regional Health Authority.

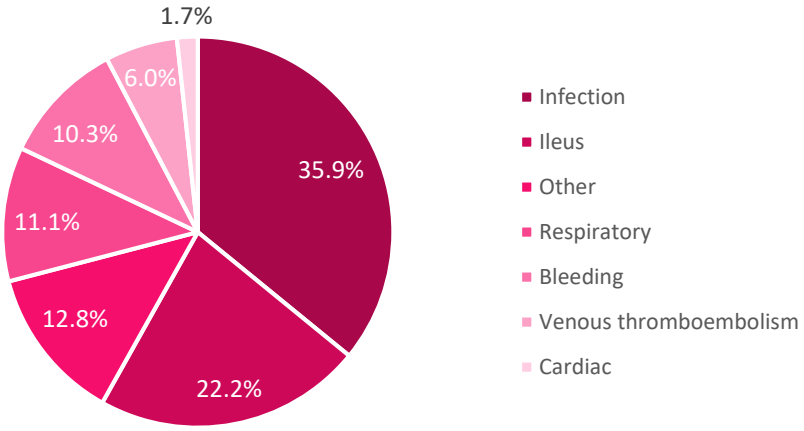
Surgical Quality Indicators

Figure 6. 2 Percentage of ovarian cancer surgery patients who had at least one in-hospital post-operative complication



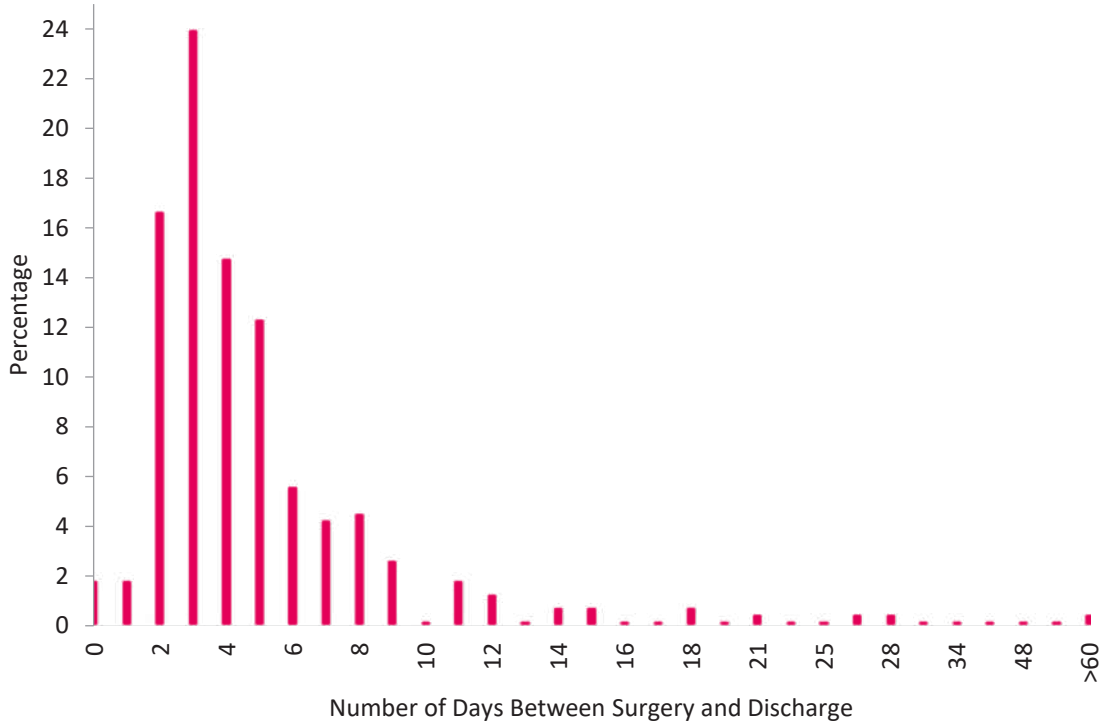
The percentage of ovarian cancer patients who had surgery and had an in-hospital post-operative complication ranged from 13.1% in 2015 to 25.8% in 2018.

Figure 6. 3 Percentage of in-hospital post-operative complications experienced by ovarian cancer patients by complication type, 2015 to 2020



Infections (35.9%) and ilei (22.2%) were the most frequent complications among ovarian cancer patients who had surgery between 2015 and 2020. A complete list of post-operative complications can be found in Appendix 6.1.

Figure 6. 4 Post-operative length of stay in ovarian cancer patients, 2015 to 2020

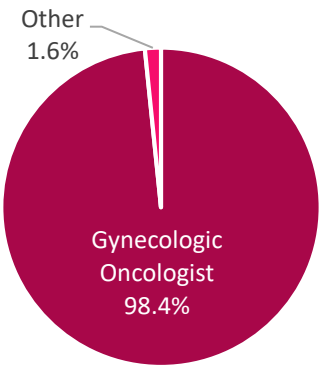


Between 2015 and 2020, the median length of stay between the surgery date and discharge was 4 days. Few individuals (0.5%) stayed in hospital more than 60 days after surgery.

Hospital Readmissions

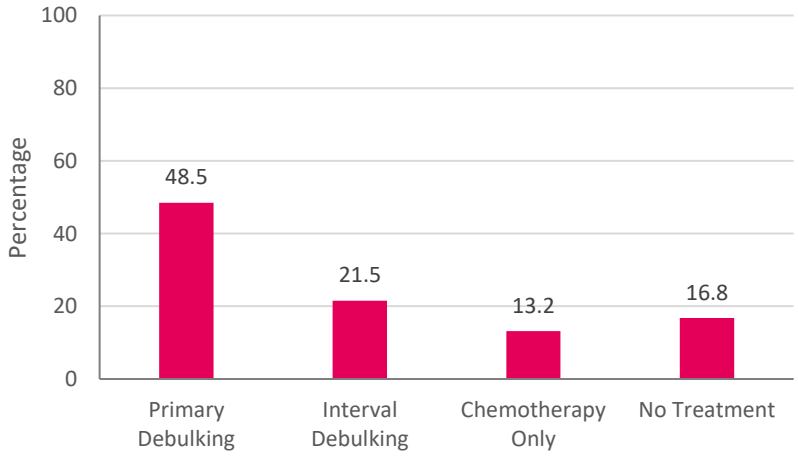
Between 2015 and 2020, 10.2% of ovarian cancer patients who had surgery were readmitted to hospital within 30 days of surgery.

Figure 6. 5 Percentage of ovarian cancer patients whose surgery was conducted by a gynecologic oncologist, 2015 to 2020



Most (98.4%) of individuals with ovarian cancer had surgery performed by a gynecologic oncologist in concordance with recommended guidelines for optimal outcomes. Less than 2% were conducted by general gynecologists or general surgeons.

Figure 6. 6 Types of first treatment received among ovarian cancer patients, 2015 to 2020



One half of patients (48.5 %) had primary debulking, 21.5% had interval debulking, and 13.2% had chemotherapy as their first treatment. Seventeen percent of patients (16.8%) had no treatment.

Table 6. 2 Median number of days between surgical consult and first treatment among ovarian cancer patients

Diagnosis Year	Median (Days)	90th Percentile (Days)
2015	41	108
2016	69	108
2017	72	108
2018	47	112
2019	49	118
2020	52	165

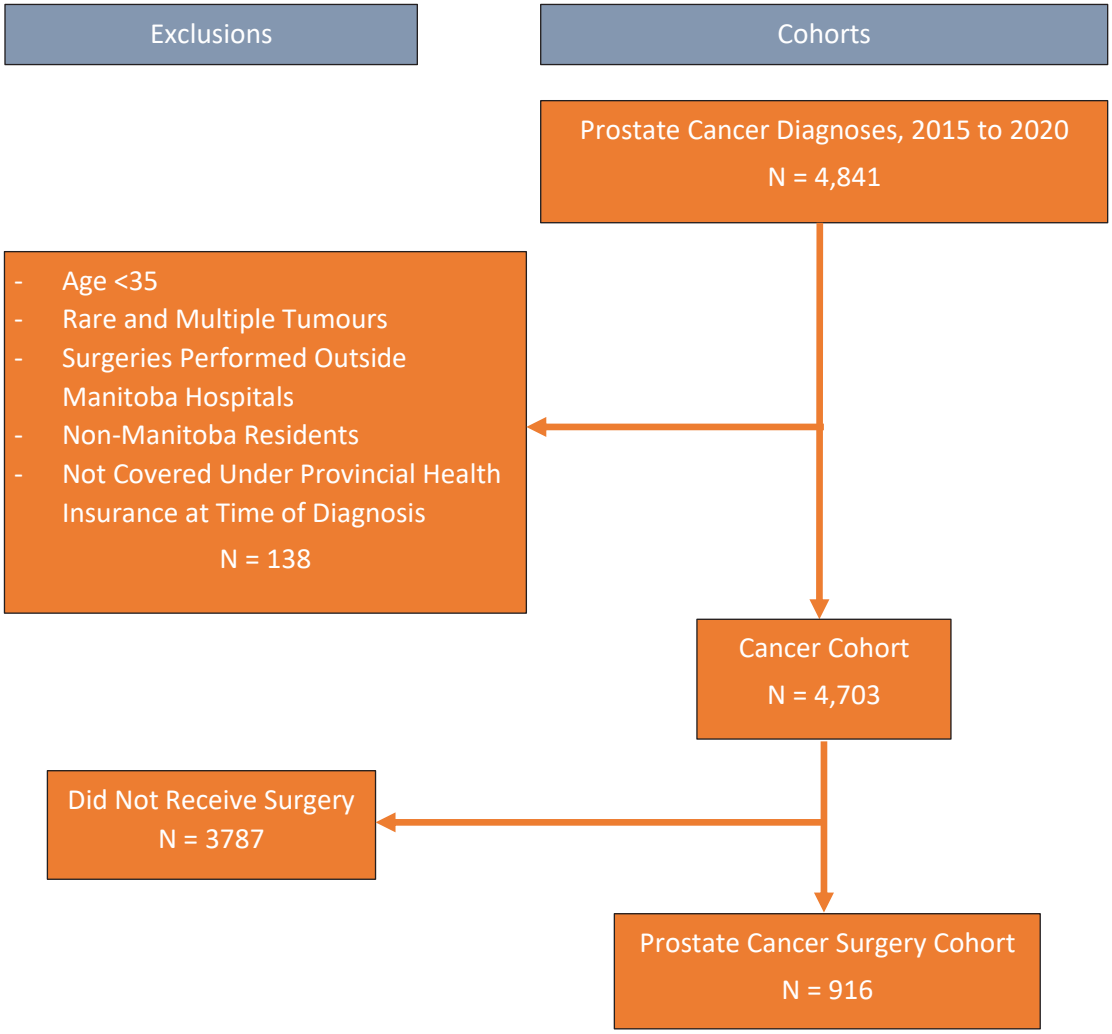
The median number of days between the last surgical consult and first treatment date (surgery or chemotherapy) varied from 41 days in 2015 to 72 days in 2017.

CHAPTER 7. PROSTATE CANCER

Key Findings

- The number of individuals diagnosed with prostate cancer increased between 2015 and 2020. In 2019, 930 individuals were diagnosed with prostate cancer compared to 769 individuals in 2018.
- Between 2015 and 2020,
  - The percentage of prostate cancer patients who had surgery remained stable until a decrease from 20.1% in 2019 to 16.3% in 2020 due to incomplete treatment data and impact of the COVID-19 pandemic on the health care system.
  - Most prostate cancer surgeries (91.6%) were conducted in the Winnipeg Regional Health Authority.
  - Four percent of prostate cancer patients had an in-hospital post-operative complication. Most complications were related to infections (42.3%).
  - The median length of stay between surgery and discharge was 4 days.
  - Readmission to hospital within 30 days of surgery occurred for 5.8% of prostate cancer patients.
  - The percentage of prostate cancer patients who had 1-7 lymph nodes removed was 33.7% in the Winnipeg Regional Health Authority and 68.8% in Prairie Mountain Health. The percentage of prostate cancer patients who had 8 or more lymph nodes removed was 64.6 % in the Winnipeg Regional Health Authority and 27.3% in Prairie Mountain Health.
  - Seven percent of prostate cancer patients had Androgen Deprivation Therapy prior to surgery.
  - Fifty-six percent of prostate cancer patients who had surgery had extraprostatic extension. This varied by surgical approach; 56.4% of open surgeries and 28.6% of laparoscopic surgeries had an extraprostatic extension. Percentages were similar by RHA of surgery.
  - The median number of days between biopsy and surgery was 160 days. This decreased from 185 in 2017 to 113 in 2020 and ranged from 126 days for patients living in Prairie Mountain Health to 216 days for patients living in the Northern Health Region.

Prostate Cancer and Cancer Surgery Cohorts



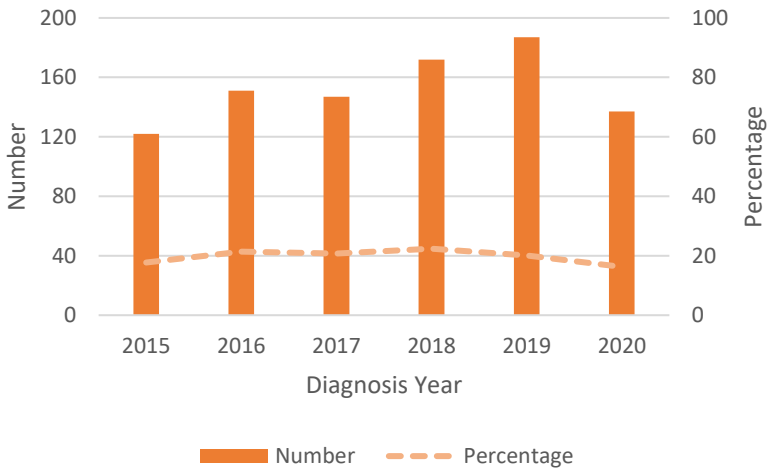
Descriptive Indicators

Table 7. 1 Number of individuals diagnosed with prostate cancer

Diagnosis Year	Prostate Cancer
2015	687
2016	708
2017	709
2018	769
2019	930
2020	900

The number of individuals diagnosed with prostate cancer increased by 21% from 769 in 2018 to 930 in 2019. Increases in prostate cancer occurred in Manitoba previously and were associated with healthcare system changes (e.g. new urologists in the system).

Figure 7. 1 Number and percentage of prostate cancer patients who had surgery

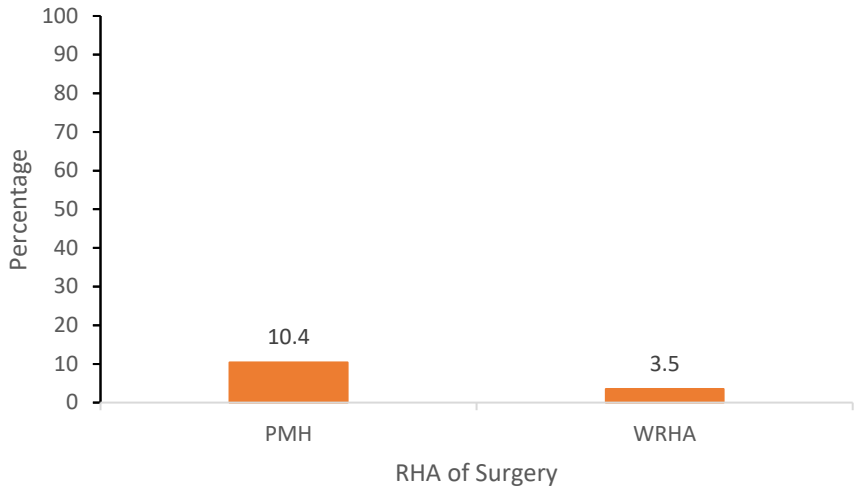


The percentage of prostate cancer patients who had surgery remained stable until a decrease from 20.1% in 2019 to 16.3% in 2020 due to incomplete treatment data and the impact of the COVID-19 pandemic on the health care system.

Most prostate cancer surgeries (91.6%) were conducted in the Winnipeg Regional Health Authority.

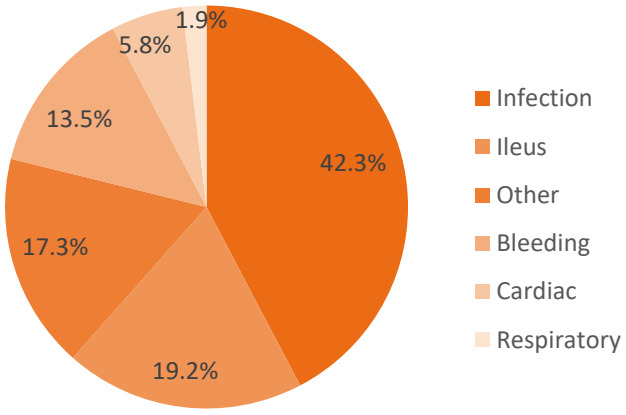
Surgical Quality Indicators

Figure 7. 2 Percentage of prostate cancer patients who had a post-operative complication following surgery by regional health authority (RHA) of surgery, 2015 to 2020



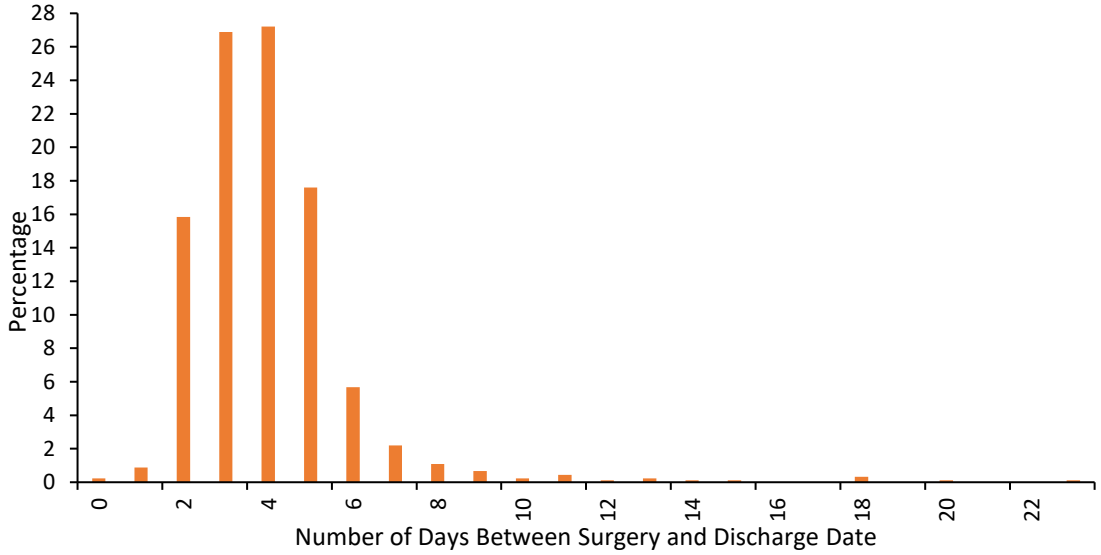
Between 2015 and 2020, 10.4% of prostate cancer patients who had surgery in Prairie Mountain Health and 3.5% who had surgery in the Winnipeg Regional Health Authority had a post-operative complication.

Figure 7. 3 Percentage of in-hospital post-operative complications experienced by prostate cancer patients by complication type, 2015 to 2020



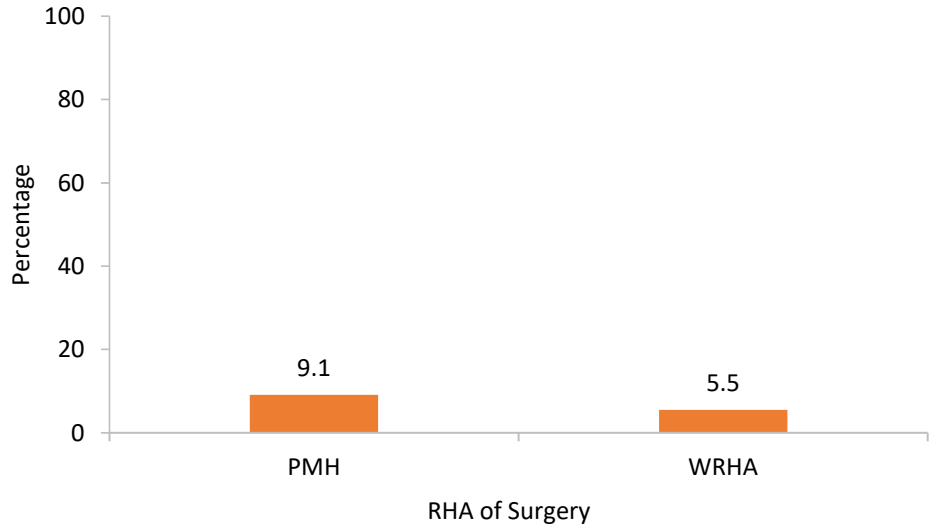
Most complications were related to infections (42.3%) followed by ilei (19.2%). A complete list of post-operative complications can be found in Appendix 7.1.

Figure 7. 4 Post-operative median length of stay in prostate cancer patients, 2015 to 2020



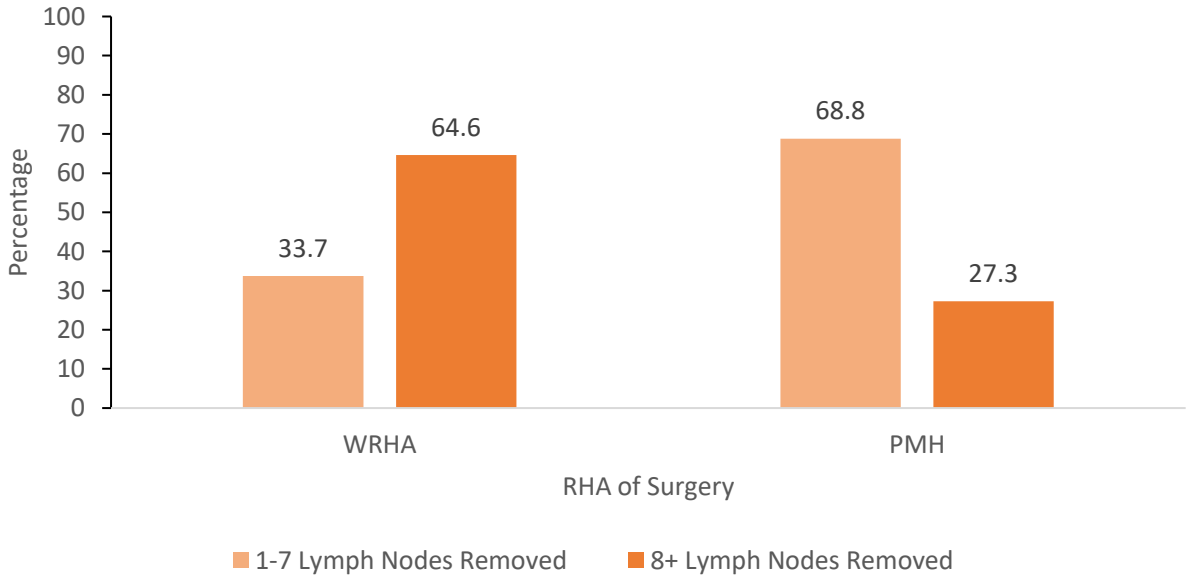
Between 2015 and 2020, the median length of stay between surgery date and discharge was 4 days for prostate cancer surgery patients.

Figure 7. 5 Percentage of prostate cancer patients who were readmitted within 30 days of surgery by regional health authority (RHA) of surgery, 2015 to 2020



Between 2015 and 2020, 9.1% of prostate cancer patients who had surgery in Prairie Mountain Health and 5.5% of prostate cancer patients who had surgery in the Winnipeg Regional Health Authority were readmitted to hospital within 30 days of surgery.

Figure 7. 6 Percentage of prostate cancer patients who had 1 to 7 or 8 or more lymph nodes removed and examined during surgery by regional health authority (RHA) of surgery, 2015 to 2020

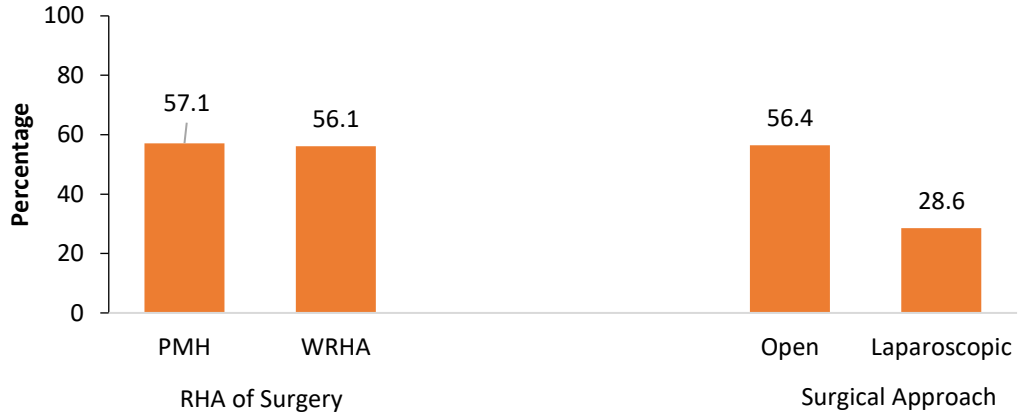


The percentage of prostate cancer patients who had 1-7 lymph nodes removed was 33.7% in the Winnipeg Regional Health Authority and 68.8% in Prairie Mountain Health. The percentage of prostate cancer patients who had 8 or more lymph nodes removed was 64.6 % in the Winnipeg Regional Health Authority and 27.3% in Prairie Mountain Health.

Androgen Deprivation Therapy

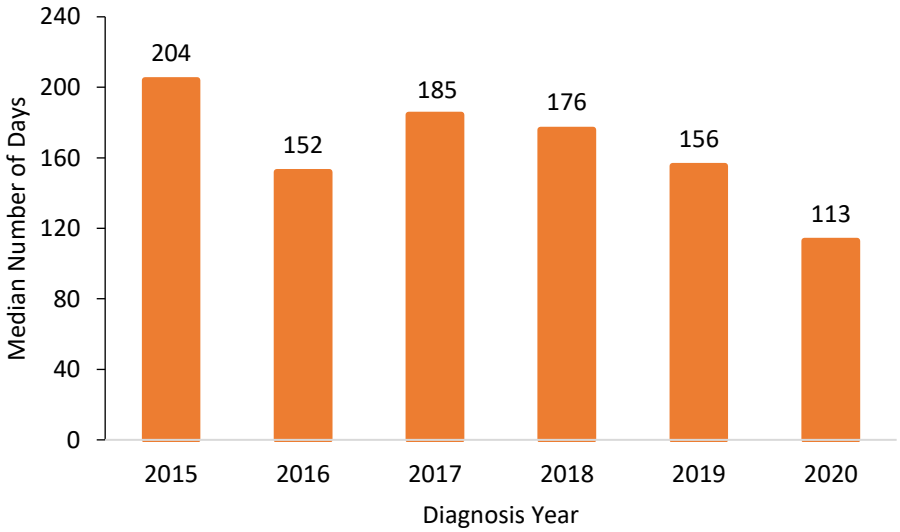
From 2015 to 2020, 6.9% of prostate cancer patients had Androgen Deprivation Therapy (ADT) prior to surgery. Androgen Deprivation Therapy was provided more frequently because of long surgery wait times exacerbated by the COVID-19 pandemic.

Figure 7. 7 Percentage of prostate cancer surgery patients with extraprostatic extension by regional health authority (RHA) of surgery and surgical approach, 2015 to 2020



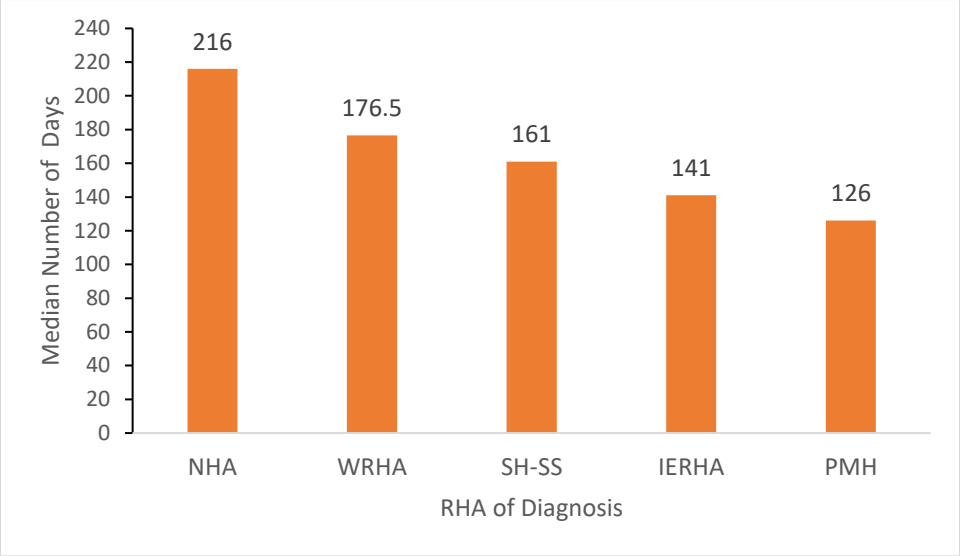
The percentage of prostate cancer surgery patients who had an extraprostatic extension was 57.1% in Prairie Mountain Health and 56.1% in the Winnipeg Regional Health Authority. The percentage of prostate cancer surgery patients who had an open surgical approach was 56.4% while 28.6% had laparoscopic surgery.

Figure 7. 8 Median number of days between last biopsy and first surgery date among prostate cancer patients by diagnosis year, 2015 to 2020



Between 2015 and 2020, the median number of days between the biopsy and surgery dates was 160 days. This decreased from 185 days in 2017 to 113 days in 2020.

Figure 7. 9 Median number of days between last biopsy date and first surgery date among prostate cancer patients by regional health authority (RHA) of diagnosis, 2015 to 2020



Between 2015 and 2020, the median number of days between biopsy date and surgery date ranged from 126 days for patients living in Prairie Mountain Health to 216 days for patients living in the Northern Health Region.

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ACRONYMS

BCS	Breast Conserving Surgery
BSO	Bilateral Salpingo-oophorectomy
CCMB	CancerCare Manitoba
CCI	Canada Classification of Health Interventions
CIHI	Canadian Institute for Health Information
CPAC	Canadian Partnership Against Cancer
CRC	Colorectal Cancer
CRM	Circumferential Resection Margin
DCIS	Ductal Carcinoma *in situ*
IERHA	Interlake-Eastern Regional Health Authority
KPI	Key Performance Indicator
LOS	Length of Stay
MCR	Manitoba Cancer Registry
MH	Manitoba Health
NCBC	National Consortium of Breast Centers
NHA	Northern Health Authority
NSQIP	National Surgical Quality Improvement Program
NSCLC	Non-Small Cell Lung Cancer
PLND	Pelvic Lymph Node Dissection
PMH	Prairie Mountain Health
RHA	Regional Health Authority
SCLC	Small Cell Lung Cancer
SH-SS	Southern Health - Santé Sud
WRHA	Winnipeg Regional Health Authority

GLOSSARY

Adjuvant therapy Treatment (e.g. chemotherapy, radiation, or hormonal therapy) provided after cancer surgery.	**Debulking** A surgical procedure that aims to remove as much visible cancer in the abdomen as possible.
Approach Method used to obtain access to the cancerous tissue that requires an invasive surgical treatment. For example, open versus laparoscopic approaches.	**Definitive surgery** A surgery that that has a curative intent and aims to remove the tumour.
Bilobectomy A surgical procedure where two adjacent lobes of the right lung are removed along with the tumour.	**Extraprostatic Extension (EPE)** Local spread of prostate cancer beyond the borders of the prostate.
Biopsy Removal of a tissue sample from the body that is examined by a pathologist for the presence of cancerous cells.	**Gleason score** Prostate tumours are microscopically examined, and are classified and assigned a Gleason score. Lower scores indicate a lower likelihood of metastasis.
Breast conserving surgery Also known as a lumpectomy, or partial mastectomy, breast conservation surgery is a procedure that removes the tumour and a thin margin of non-cancerous tissue around the tumour. Typically, breast conservation therapy preserves the skin, areola, and nipple.	**Hospital admission** When an individual enters the hospital and is registered as a patient.
Bypass (colorectal) A bypass is a surgical procedure in which a section of the bowel is bypassed internally, and is typically palliative.	**Hysterectomy** A surgery that removes the entire uterus.
Cohort A group of individuals that share a common characteristic.	**Immediate reconstruction** Surgical reconstruction of the breast that is conducted at the same time as a mastectomy.
Colonoscopy A procedure to examine the colon where a small camera is inserted through the anus.	**Incidence** The frequency of new cases in the Manitoba population.
CRM Circumferential Resection Margin (CRM) is the outer edge of the tissues removed during surgery. A negative CRM indicates that no cancerous tissues were present at the margin or within 1mm of the margin.	**Invasive breast cancer** Invasive breast cancer occurs when the cancerous cells have spread beyond the ducts or lobules to the surrounding breast tissue.

DCIS Ductal Carcinoma in situ (DCIS) occurs when abnormal cells proliferate in the breast, but do not spread beyond the milk duct.	**Key performance indicator** Measurable variable that can be used to assess and/or monitor a process or outcome.
Mastectomy Mastectomy removes the tumour along with all breast tissue. Mastectomies are considered simple, total, or radical depending on the extent of tissues removed. Mastectomies may remove or preserve the skin, areola and/or nipple, or muscle depending on disease progression and patient choice.	**Laparoscopic approach** Surgical method that uses instruments passed through small incisions in the abdominal wall, often with video guidance.
Median The middle value in a distribution.	**Readmission** When an individual who was previously discharged from a hospital after surgery is readmitted.
Metastasis When cancerous cells have spread to another part of the body from where the primary tumour is located.	**Re-excision** A second breast conserving surgery or mastectomy to treat the same tumour within one-year of the first breast conserving surgery.
Neo-adjuvant Treatment (e.g. chemotherapy, radiation, or hormonal therapy) provided before undergoing cancer surgery.	**Resection** Type of surgical procedure used to treat cancer by removing cancerous tissues along with some surrounding normal tissue.
Omentectomy A procedure that removes all or part of the omentum (the thin layer of tissues that envelopes abdominal organs including the intestines and stomach).	**Salpingo-oophorectomy** The surgical removal of one or both of the fallopian tubes and ovaries.
Oophorectomy The surgical removal of an ovary.	**Segmentectomy** A segmentectomy removes a larger anatomic segment of lung tissue, along with the tumour, than a wedge resection with division of the segmental bronchus, artery, and vein but does not remove a whole lobe.
Open approach A surgical method that involves making an incision in the skin to expose the site of the procedure.	**Stage** Designation given to tumours based on size and the degree that cancerous cells have spread to other tissues in the body.
Pneumonectomy A surgical procedure that completely removes either the right or left lung.	**Stoma** The part of the colon or small bowel that is exposed during a colostomy or ileostomy and opens at the skin surface.

Post-operative complication An undesirable and unplanned event that occurs after surgery that negatively affects a patient's health (e.g. cardiac event or wound infection). All post-operative complications in this report occurred during the same hospital stay as the index surgery.	**Surgical consult** Pre-operative meeting with the surgeon to undergo an assessment and discuss various aspects of the surgical procedure including risks and benefits.
Primary tumour The first/original tumour that originates in the body.	**Surgical procedure** A series of actions conducted to remove, treat, and/or alleviate the symptoms of cancer. Different types of cancer are associated with specific surgical procedures.
Prostatectomy (radical) A procedure that removes the tumour along with the entire prostate gland. Lymph nodes may or may not be removed as part of the procedure.	**VATS** Video-assisted thoracic surgery (VATS) is a surgical procedure where a thin tube with a camera is inserted into the thoracic cavity through a small incision. One or two additional incisions are made and instruments are passed through these incisions to allow the surgeon to complete the lung resection. Wedge A procedure that removes a small wedge or pie shaped portion of lung tissue and tumour from one lobe.

TECHNICAL APPENDIX
Cancer Surgery Quality in Manitoba

Cohort

Study Population

All Manitobans aged 20 or over diagnosed with an invasive colon, rectal, breast, ovarian, or lung tumour between January 1, 2015 and December 31, 2020 were included in this study. Manitoba residents 35 years old and over diagnosed with prostate cancer between 2015 and 2020 were included. Women with ductal carcinoma *in situ* (DCIS) during this period were also included.

Surgical Treatment

All relevant surgical treatments that were provided in the 12 months following a cancer diagnosis (up until March 31, 2021) were included in this study.

Procedures for the creation of stomas were also included if they preceded a colon or rectal resection which could be up to 1 year prior to their diagnosis date.

Cancer Site

The following cancers were included: colon, rectal, breast (female), ovarian, lung, and prostate. The table below contains the ICD-O codes that were used to identify each of these cancer sites.

Cancer Site	ICD-O Code
Colon	C18.0 (cecum), C18.2-C18.9 (colon), C19.9 (rectosigmoid junction)
Rectal	C20.9 (rectum, NOS)
Breast	C50 (breast)
Ovarian	C56.9 (ovary), C48.2 (peritoneum, NOS), C57* (other and unspecified female genital organs)
Lung	C34 (bronchus and lung)
Prostate	C61 (prostate gland)

**Ovarian includes other female genital organs because research suggests that most cancers of the female genital organs originate in the ovary.*

Data Sources

Database	Source of database	Years
Manitoba Cancer Registry (MCR)	CancerCare Manitoba	January 1, 2015-March 31, 2021
Medical Claims Database	Manitoba Health	January 1, 2015-March 31, 2021
Discharge (Hospital) Abstracts Database	Manitoba Health	January 1, 2015-March 31, 2021
Manitoba Health Coverage Data File	Manitoba Health	January 1, 2015-November 30, 2021

Breast Cancer Surgery

Breast Cancer Cohort

- The breast cancer cohort includes individuals diagnosed with invasive carcinoma or ductal carcinoma *in situ* between 2015 and 2020 who received treatment between 2015 and 2021. Note that the 2021 treatment data included in this report are only partially complete so treatment data was unavailable for some individuals diagnosed in 2020 at the time of analysis.
- Rare tumours that are not representative of the usual management course were excluded (Appendix 3.3).
- If a patient had more than one primary tumour diagnosed within 30 days, the highest stage tumour was included.
- If a patient had more than one primary tumour diagnosed within 1 year, but more than 30 days apart, the first tumour was included.

Breast Cancer Surgery Cohort

- The breast cancer surgery cohort includes patients who had breast cancer surgery within 12 months of their diagnosis date.
    - Of the 935 individuals who did not receive surgery, 209 died and 8 were lost to follow-up within 1 year from diagnosis.
- Cancer surgery information was obtained using the Manitoba Cancer Registry, the Manitoba Hospital Discharge Abstracts Database, and the Manitoba Medical Claims Database. Surgeries were coded following the Canadian Classification of Health Intervention (CCI) codes and are listed in Appendix 3.2.

Colorectal Cancer Surgery

Colorectal Cancer Cohort

- The colorectal cancer cohort includes individuals diagnosed with colon and rectal cancer between 2015 and 2020 who received treatment between 2015 and 2021. Note that the 2021 treatment data included in this report are only partially complete so treatment data was unavailable for some individuals diagnosed in 2020 at the time of analysis.
- Rare tumours that are not representative of the usual management course were excluded (Appendix 4.3).
- If a patient had more than one primary tumour diagnosed within 30 days, the highest stage tumour was included.
- If a patient had more than one primary tumour diagnosed within 1 year, but more than 30 days apart, the first tumour was included.

Colorectal Cancer Surgery Cohort

- The colorectal cancer surgery cohort includes patients who had colon and rectal cancer surgery within 12 months of their diagnosis date.
    - Of the 1380 individuals who did not receive surgery, 652 (476 colon, 176 rectum) died and 5 (4 colon, 1 rectum) were lost to follow-up within 1 year from diagnosis.
- Cancer surgery information was identified using a combination of the Manitoba Cancer Registry, the Manitoba Hospital Discharge Abstracts Database, and the Manitoba Medical Claims Database. Colorectal cancer surgeries were coded following the Canadian Classification of Health Intervention (CCI) codes and are listed in Appendix 4.2.

Lung Cancer Surgery

Lung Cancer Cohort

- The lung cancer cohort includes individuals diagnosed with non-small cell lung cancer between 2015 and 2020 who received treatment between 2015 and 2021. Note that the 2021 data included in this report are only partially complete so treatment data was unavailable for some individuals diagnosed in 2020 at the time of analysis.
- Rare tumours that are not representative of the usual management course were excluded (Appendix 5.3).
- If a patient had more than one primary tumour diagnosed within 30 days, the highest stage tumour was included.
- If a patient had more than one primary tumour diagnosed within 1 year, but more than 30 days apart, the first tumour was included.

Lung Cancer Surgery Cohort

- The lung cancer surgery cohort includes patients who had lung cancer surgery within 12 months of their diagnosis date.
    - Of the 3,635 individuals that did not receive surgery, 2,339 died and one was lost to follow-up within 1 year of diagnosis.
- Cancer surgery information was identified using a combination of the Manitoba Cancer Registry and the Manitoba Hospital Discharge Abstracts Database. Lung cancer surgeries were coded following the Canadian Classification of Health Intervention (CCI) codes and are listed in Appendix 5.2.

Ovarian Cancer Surgery

Ovarian Cancer Cohort

- The ovarian cancer cohort includes individuals diagnosed between 2015 and 2020 who received treatment between 2015 and 2021. Note that the 2021 treatment data included in this report are only partially complete so treatment data was unavailable for some individuals diagnosed in 2020 at the time of analysis.
- Rare tumours that are not representative of the usual management course were excluded (Appendix 6.3).
- If a patient had more than one primary tumour diagnosed within 30 days, the highest stage tumour was included.
- If a patient had more than one primary tumour diagnosed within 1 year, but more than 30 days apart, the first tumour was included.

Ovarian Cancer Surgery Cohort

- The ovarian cancer surgery cohort includes patients who had ovarian cancer surgery within 12 months of their diagnosis date.
    - Of the 159 individuals that did not receive surgery, 114 died within 1 year of diagnosis.
- Cancer surgery information was identified using the Manitoba Cancer Registry, the Manitoba Hospital Discharge Abstracts Database, and the Manitoba Medical Claims Database. Ovarian cancer surgeries were coded following the Canadian Classification of Health Intervention (CCI) codes and are listed in Appendix 6.2.

Prostate Cancer Surgery

Prostate Cancer Cohort

- The prostate cancer cohort includes individuals diagnosed between 2015 and 2020 who received treatment between 2015 and 2021. Note that the 2021 data included in this report are only partially complete so treatment data was unavailable for some individuals diagnosed in 2020 at the time of analysis.
- Rare tumours that are not representative of the usual management course were excluded (Appendix 7.3).
- If a patient had more than one primary tumour diagnosed within 30 days, the highest stage tumour was included.
- If a patient had more than one primary tumour diagnosed within 1 year, but more than 30 days apart, the first tumour was included.

Prostate Cancer Surgery Cohort

- The prostate cancer surgery cohort includes patients who had prostate cancer surgery within 12 months of their diagnosis.
    - Of the 3,787 individuals that did not receive surgery, 237 died and 11 were lost to follow-up within 1 year from diagnosis.
- Cancer surgery information was obtained from a combination of the Manitoba Cancer Registry and the Manitoba Hospital Discharge Abstracts Database. Surgeries were coded following the Canadian Classification of Health Intervention (CCI) codes and are listed in Appendix 7.2.

Complication List (ICD-O Code) List

ICD-O Codes

Breast Cancer

Appendix 3. 1 – In-hospital post-operative complications (breast cancer)

Complication	%
Bleeding	
T81.0: Haemorrhage and haematoma complicating a procedure, not elsewhere classified	57.14
Cardiac	
I21.4: Acute subendocardial myocardial infarction	2.38
I46.0: Cardiac arrest with successful resuscitation	1.19
I48.00: Paroxysmal atrial fibrillation	3.57
I48.02: Chronic atrial fibrillation	2.38
I49.9: Cardiac arrhythmia, unspecified	1.19
J81: Pulmonary oedema	1.19
Infection	
A04.7: Enterocolitis due to Clostridium difficile	1.19
A09.9: Gastroenteritis and colitis of unspecified origin	1.19
A41.9: Septicaemia, unspecified	1.19
B95.6: Staphylococcus aureus as the cause of diseases classified to other chapters	1.19
J18.9: Pneumonia, unspecified	1.19
T81.4: Infection following a procedure, not elsewhere classified	2.38
Respiratory	
J69.0: Pneumonitis due to food and vomit	1.19
J93.1: Other spontaneous pneumothorax	2.38
J93.9: Pneumothorax, unspecified	2.38
J95.2: Acute pulmonary insufficiency following nonthoracic surgery	3.57
J95.80: Postprocedural pneumothorax	1.19
J98.10: Atelectasis	2.38
Venous thromboembolism	
I26.9: Pulmonary embolism without mention of acute cor pulmonale	2.38
I82.8: Embolism and thrombosis of other specified veins	1.19
Other	

N17.9: Acute renal failure, unspecified	2.38
R33: Retention of urine	1.19
T81.3: Disruption of operation wound, not elsewhere classified	2.38

Colorectal Cancer

Appendix 4.1 a – In-hospital post-operative complications (colon cancer)

Complication	%
Bleeding	
K92.2: Gastrointestinal hemorrhage, unspecified	2.37
R57.1: Hypovolemic shock	0.21
T81.0: Hemorrhage and hematoma complicating a procedure, not elsewhere classified	4.44
Cardiac	
I21.0: Acute transmural myocardial infarction of anterior wall	0.41
I21.3: Acute transmural myocardial infarction of unspecified site	0.1
I21.4: Acute sub endocardial myocardial infarction	0.83
I21.9: Acute myocardial infarction, unspecified	0.52
I24.8: Other forms of acute ischemic heart disease	0.1
I24.9: Acute ischemic heart disease, unspecified	0.1
I30.9: Acute pericarditis, unspecified	0.1
I46.0: Cardiac arrest with successful resuscitation	0.52
I46.9: Cardiac arrest, unspecified	0.41
I48.00: Paroxysmal atrial fibrillation	1.44
I48.02: Chronic atrial fibrillation	0.31
I49.9: Cardiac arrhythmia, unspecified	0.21
J81: Pulmonary oedema	1.44
Ileus	
K56.7: Ileus, unspecified	16.20
K56.0: Paralytic ileus	0.72
Infection	
A04.7: Enterocolitis due to Clostridium difficile	1.65
A09.0: Other and unspecified gastroenteritis and colitis of infectious origin	0.21
A09.9: Gastroenteritis and colitis of unspecified origin	0.93
A41.0: Septicemia due to Staphylococcus aureus	0.1
A41.1: Septicemia due to other specified staphylococcus	0.1
A41.51: Septicemia due to Pseudomonas	0.1
A41.58: Septicemia due to other gram-negative organisms	0.21
A41.8: Other specified septicemia	0.21
A41.80: Septicemia due to enterococcus	0.1

A41.9: Septicemia, unspecified	3.61
B95.21: Enterococcus as the cause of diseases classified to other chapters	0.1
B95.6: Staphylococcus aureus as the cause of diseases classified to other chapters	0.1
B96.1: Klebsiella pneumoniae [K. pneumoniae] as the cause of diseases classified to other chapters	0.31
B96.2: Escherichia coli [E. coli] as the cause of diseases classified to other chapters	0.93
B96.4: Proteus (mirabilis)(morganii) as the cause of diseases classified to other chapters	0.1
B96.5: Pseudomonas (aeruginosa)(mallei)(pseudomallei) as the cause of diseases classified to other chapters	0.21
J15.0: Pneumonia due to Klebsiella pneumoniae	0.1
J18.0: Bronchopneumonia, unspecified	0.1
J18.1: Lobar pneumonia, unspecified	0.21
J18.9: Pneumonia, unspecified	4.23
K62.5: Hemorrhage of anus and rectum	0.93
K63.0: Abscess of intestine	0.52
K63.2: Fistula of intestine	1.44
K65.0: Acute peritonitis	4.75
K65.8: Other peritonitis	0.52
K65.9: Peritonitis, unspecified	0.31
L02.2: Cutaneous abscess, furuncle and carbuncle of trunk	0.52
N32.1: Vesicointestinal fistula	0.52
R57.2: Septic shock	2.79
T81.4: Infection following a procedure, not elsewhere classified	11.56
T81.82: Persistent postoperative fistula	0.21
T81.83: Postoperative leak	6.19
Respiratory	
J69.0: Pneumonitis due to food and vomit	1.96
J69.8: Pneumonitis due to other solids and liquids	0.21
J80: Adult respiratory distress syndrome	0.52
J90: Pleural effusion, not elsewhere classified	1.34
J91: Pleural effusion in conditions classified elsewhere	0.1
J93.0: Spontaneous tension pneumothorax	0.1
J93.9: Pneumothorax, unspecified	0.21
J94.8: Other specified pleural conditions	0.1
J95.2: Acute pulmonary insufficiency following nonthoracic surgery	2.37

J95.80: Postprocedural pneumothorax	0.1
J95.88: Other postprocedural respiratory disorders	0.1
J98.10: Atelectasis	1.14
Venous thromboembolism	
I26.0: Pulmonary embolism with mention of acute cor pulmonale	0.21
I26.9: Pulmonary embolism without mention of acute cor pulmonale	2.58
I82.9: Embolism and thrombosis of unspecified vein	0.1
Other	
E86.0: Dehydration	0.93
K31.6: Fistula of stomach and duodenum	0.1
L89.0: Decubitus ulcer limited to erythema only [redness] without skin breakdown (Stage 1)	0.21
L89.1: Decubitus ulcer limited to breakdown of skin (Stage 2)	0.62
L89.9: Decubitus ulcer without mention of severity	0.21
N17.0: Acute renal failure with tubular necrosis	0.52
N17.9: Acute renal failure, unspecified	5.68
R33: Retention of urine	3.2
T81.3: Disruption of operation wound, not elsewhere classified	3.10

Appendix 4.1 b – In-hospital post-operative complications (rectal cancer)

Complication	%
Bleeding	
R57.1: Hypovolemic shock	0.31
T81.0: Hemorrhage and hematoma complicating a procedure, not elsewhere classified	3.09
Cardiac	
I21.1: Acute transmural myocardial infarction of inferior wall	0.31
I21.3: Acute transmural myocardial infarction of unspecified site	0.31
I21.4: Acute sub endocardial myocardial infarction	0.31
I21.9: Acute myocardial infarction, unspecified	0.31
I33.0: Acute and subacute infective endocarditis	0.31
I46.0: Cardiac arrest with successful resuscitation	1.54
I46.9: Cardiac arrest, unspecified	0.31
I48.00: Paroxysmal atrial fibrillation	0.62
I48.02: Chronic atrial fibrillation	0.62
Ileus	
K56.7: Ileus, unspecified	22.22
K56.0: Paralytic ileus	0.31
Infection	
A04.7: Enterocolitis due to Clostridium difficile	0.93
A09.9: Gastroenteritis and colitis of unspecified origin	0.31
A40.8: Other streptococcal septicemia	0.31
A41.0: Septicemia due to Staphylococcus aureus	0.31
A41.58: Septicemia due to other gram-negative organisms	0.62
A41.8: Other specified septicemia	0.31
A41.9: Septicemia, unspecified	0.93
B95.21: Enterococcus as the cause of diseases classified to other chapters	0.31
B95.6: Staphylococcus aureus as the cause of diseases classified to other chapters	0.31
B95.7: Other staphylococcus as the cause of diseases classified to other chapters	0.93
B96.2: Escherichia coli [E. coli] as the cause of diseases classified to other chapters	1.23
B96.4: Proteus (mirabilis)(morganii) as the cause of diseases classified to other chapters	0.31
J15.0: Pneumonia due to Klebsiella pneumoniae	0.31
J18.9: Pneumonia, unspecified	3.7
J85.0: Gangrene and necrosis of lung	0.31
K62.5: Hemorrhage of anus and rectum	0.93
K63.2: Fistula of intestine	0.62
K65.0: Acute peritonitis	4.32
K65.8: Other peritonitis	0.31
K65.9: Peritonitis, unspecified	0.62

L02.2: Cutaneous abscess, furuncle and carbuncle of trunk	0.31
R57.2: Septic shock	1.23
T81.4: Infection following a procedure, not elsewhere classified	13.27
T81.83: Postoperative leak	6.48
Respiratory	
J69.0: Pneumonitis due to food and vomit	1.54
J69.8: Pneumonitis due to other solids and liquids	0.31
J80: Adult respiratory distress syndrome	0.31
J90: Pleural effusion, not elsewhere classified	0.62
J95.2: Acute pulmonary insufficiency following nonthoracic surgery	1.23
J95.88: Other postprocedural respiratory disorders	0.31
J98.10: Atelectasis	0.62
R09.2: Respiratory arrest	0.31
Venous thromboembolism	
I26.9: Pulmonary embolism without mention of acute cor pulmonale	1.54
Other	
E86.0: Dehydration	0.93
L89.1: Decubitus ulcer limited to breakdown of skin (Stage 2)	0.93
L89.2: Decubitus ulcer with fat layer exposed (Stage 3)	0.93
L89.8: Decubitus ulcer with necrosis involving muscle or bone (Stage X)	0.31
L89.9: Decubitus ulcer without mention of severity	0.62
N17.0: Acute renal failure with tubular necrosis	0.93
N17.9: Acute renal failure, unspecified	5.25
R33: Retention of urine	7.41
T81.3: Disruption of operation wound, not elsewhere classified	6.17

Lung Cancer Surgery

Appendix 5. 1 – In-hospital post-operative complications (lung cancer)

Complication	%
Bleeding	
T81.0: Haemorrhage and haematoma complicating a procedure, not elsewhere classified	7.19
Cardiac	
I21.4: Acute subendocardial myocardial infarction	3.60
I21.9: Acute myocardial infarction, unspecified	0.36
I24.9: Acute ischaemic heart disease, unspecified	0.36
I30.9: Acute pericarditis, unspecified	0.36
I46.0: Cardiac arrest with successful resuscitation	0.72
I46.9: Cardiac arrest, unspecified	1.08
I48.00: Paroxysmal atrial fibrillation	4.68
I48.02: Chronic atrial fibrillation	0.36
I49.9: Cardiac arrhythmia, unspecified	0.36
J81: Pulmonary oedema	0.36
Ileus	
K56.7: Ileus, unspecified	1.44
K56.0: Paralytic ileus	0.36
Infection	
A04.7: Enterocolitis due to Clostridium difficile	0.36
A41.9: Septicaemia, unspecified	0.36
B95.6: Staphylococcus aureus as the cause of diseases classified to other chapters	0.36
J15.1: Pneumonia due to Pseudomonas	1.08
J15.2 : Pneumonia due to Staphylococcus	0.36
J18.0: Bronchopneumonia, unspecified	0.36
J18.9: Pneumonia, unspecified	9.71
J86.9: Pyothorax without fistula	0.72
L02.2: Cutaneous abscess, furuncle and carbuncle of trunk	0.36
R57.2: Septic shock	0.36
T81.4: Infection following a procedure, not elsewhere classified	1.44
T81.83: Postoperative leak	25.9
Respiratory	
J69.0: Pneumonitis due to food and vomit	2.16

J80: Adult respiratory distress syndrome	2.16
J90: Pleural effusion, not elsewhere classified	2.52
J91: Pleural effusion in conditions classified elsewhere	0.36
J93.1: Other spontaneous pneumothorax	0.72
J93.8: Other pneumothorax	0.36
J93.9: Pneumothorax, unspecified	2.52
J94.1: Fibrothorax	0.72
J94.2: Haemothorax	2.16
J94.8: Other specified pleural conditions	2.52
J95.2: Acute pulmonary insufficiency following nonthoracic surgery	1.08
J95.80: Postprocedural pneumothorax	5.04
J95.88: Other postprocedural respiratory disorders	3.24
J98.10: Atelectasis	2.16
Venous thromboembolism	
I26.0: Pulmonary embolism with mention of acute cor pulmonale	0.36
I26.9: Pulmonary embolism without mention of acute cor pulmonale	3.60
Other	
I89.8: Other specified noninfective disorders of lymphatic vessels and lymph nodes	0.72
L89.0: Decubitus ulcer limited to erythema only [redness] without skin breakdown (Stage 1)	0.36
L89.1: Decubitus ulcer limited to breakdown of skin (Stage 2)	0.36
L89.2: Decubitus ulcer with fat layer exposed (Stage 3)	0.36
N17.9: Acute renal failure, unspecified	2.16
R33: Retention of urine	1.80

Ovarian Cancer

Appendix 6. 1 – In-hospital post-operative complications (ovarian cancer)

Complication	%
Bleeding	
R57.1: Hypovolaemic shock	0.85
T81.0: Haemorrhage and haematoma complicating a procedure, not elsewhere classified	9.4
Cardiac	
I46.0: Cardiac arrest with successful resuscitation	0.85
J81: Pulmonary oedema	0.85
Ileus	
K56.7: Ileus, unspecified	21.37
K56.0: Paralytic ileus	0.85
Infection	
A09.0: Other and unspecified gastroenteritis and colitis of infectious origin	0.85
A09.9: Gastroenteritis and colitis of unspecified origin	3.42
A41.0: Septicemia due to Staphylococcus aureus	0.85
A41.9: Septicemia, unspecified	2.56
B96.2: Escherichia coli [E. coli] as the cause of diseases classified to other chapters	1.71
J18.9: Pneumonia, unspecified	5.13
K65.0: Acute peritonitis	5.13
L02.2: Cutaneous abscess, furuncle and carbuncle of trunk	1.71
R57.2: Septic shock	0.85
T81.4: Infection following a procedure, not elsewhere classified	11.97
T81.83: Postoperative leak	1.71
Respiratory	
J69.0: Pneumonitis due to food and vomit	1.71
J80: Adult respiratory distress syndrome	1.71
J90: Pleural effusion, not elsewhere classified	4.27
J95.2: Acute pulmonary insufficiency following non-thoracic surgery	2.56
J98.10: Atelectasis	0.85
Venous thromboembolism	
I26.9: Pulmonary embolism without mention of acute corpulmonale	4.27
I82.8: Embolism and thrombosis of other specified veins	1.71
Other Complications	
N17.0: Acute renal failure with tubular necrosis	0.85
N17.9: Acute renal failure, unspecified	4.27
R33: Retention of urine	1.71
T81.3: Disruption of operation wound, not elsewhere classified	5.98

Prostate Cancer

Appendix 7. 1 – In-hospital post-operative complications (prostate cancer)

Complication	%
Bleeding	
R57.1: Hypovolaemic shock	1.92
T81.0: Haemorrhage and haematoma complicating a procedure, not elsewhere classified	11.54
Cardiac	
I21.4: Acute subendocardial myocardial infarction	1.92
I48.00: Paroxysmal atrial fibrillation	3.85
Ileus	
K56.7: Ileus, unspecified	17.31
K56.0: Paralytic, Ileus	1.92
Infection	
A04.7: Enterocolitis due to Clostridium difficile	1.92
A09.9: Gastroenteritis and colitis of unspecified origin	1.92
A41.9: Septicaemia, unspecified	1.92
J18.9: Pneumonia, unspecified	1.92
J85.2: Abscess of lung without pneumonia	1.92
K65.9: Peritonitis, unspecified	1.92
N32.1: Vesicointestinal fistula	1.92
R57.2: Septic shock	1.92
T81.4: Infection following a procedure, not elsewhere classified	11.54
T81.82: Persistent postoperative fistula	1.92
T81.83: Postoperative Leak	13.46
Respiratory	1.92
J98.10: Atelectasis	1.92
Other Complications	
N17.0: Acute renal failure with tubular necrosis	1.92
N17.9: Acute renal failure, unspecified	7.69
R33: Retention of urine	1.92
T81.3: Disruption of operation wound, not elsewhere classified	5.77

Procedure (CCI) Codes

Breast – Procedure

Appendix 3. 2 – CCI codes for breast cancer surgery

Procedure	CCI Codes
Breast conserving surgery	1YM87DA, 1YM87GB, 1YM87LA, 1YM87LAXXA, 1YM87UTXXA, 1YM87LAXXE, 1YM87UT, 1YM88UTXXE, 1YM88LAPM, 1YM88LATP, 1YM88LAPMG, 1YM88LAPMF, 1YM88LAPME, 1YM88LATPE, 1YM88LAPMK, 1YM88LATPK, 1YM88LATPG, 1YM88LAXXG, 1YM88LATPF, 1YM88LAXXF
Mastectomy without immediate reconstruction	1YM89LA, 1YM89LAXXA, 1YM89LAXXE, 1YM91LA, 1YM91LAXXA, 1YM91LAXXE, 1YM91LATP, 1YM91LAPM, 1YM91LAXXQ, 1YM91TR, 1YM91TRXXA, 1YM91TRXXE, 1YM91WP, 1YM91WPXXA, 1YM91WPXXE
Mastectomy with immediate reconstruction	1YM90LAXXE, 1YM90LAXXG, 1YM90LAXXF, 1YM90LAXXQ, 1YM90LAPM, 1YM90LAPMG, 1YM90LAPMF, 1YM90LAPME, 1YM90LAPMK, 1YM90LATP, 1YM90LATPG, 1YM90LATPF, 1YM90LATPE, 1YM90LATPK, 1YM90LAQF, 1YM90LAQFF, 1YM90LAQFG, 1YM90LAQFE, 1YM92LAXXE, 1YM92LAXXG, 1YM92LAXXF, 1YM92LAXXQ, 1YM92LAPMG, 1YM92LAPMF, 1YM92LAPME, 1YM92LAPMK, 1YM92LATPG, 1YM92LATPF, 1YM92LATPE, 1YM92LATPK, 1YM92LAQFF, 1YM92LAQFG, 1YM92TRQFE, 1YM92TRQFF, 1YM92TRQFG, 1YM92TRXXG, 1YM92TRXXF, 1YM92TRXXQ, 1YM92TRPMG, 1YM92TRPMF, 1YM92TRPME, 1YM92TRPMK, 1YM92TRTPG, 1YM92TRTPF, 1YM92TRTPE, 1YM92TRTPK, 1YM92TRXXE, 1YM92WPQFF, 1YM92WPQFG, 1YM92WPXXG, 1YM92WPXXF, 1YM92WPXXQ, 1YM92WPPMG, 1YM92WPPMF, 1YM92WPPME, 1YM92WPPMK, 1YM92WPTPG, 1YM92WPTPF, 1YM92WPTPE, 1YM92WPTPK, 1YM92WPQFE
Axillary lymph node dissection	1MD87LA, 1MD89LA, 1MD89LAXXA, 1MD89LAXXE, 1MD89LAXXF, 1MD89LAXXG, 1MD89LAXXN

Colorectal – Procedure

Appendix 4.2 – CCI codes for colorectal cancer surgery

Colorectal - Procedure	**CCI Code**
Resection with reversible stoma	1NK77EN, 1NK77RR, 1NM77DY, 1NM77EP, 1NM77EPXXG, 1NM77RS, 1NM77RSXXG, 1NM77TG
Resection with potentially reversible stoma	1NK87DX, 1NK87DY, 1NK87TF, 1NK87TG, 1NM87DX, 1NM87DY, 1NM87TF, 1NM87TG, 1NM89DX, 1NM89TF, 1NM91DE, 1NM91DX, 1NM91DY, 1NM91TF, 1NM91TG, 1NQ87DX, 1NQ87TF, 1NQ89KZXXG, 1NQ89SFXXG
Resection with permanent stoma	1NQ89AB, 1NQ89LH, 1NQ89LHXXG, 1NQ89RS, 1NQ89RSXXG
Resection with no stoma	1NK87DN, 1NK87DA, 1NK87DP, 1NK87LA, 1NK87RE, 1NK87RF, 1NM87DA, 1NM87DE, 1NM87DF, 1NM87DN, 1NM87GB, 1NM87LA, 1NM87RD, 1NM87RE, 1NM87RN, 1NM87WJ, 1NM89DF, 1NM89KZXXG, 1NM89RN, 1NM89SFXXG, 1NM91DF, 1NM91DN, 1NM91RD, 1NM91RE, 1NM91RN, 1NQ87CA, 1NQ87DA, 1NQ87DE, 1NQ87DF, 1NQ87LA, 1NQ87PB, 1NQ87PF, 1NQ87RD, 1NQ89GV, 1NQ89KZ, 1NQ89SF, 1NQ90LAXXG

Lung – Procedure

Appendix 5. 2 – CCI codes for lung cancer surgery

Procedure	CCI Code
Sublobar resection	1GR87DA, 1GR87NW, 1GR87QB
Lobectomy	1GR91QB, 1GR91QBXXA, 1GR91QBXXG, 1GR91QBXXF, 1GR91QBXXN, 1GR91QBXXQ, 1GR91NW, 1GR91NWXXA, 1GR91NWXXG, 1GR91NWXXF, 1GR91NWXXN, 1GR91NWXXQ, 1GR91NWXXL, 1GR89DA, 1GR89NW, 1GR89QB
Bilobectomy	1GT87DA, 1GT87NW, 1GT87QB
Pneumonectomy	1GT89DA, 1GT89NW, 1GT89QB, 1GT91QB, 1GT91QBXXN, 1GT91QBXXG, 1GT91QBXXF, 1GT91QBXXQ, 1GT91NW, 1GT91NWXXN, 1GT91NWXXG, 1GT91NWXXF, 1GT91NWXXQ

Ovarian – Procedure

Appendix 6. 2 – CCI codes for ovarian cancer surgery

Procedure	CCI Code
Unilateral salpingo-oophorectomy (USO) or bilateral salpingo-oophorectomy (BSO)	1RB87DA, 1RB87LA, 1RB87RA, 1RB89, 1RB89DA, 1RB89LA, 1RB89RA, 1RD89, 1RD89DA, 1RD89LA, 1RD89RA, 1RF87, 1RF87DA, 1RF87LA, 1RF87RA, 1RF89, 1RF89DA, 1RF89LA, 1RF89RA
Hysterectomy	1RM87, 1RM87DAGX, 1RM87DAAK, 1RM87DAAG, 1RM87BAGX, 1RM87BAAK, 1RM87BAAG, 1RM87CAAF, 1RM87CAAE, 1RM87CAGX, 1RM87CAAK, 1RM87LAGX, 1RM87LAAK, 1RM89, 1RM89AA, 1RM89CA, 1RM89DA, 1RM89LA, 1RM91, 1RM91AA, 1RM91CA, 1RM91DA, 1RM91LA
Omentectomy	1OT87DA, 1OT87LA, 1OT91LA
Debulking	1NV89DA, 1NV89LA, 1OB87, 1OB89, 1OA87, 1GX87, 1NM77, 1RS87, 1RS89, 1PM87, 1PM89, 1PM91, 1NM87, 1NM89, 1NM91, 1NQ87, 1NQ89, 1NK87, 1NK58, 1PM77, 1PV80, 1RM59, 1RN59
Vulva and cervix resection	1RW87, 1RW88, 1RW91, 1RY87, 1RN87, 1RN89
Lymph node excision	1MH87DA, 1MH87LA, 1MG87DA, 1MG87LA, 1MG87QF, 1MJ87, 1MJ89, 1MJ91, 1MG89, 1MH89

Prostate – Procedure

Appendix 7. 2 – CCI codes for prostate cancer surgery

Procedure	CCI Code
Radical prostatectomy	1QT91PB, 1QT91PK, 1QT91DA

Excluded Tumour Types

Breast Cancer Excluded Tumour

Appendix 3. 3 – Breast cancer excluded tumour types

Tumour Type	Morphology Code
Sarcomas, lymphomas, and ill-defined tumours	8710, 8800, 8801, 8802, 8803, 8804, 8805, 8806, 8810, 8811, 8812, 8813, 8814, 8832, 8833, 8840, 8850, 8851, 8852, 8853, 8854, 8855, 8857, 8858, 8890, 8891, 8894, 8895, 8896, 8900, 8901, 8902, 8910, 8912, 8920, 8921, 8930, 8931, 8933, 8935, 8936, 8963, 8964, 8980, 8981, 8991, 9040, 9041, 9042, 9043, 9044, 9051, 9120, 9124, 9140, 9170, 9180, 9181, 9182, 9183, 9184, 9185, 9186, 9187, 9192, 9193, 9194, 9195, 9220, 9221, 9231, 9240, 9242, 9243, 9250, 9251, 9252, 9260, 9270, 9290, 9330, 9342, 9442, 9480, 9530, 9539, 9581, 9590-9999
Neuroendocrine tumours	8041, 8574, 8246, 8240, 8249, 8013, 8241
Other	8046, 9020

Colorectal Cancer Excluded Tumour

Appendix 4.3 – Colorectal cancer excluded tumour types

Tumour Type	Morphology Code
Sarcomas, lymphomas, and ill-defined tumours	8710, 8800, 8801, 8802, 8803, 8804, 8805, 8806, 8810, 8811, 8812, 8813, 8814, 8832, 8833, 8840, 8850, 8851, 8852, 8853, 8854, 8855, 8857, 8858, 8890, 8891, 8894, 8895, 8896, 8900, 8901, 8902, 8910, 8912, 8920, 8921, 8930, 8931, 8933, 8935, 8936, 8963, 8964, 8980, 8981, 8991, 9040, 9041, 9042, 9043, 9044, 9051, 9120, 9124, 9140, 9170, 9180, 9181, 9182, 9183, 9184, 9185, 9186, 9187, 9192, 9193, 9194, 9195, 9220, 9221, 9231, 9240, 9242, 9243, 9250, 9251, 9252, 9260, 9270, 9290, 9330, 9342, 9442, 9480, 9530, 9539, 9581, 9590-9999
Neuroendocrine tumours	8246, 8240, 8045, 8244, 8153, 8013, 8041, 8241, 8249, 8156, 8243, 8152
Other (colon)	8020
Other (rectum)	8083, 8510

Lung Cancer Excluded Tumour

Appendix 5. 3 – Lung cancer excluded tumour types

Tumour Type	Morphology Code
Sarcomas, lymphomas, and ill-defined tumours	8710, 8800, 8801, 8802, 8803, 8804, 8805, 8806, 8810, 8811, 8812, 8813, 8814, 8832, 8833, 8840, 8850, 8851, 8852, 8853, 8854, 8855, 8857, 8858, 8890, 8891, 8894, 8895, 8896, 8900, 8901, 8902, 8910, 8912, 8920, 8921, 8930, 8931, 8933, 8935, 8936, 8963, 8964, 8980, 8981, 8991, 9040, 9041, 9042, 9043, 9044, 9051, 9120, 9124, 9140, 9170, 9180, 9181, 9182, 9183, 9184, 9185, 9186, 9187, 9192, 9193, 9194, 9195, 9220, 9221, 9231, 9240, 9242, 9243, 9250, 9251, 9252, 9260, 9270, 9290, 9330, 9342, 9442, 9480, 9530, 9539, 9581, 9590-9999
Neuroendocrine tumours	8041, 8249, 8045, 8013, 8240, 8013, 8246, 8241

Ovarian Cancer Excluded Tumour

Appendix 6. 3 – Ovarian cancer excluded tumour types

Excluded Tumours	Morphology Code
Sarcomas, lymphomas, and ill-defined tumours	8710, 8800, 8801, 8802, 8803, 8804, 8805, 8806, 8810, 8811, 8812, 8813, 8814, 8832, 8833, 8840, 8850, 8851, 8852, 8853, 8854, 8855, 8857, 8858, 8890, 8891, 8894, 8895, 8896, 8900, 8901, 8902, 8910, 8912, 8920, 8921, 8930, 8931, 8933, 8935, 8936, 8963, 8964, 8980, 8981, 8991, 9040, 9041, 9042, 9043, 9044, 9051, 9120, 9124, 9140, 9170, 9180, 9181, 9182, 9183, 9184, 9185, 9186, 9187, 9192, 9193, 9194, 9195, 9220, 9221, 9231, 9240, 9242, 9243, 9250, 9251, 9252, 9260, 9270, 9290, 9330, 9342, 9442, 9480, 9530, 9539, 9581, 9590-9999

Prostate Cancer Excluded Tumour

Appendix 7. 3 – Prostate cancer excluded tumour types

Tumour Type	Morphology Code
Sarcomas, lymphomas, and ill-defined tumours	8710, 8800, 8801, 8802, 8803, 8804, 8805, 8806, 8810, 8811, 8812, 8813, 8814, 8832, 8833, 8840, 8850, 8851, 8852, 8853, 8854, 8855, 8857, 8858, 8890, 8891, 8894, 8895, 8896, 8900, 8901, 8902, 8910, 8912, 8920, 8921, 8930, 8931, 8933, 8935, 8936, 8963, 8964, 8980, 8981, 8991, 9040, 9041, 9042, 9043, 9044, 9051, 9120, 9124, 9140, 9170, 9180, 9181, 9182, 9183, 9184, 9185, 9186, 9187, 9192, 9193, 9194, 9195, 9220, 9221, 9231, 9240, 9242, 9243, 9250, 9251, 9252, 9260, 9270, 9290, 9330, 9342, 9442, 9480, 9530, 9539, 9581, 9590-9999
Neuroendocrine tumours	8013, 8041, 8240, 8574, 8249, 8246, 8241
Other	8045, 81303, 8255, 8490, 8500

Methodology

Descriptive Indicator Definitions

Percentage of individuals diagnosed with cancer who had surgery within 12 months of diagnosis	
Disease Site(s)	All disease site
Purpose/Rationale for Measurement	To determine the surgical treatment utilization in Manitoba
Indicator Calculation	$\frac{\text{Number of new cancer patients who have a surgical treatment within 12 months of diagnosis coded in Manitoba Cancer registry and/or DAD}}{\text{Number of cancer patients}} \times 100 =$ % of individuals diagnosed with cancer who had surgery within 12 months of diagnosis
Inclusion/Exclusion Criteria	Include those aged ≥20 (for prostate cancer age ≥35), Manitoba residents, invasive only. Exclude lymphomas, sarcomas, ill-defined tumours, and neuroendocrine tumours (neuroendocrine tumours included in ovarian tumours)
Data Source(s)	Manitoba Cancer Registry (MCR), Discharge Abstracts Database (DAD)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Percentage of cases that had cancer surgery within one year of diagnosis by regional health authority of residence	
Disease Site(s)	All disease site
Purpose/Rationale for Measurement	Determining the patients access to high-quality care closer to home.
Indicator Calculation	$\frac{\text{Number of cases that undergo surgery within one year of diagnosis by RHA in which they live at diagnosis}}{\text{Number of cases that undergo surgery within one year of diagnosis}} \times 100 =$ % of cancer surgery patients by RHA of residence
Inclusion/Exclusion Criteria	Include those aged ≥20 (for prostate cancer age ≥35), Manitoba residents, invasive only. Exclude lymphomas, sarcomas, ill-defined tumours, and neuroendocrine tumours (neuroendocrine tumours included in ovarian tumours)
Data Source(s)	Manitoba Cancer Registry (MCR), Manitoba Health Population Registry
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Percentage of cancer surgery patients who had at least one in-hospital post-operative complication	
Disease Site(s)	All disease sites
Purpose/Rationale for Measurement	To understand the rate of post-operative complications after surgery.
Indicator Calculation	$\frac{\text{Number of cancer surgery patients who had at least one in-hospital post-operative complication}}{\text{Total number of cancer patients who had surgery}} \times 100 =$ % of cancer surgery patients who had at least one in-hospital post-operative complication
Inclusion/Exclusion Criteria	Include those aged ≥20 (for prostate cancer age ≥35), Manitoba residents, invasive only. Exclude lymphomas, sarcomas, ill-defined tumours, and neuroendocrine tumours (neuroendocrine tumours included in ovarian tumours)
Data Source(s)	Manitoba Cancer Registry (MCR), Discharge Abstracts Data (DAD)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Percentage of cancer surgery patients who were readmitted to hospital within 30 days of surgery	
Disease Site(s)	All disease sites
Purpose/Rationale for Measurement	To determine the hospital readmission rate within province to incorporate coaching and teaching techniques in current paradigm.
Indicator Calculation	$\frac{\text{Number of cancer patients readmitted to hospital within 30 days of surgery}}{\text{Total number of cancer patients who had surgery}} \times 100 =$ % of cancer patients who were readmitted to hospital within 30 days of surgery
Inclusion/Exclusion Criteria	Include those aged ≥20 (for prostate cancer age ≥35), Manitoba residents, invasive only. Exclude lymphomas, sarcomas, ill-defined tumours, and neuroendocrine tumours (neuroendocrine tumours included in ovarian tumours)
Data Source(s)	Manitoba Cancer Registry (MCR), Discharge Abstracts Database (DAD)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Number of days between surgery date and discharge date among cancer surgery patients	
Disease Site(s)	All disease sites
Purpose/Rationale for Measurement	To determine the length of post-operative hospital stay and enabling patients to return to their routine life. Length of post-operative hospital stay is an important indicator of surgical quality.
Indicator Calculation	Report minimum, 50th percentile (median), 90th percentile, maximum. Also report the percentage by the number of days (see example figure below)
Inclusion/Exclusion Criteria	Include those aged ≥20 (for prostate cancer age ≥35), Manitoba residents, invasive only. Exclude lymphomas, sarcomas, ill-defined tumours, and neuroendocrine tumours (neuroendocrine tumours included in ovarian tumours)
Data Source(s)	Manitoba Cancer Registry (MCR), Discharge Abstracts Database (DAD)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Appendix 3. 4 – Breast quality indicator definitions

Percentage of invasive breast cancer patients who had a resection within 30 days of their surgical consult	
Disease Site(s)	Breast
Purpose/Rationale for Measurement	Timely access to care impacts patient satisfaction and outcomes and is an important health system measurement.
Indicator Calculation	Number of invasive breast cancer patients who had their first curative resection within 30 (<= 30) days from their first consult date / Number of invasive breast cancer patients who had a curative resection within one year after diagnosis X 100 = % of breast cancer patients who had a resection within 30 days of their surgical consult
Inclusion/Exclusion Criteria	Excludes patients who received neoadjuvant chemotherapy, tumours that are stage IV or have an unknown or not applicable stage, non-Manitoba residents at time of diagnosis, lymphomas, sarcomas, and neuroendocrine tumours. Includes those ≥20 at diagnosis and invasive tumours only.
Data Source(s)	Manitoba Cancer Registry (MCR), Medical Claims Database
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Percentage of patients who have breast cancer surgery in the same regional health authority in which they were diagnosed	
Disease Site(s)	Breast
Purpose/Rationale for Measurement	Patients should have access to high-quality care closer to home when appropriate.
Indicator Calculation	Number of breast cancer patients who had their first surgery within one year of diagnosis in their RHA of residence / Number of breast cancer patients who had a resection within one year of diagnosis X 100 = % of breast cancer patients who received their diagnosis and first surgery within one year in their regional health authority of residence
Inclusion/Exclusion Criteria	Excludes non-Manitoba residents at time of diagnosis, lymphomas, sarcomas, and neuroendocrine tumours. Includes those ≥20 at diagnosis.
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Percentage of invasive breast cancer patients who had axillary clearance within one year of diagnosis with no pathological evidence of nodal metastatic disease	
Disease Site(s)	Breast
Purpose/Rationale for Measurement	Patients with no nodal metastatic disease should not undergo an axillary lymph node dissection.
Indicator Calculation	$\frac{\text{Number of node negative invasive breast cancer patients who had an axillary dissection within one year of diagnosis}}{\text{Number of node negative invasive breast cancer patients}} \times 100 =$ % of invasive breast cancer patients who had axillary clearance within one year of diagnosis with no pathological evidence of nodal metastatic disease
Inclusion/Exclusion Criteria	Excludes patients who received neoadjuvant chemotherapy, tumours that are stage IV or have an unknown or not applicable stage, non-Manitoba residents at time of diagnosis, non-invasive/in situ cancers, lymphomas, sarcomas, and neuroendocrine tumours. Includes those ≥20 at diagnosis and invasive tumours only.
Data Source(s)	Manitoba Cancer Registry (MCR), Discharge Abstracts Database (DAD)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Percentage of breast cancer patients who had a re-excision within 1 year of a breast conserving surgery	
Disease Site(s)	Breast
Purpose/Rationale for Measurement	Re-excision can cause psychological and economic stress to patients and delays in adjuvant treatment. A low or high value for this indicator may be a sign of poor surgical quality. Low % = The amount of tissue removed is consistently excessive High % = The amount of tissue removed is consistently too conservative
Indicator Calculation	$\frac{\text{Number of breast cancer patients who had a re-excision within one year of breast conserving surgery}}{\text{Number of breast cancer patients who had breast conserving surgery within one year of diagnosis}} \times 100 =$ % of breast cancer patients who had a re-excision within 1 year of a breast conserving surgery
Inclusion/Exclusion Criteria	Exclude non-Manitoba residents at time of diagnosis, lymphomas, sarcomas, and neuroendocrine tumours. Includes those ≥20 at diagnosis.
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Appendix 4. 1 – Colorectal quality indicator definitions

Percentage of patients who have colon or rectal cancer surgery in the same regional health authority in which they were diagnosed	
Disease Site(s)	Colon, rectal (analyze separately)
Purpose/Rationale for Measurement	To understand access to colorectal cancer surgery access across Manitoba
Indicator Calculation	$\frac{\text{Number of patients who had colon or rectal cancer surgery in the same RHA in which they were diagnosed}}{\text{Total number of patients diagnosed with colon or rectal cancer that had surgery within one year of diagnosis}} \times 100$ = % of patients who have colon or rectal cancer surgery in the same RHA in which they were diagnosed
Inclusion/Exclusion Criteria	Exclude non-Manitoba residents at time of diagnosis, non-invasive/in situ cancers, lymphomas, sarcomas, and neuroendocrine tumours. Includes those ≥20 at diagnosis.
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Percentage of colon or rectal cancer patients who have a resection within one year of diagnosis who have >=12 lymph nodes removed and pathologically examined	
Disease Site(s)	Colon, rectal (analyze separately)
Purpose/Rationale for Measurement	• Critical for proper staging and adjuvant treatment planning. • Reflects most clinical guidelines. Removing 12 nodes provides a threshold at which the chance of false negative nodal staging is reduced.
Indicator Calculation	$\frac{\text{Number of individuals diagnosed with colon or rectal cancer who undergo a resection within one year of diagnosis and have >=12 lymph nodes removed and examined}}{\text{Total number of individuals diagnosed with colon or rectal cancer who have a resection within one year of diagnosis}} \times 100 =$ % of of colon or rectal cancer patients who have a resection within one year of diagnosis who have >=12 lymph nodes removed and pathologically examined
Inclusion/Exclusion Criteria	Exclude non-Manitoba residents at time of diagnosis, non-invasive/in situ cancers, lymphomas, sarcomas, and neuroendocrine tumours. Includes those ≥20 at diagnosis.
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Percentage of colon or rectal cancer patients who had surgery via a laparoscopic approach	
Disease Site(s)	Colon, rectal (analyze separately)
Purpose/Rationale for Measurement	Surgeries conducted via a laparoscopic approach leads to lower rate of complications post-operative pain, shorter length of stay, and improved quality of life.
Indicator Calculation	$\frac{\text{Number of individuals who had colon cancer surgery via a laparoscopic approach}}{\text{Total number of individuals who had colon cancer surgery}} \times 100 =$ % of colon cancer patients who had surgery via a laparoscopic approach
Inclusion/Exclusion Criteria	Exclude non-Manitoba residents at time of diagnosis, non-invasive/in situ cancers, lymphomas, sarcomas, and neuroendocrine tumours. Includes those ≥20 at diagnosis.
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Number of days between last biopsy and first resection for colon cancer patients who had surgery within one year of diagnosis	
Disease Site(s)	Colon
Purpose/Rationale for Measurement	To understand wait times for diagnostic services for colon cancer in Manitoba
Indicator Calculation	Report minimum, 50th percentile (median), 90th percentile, maximum Use the following tariff codes to identify biopsies: 3186, 3187, 3320
Inclusion/Exclusion Criteria	Exclude non-Manitoba residents at time of diagnosis, non-invasive/in situ cancers, individuals that received neoadjuvant chemotherapy, lymphomas, sarcomas, and neuroendocrine tumours. Includes those ≥20 at diagnosis.
Data Source(s)	Medical Claims Database, Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Percentage of individuals diagnosed with rectal cancer that had resections resulting in a positive circumferential resection margin (CRM)	
Disease Site(s)	Rectal
Purpose/Rationale for Measurement	A negative CRM indicates that no cancerous tissues were present at the margin or within 1mm of the margin. A positive CRM is associated with a higher chance of cancer recurrence. This indicator is an important and routinely used measure of surgical quality for rectal cancers.
Indicator Calculation	$\frac{\text{Number individuals diagnosed with rectal cancer that undergo a resection within one year of diagnosis that have a positive circumferential resection margin}}{\text{Total number of individuals diagnosed with rectal cancer that undergo a resection within one year of diagnosis}} \times 100 =$ % of individuals diagnosed with rectal cancer that had resections resulting in a positive circumferential resection margin
Inclusion/Exclusion Criteria	Exclude non-Manitoba residents at time of diagnosis, non-invasive/in situ cancers, lymphomas, sarcomas, and neuroendocrine tumours. Includes those ≥20 at diagnosis. Only stage II / III cancer.
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Percentage of colon or rectal cancer patients who had a liver resection for stage IV disease	
Disease Site(s)	Colon, rectal (analyze separately)
Purpose/Rationale for Measurement	A subset of patients with stage IV disease are candidates for metastasectomy. Rates of liver resections for stage IV disease is an important quality indicator for potentially curative surgery.
Indicator Calculation	$\frac{\text{Number of patients diagnosed with stage IV colon or rectal cancer patients who had a liver resection within 1 year}}{\text{Total number of patients diagnosed with stage IV colon or rectal cancer}} \times 100 =$ % of colon or rectal cancer patients who had a liver resection for stage IV disease
Inclusion/Exclusion Criteria	Exclude non-Manitoba residents at time of diagnosis, non-invasive/in situ cancers, lymphomas, sarcomas, and neuroendocrine tumours. Includes those ≥20 at diagnosis and stage IV patients only.
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Appendix 5. 4 – Lung quality indicator definitions

Proportion of non-small cell lung cancer patients who had a resection within one year of diagnosis (ages between 20 years and 74 years)	
Disease Site(s)	Lung
Purpose/Rationale for Measurement	This is an indicator of whether safe and curative surgical care is available in Manitoba.
Indicator Calculation	$\frac{\text{Number of NSCLC patients (age 20-74 years) who undergo surgery within 1 year of diagnosis}}{\text{Number of NSCLC patients who undergo surgery within 1 year of diagnosis}} \times 100 =$ % of NSCLC patients (age 20-74 years) who undergo surgery within 1 year of diagnosis
Inclusion/Exclusion Criteria	Include ages between 20years and 74 years; Manitoba residents only, invasive only Exclude lymphomas, sarcomas, ill-defined tumours, and small cell lung cancer (SCLC)
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Proportion of non-small cell lung cancer patients who had a resection within one year of diagnosis (ages ≥75 years)	
Disease Site(s)	Lung
Purpose/Rationale for Measurement	This is an indicator of whether safe and curative surgical care is available in Manitoba.
Indicator Calculation	$\frac{\text{Number of NSCLC patients (age ≥75 years) who undergo surgery within 1 year of diagnosis}}{\text{Number of NSCLC patients who undergo surgery within 1 year of diagnosis}} \times 100 =$ % of NSCLC patients (age ≥75 years) who undergo surgery within 1 year of diagnosis
Inclusion/Exclusion Criteria	Include ages ≥75; Manitoba residents only, invasive only Exclude lymphomas, sarcomas, ill-defined tumours, and small cell lung cancer (SCLC)
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Proportion of non-small cell lung cancer patients who had a resection within one year of diagnosis that died in-hospital or within 90 days of surgery	
Disease Site(s)	Lung
Purpose/Rationale for Measurement	Death within 90 days of surgery is an important indicator of whether good surgical and post-operative care is occurring.
Indicator Calculation	$\frac{\text{Number of NSCLC patients who had a resection within 1 year of diagnosis and died in-hospital or within 90 days of surgery}}{\text{Number of NSCLC patients who undergo surgery within 1 year of diagnosis}} \times 100 =$ % of NSCLC patients (age ≥75 years) who undergo surgery within 1 year of diagnosis
Inclusion/Exclusion Criteria	Include ages ≥20; Manitoba residents only, invasive only Exclude lymphomas, sarcomas, ill-defined tumours, and small cell lung cancer (SCLC)
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame xxxxxxxxxx	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Percentage of non-small cell lung cancer surgery patients who had an anatomic resection within 1 year of diagnosis	
Disease Site(s)	Lung
Purpose/Rationale for Measurement	Anatomic resections such as lobectomy, bilobectomy, and segmentectomy have superior patient outcomes and thoracic surgery centres should have a high proportion of these type of resections.
Indicator Calculation	$\frac{\text{Number of NSCLC patients who had an anatomic resection within 1 year of diagnosis}}{\text{Total number of NSCLC patients who had a resection}} \times 100 =$ % of lung cancer surgery patients who had an anatomic resection within 1 year of diagnosis
Inclusion/Exclusion Criteria	Include ≥20 age, Manitoba residents only, invasive only Exclude lymphomas, sarcomas, ill-defined tumours, and small cell lung cancer (SCLC)
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Appendix 6. 4 – Ovarian quality indicator definitions

Percentage of ovarian cancer patients whose surgery was conducted by a gynecologic oncologist	
Disease Site(s)	Ovarian
Purpose/Rationale for Measurement	Women with ovarian cancer have better outcomes including complete/ optimal staging, improved survival, and reduced surgical mortality when surgeries are performed by a gynecologic oncologist. Several guidelines recommend that definitive surgical procedures should be conducted by a gynecological oncologist.
Indicator Calculation	$\frac{\text{Number of women diagnosed with ovarian cancer who had surgery within one year of diagnosis whose primary surgery was conducted by a gynecologic oncologist}}{\text{Total number of women diagnosed with ovarian cancer who had surgery within one year of diagnosis}} \times 100 =$ % of women diagnosed with ovarian cancer who had surgery within one year of diagnosis whose primary surgery was conducted by gynecologic oncologists
Inclusion/Exclusion Criteria	Excludes non-Manitoba residents at time of diagnosis, non-invasive/in situ cancers, lymphomas, sarcomas. Includes those ≥20 at diagnosis. • General Surgeon md bloc= 041 • General Gynecologist md bloc= 09, 099 • Gyne Oncologist md bloc= 151
Data Source(s)	Manitoba Cancer Registry (MCR), Medical Claims Database
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Percentage of ovarian cancer patients by type of first treatment	
Disease Site(s)	Ovarian
Purpose/Rationale for Measurement	This indicator will help us understand the types of treatments Manitobans are receiving for ovarian cancer.
Indicator Calculation	$\frac{\text{Number of women who had ovarian cancer surgery and had primary debulking or interval debulking or chemotherapy or no treatment}}{\text{Total number of women diagnosed with ovarian cancer}} \times 100 =$ % of women diagnosed with ovarian cancer who had ovarian cancer surgery and had primary debulking or interval debulking or chemotherapy or no treatment
Inclusion/Exclusion Criteria	Excludes non-Manitoba residents at time of diagnosis, non-invasive/in situ cancers, lymphomas, sarcomas. Includes those ≥20 at diagnosis.
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Median number of days between surgical consult and first treatment among ovarian cancer	
Disease Site(s)	Ovarian
Purpose/Rationale for Measurement	To understand wait times for diagnostic services for ovarian cancer in Manitoba
Indicator Calculation	Surgery consult was defined as a medical claim where • mdbloc = 041 (surgery – general) or 155 (oncology – general surgery) or 09 (general gyne) or 099 (general gyne – out of province) or 151 (oncology – gynecological AND • tariff code = 8550 (consult) Use the CCI codes listed in the Data Specifications document to identify surgery and use CCI code = 1ZZ35CAM0 (oral) or 1ZZ35HAM0 (IV) to identify chemotherapy.
Inclusion/Exclusion Criteria	Exclude non-Manitoba residents at time of diagnosis, non-invasive/in situ cancers, lymphomas, sarcomas. Includes those ≥20 at diagnosis.
Data Source(s)	Manitoba Cancer Registry (MCR), Medical Claims Database
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Appendix 7. 4 – Prostate quality indicator definitions

Percentage of prostate cancer patients who had at least 8 lymph nodes removed and examined during a radical prostatectomy	
Disease Site(s)	Prostate
Purpose/Rationale for Measurement	Removing an appropriate number of lymph nodes is required for adequate staging.
Indicator Calculation	$\frac{\text{Number of prostate cancer surgery patients who had a radical prostatectomy and had ≥8 pelvic lymph nodes removed and examined}}{\text{Total Number of prostate cancer surgery patients who had a radical prostatectomy}} \times 100 =$ % of prostate cancer surgery patients who had ≥8 lymph nodes removed and examined during a radical prostatectomy
Inclusion/Exclusion Criteria	Include those aged ≥35, Manitoba residents, invasive only. Exclude lymphomas, sarcomas, ill-defined tumours, and neuroendocrine tumours.
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Proportion of prostate cancer surgery patients with extraprostatic extension (EPE)	
Disease Site(s)	Prostate
Purpose/Rationale for Measurement	To determine the stage of tumour at surgery which has prognostic implications.
Indicator Calculation	$\frac{\text{Number of prostate cancer surgery patients with extraprostatic extension}}{\text{Total number of prostate cancer surgery patients who had a resection}} \times 100 =$ % of prostate cancer surgery patients with extra prostatic
Inclusion/Exclusion Criteria	Include those aged ≥35, Manitoba residents, invasive only. Exclude lymphomas, sarcomas, ill-defined tumours, and neuroendocrine tumours.
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Proportion of prostate cancer patients who received androgen deprivation therapy (ADT) prior to surgery	
Disease Site(s)	Prostate
Purpose/Rationale for Measurement	The proportion of patients receiving ADT can be indicative of longer wait lists and it also has a direct impact on pathology interpretation.
Indicator Calculation	$\frac{\text{Number of prostate cancer patients who received androgen deprivation therapy prior to surgery}}{\text{Total number of prostate cancer patients}} \times 100 = \text{\% of prostate cancer patients who received androgen deprivation therapy prior to surgery}$
Inclusion/Exclusion Criteria	Include those aged ≥35, Manitoba residents, invasive only. Exclude lymphomas, sarcomas, ill-defined tumours, and neuroendocrine tumours.
Data Source(s)	Manitoba Cancer Registry (MCR)
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

Median wait time between last biopsy to first surgery for prostate cancer patients	
Disease Site(s)	Prostate
Purpose/Rationale for Measurement	To help determine wait time for surgery and determine if it is appropriate.
Indicator Calculation	Time A = Last biopsy Time B = First surgery Report a wait time distribution.
Inclusion/Exclusion Criteria	Include those aged ≥35, Manitoba residents, invasive, and Gleason score 8 or higher only. Exclude lymphomas, sarcomas, ill-defined tumours, and neuroendocrine tumours.
Data Source(s)	Manitoba Cancer Registry (MCR), Medical Claims Database
Time Frame	Diagnosis January 2015 – December 2020. Treatment January 2015 – March 2021.

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