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Cancer Surgery Quality in Manitoba

CancerCare Manitoba
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Cancer Surgery Quality in Manitoba

Special Edition – CancerCare Manitoba System Performance Report

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A Message from Dr. Sri Navaratnam, The President and CEO

CancerCare Manitoba is mandated to provide cancer control to the province of Manitoba. This is achieved through strategy and long-term planning for the delivery of excellence in cancer services.

Surgery is the curative treatment option for most cancers and thus, providing leadership for cancer surgery is crucial to obtain cancer control for the province. For this reason, CancerCare Manitoba has prioritized the role of surgery in cancer control by incorporating it into the Manitoba Cancer Plan 2016-2021; Achievement of province-wide leadership in cancer surgery.

Cancer surgeries are performed in many hospitals throughout the province. In order to provide province-wide leadership for cancer surgery, relationships with all health regions and surgeons have been enhanced with the identification of surgical leads in the regions. Through the expertise of disease site lead surgeons who are associated with CCMB, and with the surgical leads in the regions, we are working towards standardized quality cancer surgery for all Manitobans.

As the first step, we assessed the data from cancer surgeries performed in Manitoba between 2010 and 2015. This report, Cancer Surgery Quality in Manitoba, is the culmination of this assessment and reporting on quality indicators for surgeries in breast, colorectal, lung, ovarian, and prostate cancers. The report provides feedback directly to surgeons across the province and will help the public to understand the quality of service they receive. It provides the foundation to further advance the quality of cancer surgery received by Manitobans.

This report aligns with a Partner Project of the Canadian Partnership Against Cancer (CPAC), Mobilizing Evidence for Surgical Quality Improvement, working towards national surgical quality improvement for all cancer patients across the country.

As the President and CEO of CancerCare Manitoba, I am very proud to present this first report of CancerCare Manitoba on the quality of cancer surgery in the province, being made available to the public. I would like to express my appreciation and thanks to Dr. Helmut Unruh, Lead for Surgical Oncology at CancerCare Manitoba, for his leadership, and to all disease site lead surgeons who championed this assessment and analysis along with epidemiologists at CancerCare Manitoba.

CancerCare Manitoba is committed to continuing its leadership for cancer surgery to ensure Manitobans requiring surgery for cancer have equal access to standardized quality surgery regardless of where they live.

Sincerely,
Dr. Sri Navaratnam, President and CEO, CancerCare Manitoba

A Message from Dr. Helmut Unruh, Department of Surgical Oncology

This report is an important first step in the history of CancerCare Manitoba (CCMB) in that it marks the inaugural quality outcome audit in patients who have undergone surgery for cancer. The 2016-2021 Manitoba Cancer Plan identified the importance of providing province-wide leadership in cancer surgery. Many Manitobans with cancer receive surgery as their primary treatment; this is especially true for patients with breast, colorectal, ovarian, prostate, and non-small cell lung cancer. Even though many patients seen through CCMB have had surgery, CCMB has not previously been involved in assessing the quality of these surgeries. This report combines information from multiple databases to create a unique report of clinical importance to medical practitioners, medical leadership, and the public.

In order to ensure that Manitobans are receiving timely and high quality cancer surgery, it is imperative that baseline data and indicators are established so areas for improvement can be identified and future progress can be measured. This report achieves this important first step.

The Cancer Surgery Quality in Manitoba report is the culmination of more than 3 years of dedication and teamwork between CCMB Epidemiology & Cancer Registry and the Department of Surgical Oncology. I would like to extend my gratitude to the surgeon disease site-leads that served as content experts for this report. These include:

Dr. Pamela Hebbard (Breast Cancer)
Dr. Jason Park (Colorectal Cancer)
Dr. Gordon Buduhan (Lung Cancer)
Dr. Alon Altman (Ovarian Cancer)
Dr. Jeff Saranchuk (Prostate Cancer)

The surgeons have, on a voluntary basis, tirelessly worked on this report throughout its development including the selection of indicators, review of data, and writing of the final report. The report would not have been possible without the leadership provided by the Epidemiology & Cancer Registry department at CCMB. The project was led by Charlene Muzyka with the involvement of Iresha Ratnayake. Programming and data analysis was provided by Natalie Biswanger, Grace Musto, and Carmela Villaflor. Dr. Kathleen Decker provided oversight and ensured the methodology of this report was sound. Finally, I would like to acknowledge that Dr. Sri Navaratnam, Chief Operating Offer and President of CCMB, had the vision that CCMB must become more engaged in the surgical aspects of cancer treatment. Her support for this initiative was unwavering and unlimited.

It is my hope that the evidence presented in this report will be built upon to deepen our understanding of both the strengths and opportunities faced in the provision of cancer surgeries. Future projects to improve surgical quality should be developed and implemented collaboratively with provincial stakeholders, including Manitoba Health, Seniors and Active Living, regional health authorities, hospitals, the University of Manitoba, and the surgeons themselves.

Sincerely,
Helmut Unruh, MD, FRCSC

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, Seniors and Active Living, 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 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 the Prairie Mountain Health Authority, 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 800 staff members and 48 physician specialists, and has an annual operating budget of $102.2M.

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CONTENTS

OUR VISION

A world free of cancer.

OUR MISSION

To reduce and, where possible, eliminate the burden of cancer on the people of Manitoba through exemplary programs of prevention, diagnosis, treatment, rehabilitation, continuing care, research and education.

OUR VALUES

RESPECT FOR PEOPLE
Dignity, fairness, openness, equity, collaboration, cooperation, sensitivity to cultural diversity and identity, compassion, privacy, confidentiality.

INTEGRITY
Honesty, objectivity, reliability, responsibility, fidelity, transparency.

EXCELLENCE
Timeliness, efficiency, effectiveness, relevance, diligence, creativity, initiative.

STEWARDSHIP
Prudence, sensitivity to risks, opportunities and sustainability of human and material resources and the natural and built environment, accountability.

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Acronyms

APR	Abdominoperineal Resection
ASBS	American Society of Breast Surgeons
BCS	Breast Conserving Surgery
BSO	Bilateral Slapingo-oophorectomy
CCMB	CancerCare Manitoba
CCO	CancerCare Ontario
CI	Confidence Interval
CIHI	Canadian Institute for Health Information
CPAC	Canadian Partnership Against Cancer
CRC	Colorectal Cancer
CRM	Circumferential Resection Margin
DCIS	Ductal Carcinoma In Situ
EAU	European Association of Urology
EUSOMA	European Society of Breast Cancer Specialists
IERHA	Interlake-Eastern Regional Health Authority
KPI	Key Performance Indicator
LAR	Low Anterior Resection
LOS	Length of Stay
MCR	Manitoba Cancer Registry
MHSAL	Manitoba Health, Seniors and Active Living
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
PSA	Prostate-Specific Antigen
R1-R5	Rural Income Quintile 1 (lowest) through 5 (highest)
RHA	Regional Health Authority
SCLC	Small Cell Lung Cancer
SH-SS	Southern Health - Santé Sud (Southern Regional Health Authority)
SLN	Sentinel Lymph Node
STS	Society of Thoracic Surgeons
TEM	Transanal Endoscopic Micro-surgery
TURP	Transurethral Resection of the Prostate
U1-U5	Urban Income Quintile 1 (lowest) through 5 (highest)
USO	Unilateral Salpingo-oophorectomy
VATS	Video-Assisted Thorascopic Surgery
WRHA	Winnipeg Regional Health Authority

Glossary

APR
Abdominoperineal resection (APR) is a type of proctectomy performed when the tumour is located in the lower part of the rectum. The anal sphincter muscles are removed along with the rectum.

Adjuvant therapy
Treatment (e.g. chemotherapy, radiation, or hormonal therapy) provided after cancer surgery.

ASIR
Age-standardized incidence rate (ASIR) is the weighted average of the age-specific incidence rates per 100,000 Manitobans. The standard population used for weighting is the 2010 Manitoba population.

Approach
Method used to obtain access to the cancerous tissue that requires an invasive surgical treatment. For example, open versus laparoscopic approaches.

Axillary lymph node clearance
A procedure that removes all lymph nodes found in the armpit.

Bilobectomy
A surgical procedure where two adjacent lobes of the right lung are removed along with the tumour.

Biopsy
Removal of a tissue sample from the body that is examined by a pathologist for the presence of cancerous cells.

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.

Bypass (colorectal)
A bypass is a surgical procedure in which a section of the bowel is bypassed internally, and is typically palliative.

Cohort
A group of individuals that share a common characteristic.

Colectomy
A colectomy is a surgical procedure in which all or part of the colon is removed along with the tumour. A colectomy requires an incision in the abdomen.

Colonoscopy
A procedure to examine the colon where a small camera is inserted through the anus.

Colostomy
A colostomy is a surgical procedure in which a part of the colon is brought through the abdominal wall to the surface of the skin and an opening is created in it. An external pouch or bag (referred to as a stoma appliance) is adhered to the surrounding skin. Bowel contents or stool then empties into the pouch.

Co-morbidity
Having one or more conditions present at the same with as the current disease.

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.

DCIS
Ductal Carcinoma In-Situ (DCIS) occurs when abnormal cells proliferate in the breast, but do not spread beyond the milk duct.

Debulking
A surgical procedure that aims to remove as much visible cancer in the abdomen as possible.

Definitive surgery
A surgery that that has a curative intent and aims to remove the tumour.

Gleason score
Prostate tumours are microscopically examined, and are classified and assigned a Gleason score. Lower scores indicate a lower likelihood of metastasis.

Hospital admission
When an individual enters the hospital and is registered as a patient.

Hysterectomy
A surgery that removes the entire uterus.

Ileostomy
An ileostomy is a surgical procedure in which a part of the small intestine is brought out to the skin and opened like a colostomy. An external pouch or bag (referred to as a stoma appliance) is adhered to the surrounding skin. Bowel contents or stool then empties into the pouch.

Immediate reconstruction
Surgical reconstruction of the breast that is conducted at the same time as a mastectomy.

Incidence
The frequency of new cases in the Manitoba population.

Income quintile
The population is divided into five groups based on household income; each group is an income quintile.

Invasive breast cancer
Invasive breast cancer occurs when the cancerous cells have spread beyond the ducts or lobules to the surrounding breast tissue.

Key performance indicator
Measurable variable that can be used to assess and/or monitor a process or outcome.

Laparoscopic approach
Surgical method that uses instruments passed through small incisions in the abdominal wall, often with video guidance.

Length of Stay
The number of days between hospital admission for surgery and discharge.

Lobectomy
A procedure where one lobe of the lung is removed along with the tumour.

LAR
Low anterior resection (LAR) is a type of proctectomy usually conducted when the tumour is located in the more upper portions of the rectum. The anal sphincter muscles are kept intact.

Lymphadenectomy
Lymph nodes situated near a tumour are surgically removed and microscopically examined to determine if cancer has spread to the lymphatic system.

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.

Median
The middle value in a distribution.

Metastasis
When cancerous cells have spread to another part of the body from where the primary tumour is located.

Neo-adjuvant
Treatment (e.g. chemotherapy, radiation, or hormonal therapy) provided before undergoing cancer surgery.

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).

Oophorectomy
The surgical removal of an ovary.

Open approach
A surgical method that involves making an incision in the skin to expose the site of the procedure.

Palliative surgery
A surgical procedure that aims to relieve symptoms of cancer, but is not intended to be curative.

Pneumonectomy
A surgical procedure that completely removes either the right or left lung.

Polypectomy
A polypectomy is a form of local excision in which polyps are removed from inside the colon, usually during a colonoscopy.

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.

Post-operative mortality
Death within 30, 60 or 90-days after a surgery.

Primary tumour
The first/original tumour that originates in the body.

Proctectomy
A proctectomy is a surgical procedure that removes all or part of the rectum along with the tumour. The two main types of proctectomies are low anterior resection (LAR) and abdominoperineal resection (APR).

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.

PSA
Prostate specific antigen (PSA) is a protein that is made by the prostate. The amount of PSA in the body is measured via blood test to screen for prostate cancer.

Readmission
When an individual who was previously discharged from a hospital after surgery is re-admitted.

Re-excision
A second breast conserving surgery or mastectomy to treat the same tumour within one-year of the first breast conserving surgery.

Resection
Type of surgical procedure used to treat cancer by removing cancerous tissues along with some surrounding normal tissue.

Salpingo-oophorectomy
The surgical removal of one or both of the fallopian tubes and ovaries.

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.

Sentinel lymph node biopsy
A surgical procedure to remove the lymph nodes directly draining the tumour. The procedure is usually conducted at the same time as a breast conserving surgery or mastectomy.

Stage
Designation given to tumours based on size and the degree that cancerous cells have spread to other tissues in the body.

Stoma
The part of the colon or small bowel that is exposed during a colostomy or ileostomy and opens at the skin surface.

Sublobar resection
Type of lung resection where a portion of lung lobe tissue along with the tumour is removed. Includes wedge resections and segmentectomies.

Surgical consult
Pre-operative meeting with the surgeon to undergo an assessment and discuss various aspects of the surgical procedure including risks and benefits.

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.

TEM
Transanal Endoscopic Micro-surgery (TEM) is a type of local excision of a rectal tumour that removes a small amount of surrounding tissue using highly specialized equipment and techniques. It is performed "per orifice" through the anal opening and does not require an abdominal incision.

TURP
Transurethral resection of the prostate (TURP) is a procedure that removes a portion of the prostate gland and is typically conducted to reduce or alleviate symptoms of prostate cancer.

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.

95% confidence interval
Provides a range estimate of where the true population value will reside 95% of the time, based on a set of sample values.

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 2010 and 2014 using administrative health data and Manitoba Cancer Registry data.

Key Findings

Breast cancer surgery

- The percentage of women who underwent surgery in Manitoba (92.3%) was similar to other provinces.[1]
- Nearly one-half of women (49.3%) with invasive breast cancer whose primary treatment was surgery had surgery within 30 days of their first surgical consult.
- Women who opted for a mastectomy with immediate reconstruction waited longer; 27.6% had surgery within 30 days of their first surgical consult compared to 55.0% of women who underwent breast conserving surgery.
- The rate of immediate reconstruction for invasive breast cancer patients was 10.5% in Manitoba compared to the Canadian average of 6.6%.[2]
- The percentage of women who had complete removal of axillary nodes but did not have nodal metastasis (i.e., should not have had axillary nodes removed) was 19.6%. This varied from 13.5% for women who had surgery in the Winnipeg Regional Health Authority (WRHA) to 42.4% for women who had surgery in Southern Health-Santé Sud (SH-SS). Not all women had surgery in the same Regional Health Authority in which they lived, but the pattern was similar regardless of area of residence.
- The percentage of women who had a mastectomy without reconstruction was the lowest in the WRHA (19.4%) compared to 34.7% in Prairie Mountain Health (PMH), 20.3% in Interlake-Eastern (IERHA), 28.3% in SH-SS, 24.2% in Northern Health Authority (NHA).
- Many women who had breast cancer surgery without immediate reconstruction had surgery in the same RHA in which they lived (68.6% for breast conserving surgery and 59.3% for mastectomy).

Colorectal cancer surgery

- 87.5% of colon cancer patients and 70% of rectal cancer patients were treated with a resection.
- The median number of days between first colonoscopy and surgery was 34 days. Individuals with stage IV colon cancer had the shortest wait time for surgery (21 days).
- Ninety percent of patients with stage II or III colon cancer had ≥12 lymph nodes removed during surgery which meets the national target of 90%.[3]
- The percentage of rectal cancer patients with a positive circumferential resection margin was 3.8%. This is better than that reported by all other provinces in 2010.[4]
- Greater than 95% of patients who had colon cancer resection did not receive a stoma (colostomy or ileostomy) or had a potentially reversible stoma. Seventy percent of patients who had a rectal cancer resection did not have a stoma or had a potentially reversible stoma. Although stomas may impact quality of life, they may be necessary to promote healing and reduce complications after surgery.[5]
- Most colorectal cancer patients (73% of colon and 70% of rectal) had surgery in the same RHA in which they lived.

Lung cancer surgery

- Many patients with lung cancer are not eligible for surgery due to pre-existing conditions. Sixty-five percent of stage I and stage II non-small cell lung cancer (NSCLC) cases had surgery which is similar to other jurisdictions.[6,7]
- Lung cancer resections performed using minimally invasive Video-Assisted Thorascopic Surgery (VATS) increased from 28.8% in 2010 to 62.6% in 2014. This is similar to other national and international rates.[8]
- The 30-day mortality rate after lung cancer surgery was 0.84%. This is slightly lower than published rates from other countries (1-4%).[9-12]
- Nearly all surgeries (92.7%) were conducted in the WRHA.

Ovarian cancer surgery

- The majority of women with ovarian cancer (91.7%) had surgery. The percentage of women who had surgery varied from 100% for stage I to 81.8% for stage IV cases.
- Most women (88.3%) received their first ovarian cancer surgery from a gynecologic oncologist. Current guidelines recommend that all women with ovarian cancer have their surgery conducted by a gynecologic oncologist.[13,14]
- One-quarter (25.7%) of women who had surgery for ovarian cancer had at least one post-operative complication. Complications included minor and major issues.
- Nearly all surgeries (97%) were conducted in the WRHA.

Prostate cancer surgery

- One-quarter of men (24.6%) had a radical prostatectomy within one year of diagnosis. The percentage of men who received surgery varied by stage from 2.3% for stage I to 84.5% for stage III.
- Some men opt not to have immediate surgery but choose watchful waiting or surveillance. Some, however, will have surgery at a later point in time. Of all men diagnosed with prostate cancer, 3.2% had a radical prostatectomy more than one year after diagnosis.
- The median number of lymph nodes removed and examined during radical prostatectomy was 5. Although there is no nationally accepted benchmark, this number is similar to studies from the United States.[15,16]
- The median length of stay in hospital for radical prostatectomy was 5 days. This is higher than the recently reported Canadian average of 3 days[17] which may be related to higher rates of laparoscopic surgery in other provinces.

Recommendations

Knowledge mobilization efforts were implemented across all disease sites. A community of practice (CoP) model was used to engage relevant stakeholders in discussing the report and its findings. A CoP is defined as a group of individuals that share a common goal of gaining knowledge related to a specific field. Collective learning is achieved through the sharing of information and experiences.[18] Results from this report were shared with a community of practice which consisted of surgeons, medical and radiation oncologists, radiologists, and senior administration. The community of practice developed recommendations to further understand and address the results in this report. The recommendations for each disease site are listed below.

Breast Cancer Surgery

- Some regional health authorities in Manitoba have lower rates of immediate reconstruction.

  Recommendation (1): Provide educational opportunities to surgeons to identify appropriate candidates for immediate reconstruction.

- Axillary clearance rates (for patients with no nodal disease) are higher in some RHAs compared to targets (e.g., <10% in Scotland) cited in the literature.

  Recommendation (2): Ensure all RHAs have access to resources required to conduct a sentinel lymph node biopsy.

- The Canadian Partnership Against Cancer (CPAC) has released breast surgery standards.

  Recommendation (3): Implement the following standards: 1) Ensure all Manitoba radiologists include concordance statements in their reports; 2) Ensure surgeons treating breast cancer devote a portion of yearly continuing medical education (CME) credits to maintaining competency on breast cancer treatment; 3) Ensure all patients undergoing a mastectomy are informed of all reconstructive options and the discussion is documented in the chart.

Colorectal Cancer Surgery

- The rates of laparoscopic surgery are lower than anticipated.

  Recommendation (1): Provide educational opportunities and support to surgeons to increase the percentage of laparoscopic surgeries done in Manitoba.

Lung Cancer Surgery

- There is a lack of data around nodal stations sampled before or during surgery. This data is needed to assess adequacy of nodal staging for lung cancer.

  Recommendation (1): Start collecting detailed staging data in the Manitoba Cancer Registry or through surgical synoptic reporting.

- Surgery rates for stage I and II patients start to decrease around age 65. This decrease should happen closer to age 80. It is possible that some patients who did not receive surgery in this time period were suitable candidates and should have received a curative surgery.

  Recommendation (2): Measure surgery rates by age over time to assess practice over time. Identify the percentage of patients who receive stereotactic body radiotherapy (SBRT) and explore its impact on surgery rates.

- Data are needed about chemotherapy rates among stage I and II lung cancer patients and surgical wait times.

  Recommendation (3): Measure the percentage of stage 1 and II patients referred to chemotherapy.

  Recommendation (4): Measure surgical wait times from decision to treat and/or diagnosis date to surgery.

- Current peri-operative care and diagnostic work up processes need improvement.

  Recommendation (5): Explore inefficiencies in diagnostic pathways in peri-operative care in Manitoba and develop solutions to address them.

- Future research should focus on the following:
  1) Are all stage I and II patients being assessed by thoracic surgery for curative operation?
  2) Did the surgery meet quality criteria and existing standards?
  3) Did the patient receive high-quality post-operative care?

  Recommendation (6): Future quality improvement projects should focus on monitoring these areas and implement changes as needed.

Ovarian Cancer Surgery

- Guidelines recommend that ovarian cancer surgical procedures should be conducted by a gynecologic oncologist. Almost 12 percent of surgeries are being conducted by non- gynecologic oncologist.

  Recommendation (1): Provide educational opportunities throughout the province to educate family physicians, general surgeons, radiologists etc. about when to refer patients to a gynecologic oncologist.

Prostate Cancer Surgery

- Pelvic Lymphadenectomy is used in staging prostate cancer. However, there is a lack of consensus in the medical community about the ideal number of lymph nodes that should be removed.
  A very low number of nodes may result in inadequate staging and a very high number may result in unnecessary morbidity.

  Recommendation (1): Facilitate a discussion among Manitoba urologists to determine the optimum number of nodes that should be removed for adequate staging purposes.

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CHAPTER 1. INTRODUCTION

Why was this report created?

One of CancerCare Manitoba's 2016-2021 strategic priorities is to develop and report comprehensive, integrated, and evidence-based performance indicators regarding quality and clinical outcomes.

This report contributes to this priority by conducting a descriptive analysis of cancer surgeries in Manitoba and reporting on clinically relevant evidence-based surgical key performance indicators (KPIs). The findings included in this report can be used to identify opportunities to improve cancer surgery quality, inform service planning, and support policy development to ensure Manitobans receive the best cancer surgical care possible.

What is in this report?

This report focuses on surgeries conducted for the treatment of breast, colorectal, lung, prostate, and ovarian cancers diagnosed between January 1, 2010 and December 31, 2014. Surgeries conducted to treat cancers diagnosed in this period occurred between January 1, 2010 and December 31, 2015. While surgical procedures performed to diagnose cancer, such as biopsies, are an important part of the patient journey, they are excluded from this report. This report used administrative health data and Manitoba Cancer Registry (MCR) data to assess the quality of 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 related to the following cancer surgery sites: breast, colorectal, ovarian, lung, and prostate.

A technical appendix is available on CCMB's website **https://www.cancercare.mb.ca/About-Us/corporate-publications** and contains additional information and detailed definitions for each indicator.

Complementary Surgery Indicator Projects in Manitoba

This project aligns with and complements other surgical quality improvement activities currently underway at CancerCare Manitoba (CCMB) including Surgical Synoptic Reporting and the Surgical Clinical Practice Guidelines Initiative. Together, these projects form a multi-level approach to better understand cancer surgeries and measure important surgical indicators.

Surgical Synoptic Reporting

Over 20 surgeons who practice in Winnipeg currently complete electronic standardized operative reports, called Surgical Synoptic Reports, to concisely and comprehensively record preoperative and intraoperative surgical information. In 2017, 1,087 synoptic operative reports were created. The information collected through surgical synoptic reporting is used to create feedback reports that include 26 quality indicators for breast, colon, rectal, and thyroid cancers which are provided to participating surgeons.

Along with the data presented in this report, data from surgical synoptic reports are being used to identify gaps in the quality of surgical care delivered to patients and to engage clinicians in addressing these gaps. Immersing clinicians in data review and self-reflection using data from both administrative and synoptic reporting sources and involving surgeons in identifying solutions to address quality of care gaps can increase the consistency of cancer care services and improve quality and outcomes. As part of an upcoming project, surgical synoptic reporting data will be linked to other administrative and clinical datasets including pathology, cancer registry, hospital, and medical claims. By linking these data, CCMB will maximize data impact by ensuring the accuracy and usefulness of quality indicators.

Surgical Clinical Practice Guideline Initiative (CPGI)

One of the CPGI's projects involves developing surgical clinical practice guidelines for several disease sites. A deliverable of the CPGI project is to develop quality indicators based on newly developed or adapted guidelines and to utilize the synoptic reporting system or administrative health data to measure concordance with these guidelines.

Background

Cancer

Cancer is a significant burden on Canadians. It is estimated that nearly half of all Canadians will develop cancer at some point in their lives.[1] In Manitoba 6,441 people were diagnosed with invasive cancer and 2,765 Manitobans died from cancer in 2015.[2] Both the number of people diagnosed and living with cancer in Manitoba and Canada is anticipated to increase.[1]

In Manitoba, breast, colorectal, lung and bronchus, prostate, and ovarian cancers account for over 50% of invasive cancers diagnosed each year. These cancer sites - which represent a large number of cancer cases - are the focus of this report because surgery is their primary mode of treatment.

Surgical treatment for cancer

Surgery is an integral part of cancer treatment. Approximately half of Manitobans diagnosed with cancer undergo a surgical procedure at some point during their cancer journey. The percentage of Manitobans who undergo a surgical procedure varies by cancer site due to the nature of the disease. For example, the majority of women diagnosed with breast cancer receive surgery whereas very few individuals diagnosed with lymphoma receive surgery. 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 general surgeons and surgeon specialists. Surgeon specialists receive training in cancer and/or specific disease sites (e.g. colorectal specialist). 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. It is important to note that an individual diagnosed with cancer who requires surgical treatment may have one or more procedures conducted during a single operating room visit. The treatment of one or multiple tumours may also occur during a single operating room visit. Procedures specific to each cancer site are further described in the corresponding chapters.

Indicators

This report includes descriptive indicators and key performance indicators.

Descriptive indicators

Descriptive indicators describe information related to 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 (KPIs)

KPIs are used to measure the quality of healthcare delivery or processes and health outcomes. KPIs should be standardized, measurable using high quality data, and based on evidence and standards of care.[3, 4]

The use of KPIs for other aspects of healthcare delivery and the cancer patient journey are well established. The development and reporting of KPIs is a newer concept in cancer surgery. There are several challenges to developing surgical KPIs including a lack of national and provincial surgical standards of care, variations in surgical practice, the lack of standardized surgical data, and that cancer surgery is often beyond the mandate of provincial cancer organizations. However, surgical KPIs have been developed and published by several organizations including Health Improvement Scotland[5], the American College of Surgeons – National Surgical Quality Improvement Program (NSQIP)[6], the Canadian Partnership Against Cancer (CPAC)[7], and Cancer Care Ontario (CCO).[8]

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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 included in the initial review were also recommended. The proposed indicators were further evaluated to determine whether or not data was available and if calculation of the indicator was feasible in Manitoba. A final list of descriptive and key performance indicators was identified and comprehensive indicator definitions were then developed and reviewed by the project team.

What cases are included in this report?

Manitoba residents 20 years of age and older who were diagnosed with invasive breast, colorectal, ovarian, lung, or prostate cancer between 2010 and 2014 are included. Women diagnosed with ductal carcinoma in-situ (DCIS) are also included in select indicators. All surgeries had to occur within one year of diagnosis. Select colorectal surgical procedures were included if they occurred up to one year prior to a pathological diagnosis.

Data sources

Database	Source of database	Years
Manitoba Cancer Registry	CancerCare Manitoba	2010-2015
Medical Claims Database	Manitoba Health, Seniors and Active Living	2010-2015
Discharge (Hospital) Abstracts Database	Manitoba Health, Seniors and Active Living	2010-2015
Canadian Census	Statistics Canada	2006
Manitoba Health Coverage Data File	Manitoba Health, Seniors and Active Living	2010-2015

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

- The percentage of women who underwent surgery in Manitoba (92.3%) was similar to other provinces.[1]
- Nearly one-half of women (49.3%) with invasive breast cancer whose primary treatment was surgery had surgery within 30 days of their first surgical consult.
- Women who opted for a mastectomy with immediate reconstruction waited longer; 27.6% had surgery within 30 days of their first surgical consult compared to 55.0% of women who underwent breast conserving surgery.
- The rate of immediate reconstruction for invasive breast cancer patients was 10.5% in Manitoba compared to the Canadian average of 6.6%.[2]
- The percentage of women who had complete removal of axillary nodes but did not have nodal metastasis (i.e., should not have had axillary nodes removed) was 19.6%. This varied from 13.5% for women who had surgery in the Winnipeg Regional Health Authority (WRHA) to 42.4% for women who had surgery in Southern Health-Santé Sud (SH-SS). Not all women had surgery in the same Regional Health Authority in which they lived, but the pattern was similar regardless of area of residence.
- The percentage of women who had a mastectomy without reconstruction was the lowest in the WRHA (19.4%) compared to 34.7% in PMH, 20.3% in IERHA, 28.3% in SH-SS, 24.2% in NHA.
- Many women who had breast cancer surgery without immediate reconstruction had surgery in the same RHA in which they lived (68.6% for breast conserving surgery and 59.3% for mastectomy).

Recommendations

A community of practice (CoP) model was used to engage in knowledge mobilization efforts. A CoP is defined as a group of individuals that share a common goal of gaining knowledge related to a specific field. Collective learning is achieved through the sharing of information and experiences.[3] Results from this report were shared with a breast community of practice which consisted of surgeons (from several regional health authorities), medical and radiation oncologists, radiologists, and senior administration. The community of practice developed several recommendations to further understand and address the results in this report. The recommendations are listed below.

- Some regional health authorities in Manitoba have lower rates of immediate reconstruction.

  Recommendation (1): Provide educational opportunities to surgeons to identify appropriate candidates for immediate reconstruction.

- Axillary clearance rates (for patients with no nodal disease) are higher in some regional health authorities compared to targets (e.g., <10% in Scotland) cited in the literature.

  Recommendation (2): Ensure all regional health authorities have access to necessary resources required to conduct a sentinel lymph node biopsy.

- The Canadian Partnership Against Cancer (CPAC) has released breast surgery standards.

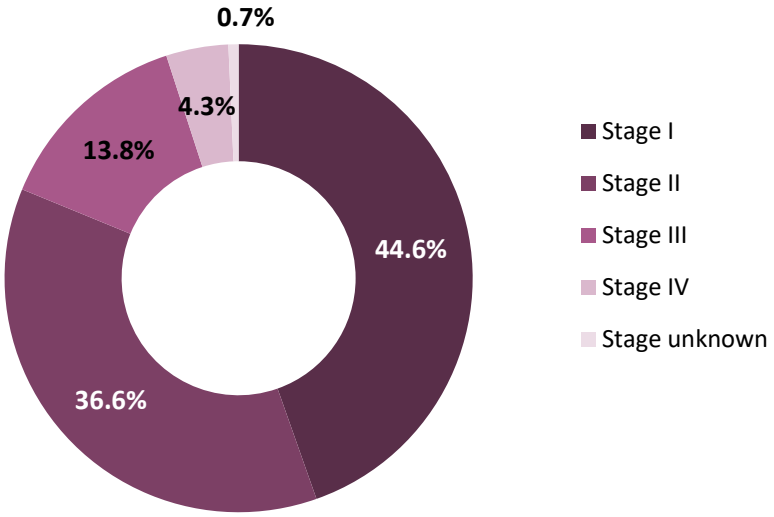
  Recommendation (3): Focus on the following standards: 1) Ensure all Manitoba Radiologists include concordance statements in their reports; 2) Ensure surgeons treating breast cancer devote a portion of yearly Continuing Medical Education (CME) credits to maintaining competency on breast cancer treatment; 3) Ensure all patients undergoing a mastectomy are informed of all reconstructive options and the discussion is documented in the chart.

Breast Cancer in Manitoba

Invasive breast cancer occurs when the cancerous cells have spread beyond the ducts or lobules to the surrounding breast tissue. The degree of spread and size of tumour influence the stage of the invasive cancer. The most common types of invasive breast cancer are invasive ductal carcinoma and invasive lobular carcinoma.

Between January 1, 2010 and December 31, 2014, 3,962 cases of invasive breast cancer were diagnosed among Manitoba women. Incidence was highest among women aged 70-79 years (393.1 cases per 100,000 women) and lowest in women aged 20-39 years (16.4 cases per 100,000 women) (Table 3.5). Invasive breast cancer was most commonly diagnosed at stage I or II (Figure 3.1).

Figure 3.1 Stage distribution of invasive breast cancer, 2010-2014



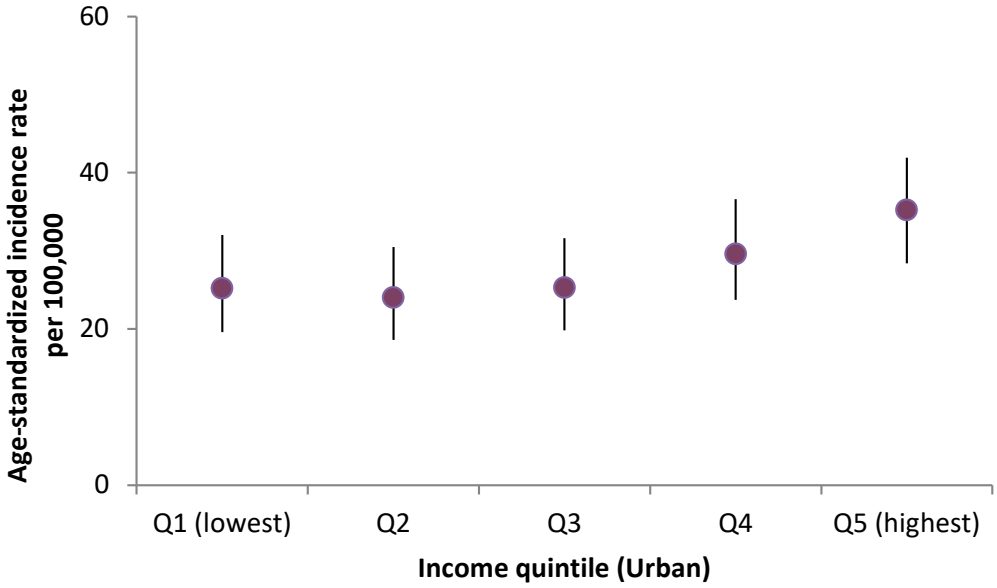
Depending on the size and spread of cells, invasive breast cancer may be treated surgically by breast conserving surgery (BCS), mastectomy, and/or axillary lymph node surgery. Neoadjuvant or adjuvant chemotherapy, radiation therapy, and/or hormone therapy may also be provided.

Ductal Carcinoma In Situ (DCIS): Non-Invasive Breast Cancer

DCIS occurs when abnormal cells proliferate, but do not spread beyond the milk duct. DCIS can also be referred to as a pre-malignant lesion or stage 0 cancer.

Between January 1, 2010 and December 31, 2014, 595 cases of DCIS were diagnosed in Manitoba women. Similar to invasive breast cancer cases, the highest incidence for DCIS was amongst the 70-79 age group (69.0 cases per 100,000 women) (Table 3.8). The rate of DCIS slightly increased as income increased among urban women (Figure 3.2). This may have been due to higher screening rates amongst high income women; DCIS is generally found via screening mammography.

Figure 3.2 Age standardized incidence rate of DCIS, by urban income quintile, 2010-2014



A surgical resection of the abnormal tissues via BCS or mastectomy is the most common treatment for DCIS. It is done to prevent future development of invasive breast cancer. Axillary lymph node dissection should generally not be performed for cases of DCIS because the abnormality has not spread beyond the ducts and into the lymphatic system.

Even though DCIS is considered a pre-cancerous diagnosis, women with DCIS were included in some indicators throughout this report. The pre-cancerous cells are removed using the same surgical procedures as invasive cancer and are performed by the same surgeons who conduct invasive breast cancer surgeries.

Additional information regarding the epidemiology of DCIS and invasive breast cancer in Manitoba are found in Tables 3.5 and 3.8 at the end of this chapter.

Description of Surgical Procedures Used to Treat Breast Cancer

Breast conservation surgery (BCS)

Also known as a lumpectomy, or partial mastectomy, BCS is a procedure that removes the tumour and a thin margin of non-cancerous tissue around the tumour. Typically, BCS preserves the skin, areola, and nipple. In the case of breast cancers found on mammography which are not palpable, a fine needle or wire is inserted into the breast by a radiologist to guide the surgeon to the location of the tumour. This is a wire- or needle-localized lumpectomy.

Mastectomy

Mastectomy removes the tumour along with all breast tissue. Mastectomies are considered simple, total, or radical depending on the extent of tissues and/or lymph nodes removed. Mastectomies may remove or preserve the skin, areola and/or nipple, or muscle depending on disease progression and patient choice. Sometimes a contralateral prophylactic mastectomy is performed at the same time; this procedure removes the tissues of the other breast without a tumour. A contralateral prophylactic mastectomy is based on patient choice and is related to reducing the risk of a subsequent breast cancer and/or desire to have both breasts look the same after reconstructive surgery.

Sentinel lymph node (SLN) biopsy

The procedure involves the removal of the lymph nodes directly draining the tumour. The procedure is usually conducted during the same operating room event as a BCS or mastectomy. The lymph node(s) to be resected are identified by injecting blue dye or radioactive material in to the breast. The dye or radioactive material drains through the lymphatic system to lymph nodes within the breast, and lymph nodes that are marked by dye or radioactive substance are removed. The procedure is conducted to determine if the cancer has metastasized into the lymphatic system which impacts subsequent treatment decisions and prognosis.

Axillary lymph node dissection

This procedure removes all lymph nodes found in the armpit (i.e., axilla). An axillary lymph node dissection is usually only performed if there is evidence that the cancer has metastasized to the lymphatic system because the procedure has a higher likelihood of morbidity including pain and arm swelling. The procedure can be conducted in conjunction with the removal of the breast tumour or during a separate operation if cancer was found in the SLNs biopsied during the original operating room event.

Descriptive Indicators

Breast Cancer Surgery

Indicator definition
Percentage of breast cancer cases that underwent surgery within one year of diagnosis.

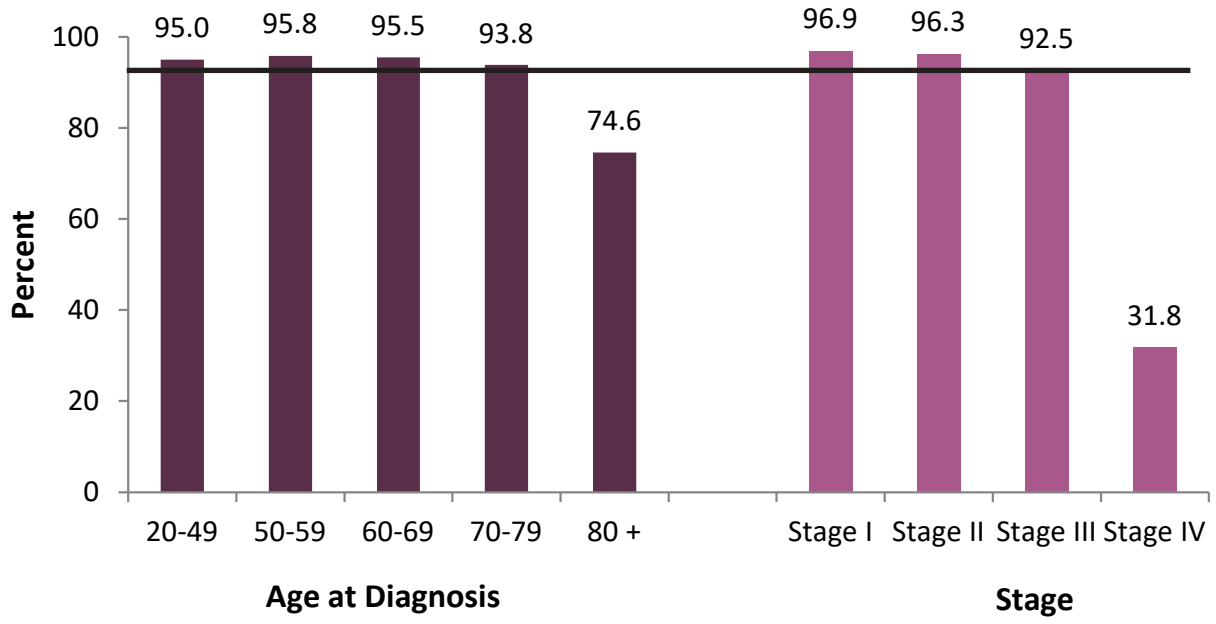
Why is this important to know?
The main mechanism for breast cancer to be potentially curable is to perform a resection; therefore, a high percentage of women typically receive breast cancer surgery. This indicator provides information that can be used for planning purposes.

Take away message
- A majority of breast cancer cases had surgery (92.3% invasive and 97.1% DCIS; Table 3.1).
- Women ≥80 years old and women with stage IV cancer were less likely to receive surgery for invasive cancer compared to all other age groups and stages (Figure 3.3).

Table 3.1 Percentage of invasive breast cancer and DCIS cases that received at least one surgery within one year of diagnosis, 2010-2014

Diagnosis	Had surgery		Did not have surgery	
	Number of cases	% Total	Number of cases	% Total
Invasive breast cancer	3,658	92.3	304	7.7
DCIS	578	97.1	17	2.9
Total	4,236	93.0	321	7.0

Figure 3.3 Percentage of invasive breast cancer cases treated with surgery, by age and stage, 2010-2014



What does the data tell us?

Over 92% of invasive breast cancer cases and 97% of DCIS cases diagnosed between 2010 and 2014 were treated with a surgical resection within one year of diagnosis (Tables 3.6 and 3.9). This is consistent with findings from similar studies.[1] Differences in DCIS surgery rates were minimal when stratified by income quintile or regional health authority (RHA) of residence. Data presented in this report includes bilateral and unilateral breast cancer cases of all stages.

Additional information regarding this indicator including stratification by income quintile and regional health authority is included in Tables 3.6, 3.7, 3.9 and 3.10 at the end of this chapter.

Surgical procedure

Indicator definition

Type of surgical procedure used to treat breast cancer cases within one year of diagnosis.

Why is this important to know?

This indicator provides information on the type of surgical procedures used to treat breast cancer in Manitoba. Knowing the type of procedures performed has the potential to influence planning regarding operating room utilization. Some women with breast cancer undergo more than one surgery. For example, if a patient opts for BCS, then the first surgery may not achieve a negative margin (rim of normal tissue around the tumour). The patient will then require additional surgery, either another BCS or a mastectomy. Subsequent surgeries may include a resection and/or reconstructive procedures.

Take away message

- Most women (Invasive: 66.7%; DCIS: 76.3%) who underwent surgery within one year of diagnosis received BCS as their first surgery (Figure 3.4).
- 10.5% of women with invasive breast cancer followed by surgery within one year of diagnosis opted for a mastectomy with immediate reconstruction as their first surgery (Figure 3.4).
- BCS was the most common type of second surgery for women with invasive cancer (55.8%) and DCIS (64.9%) who underwent at least two surgeries (Figure 3.4).
- Proportion of women who received mastectomy with immediate reconstruction varied by RHA of residence (4.5% in PMH and 15.8% in NHA; Figure 3.5).
- Proportion of women who received mastectomy without immediate reconstruction varied by RHA of treatment (20.5% in WRHA, 56.2% all other RHAs; Figure 3.6).

Figure 3.4 Type of resection, by first and second breast surgery, 2010-2014

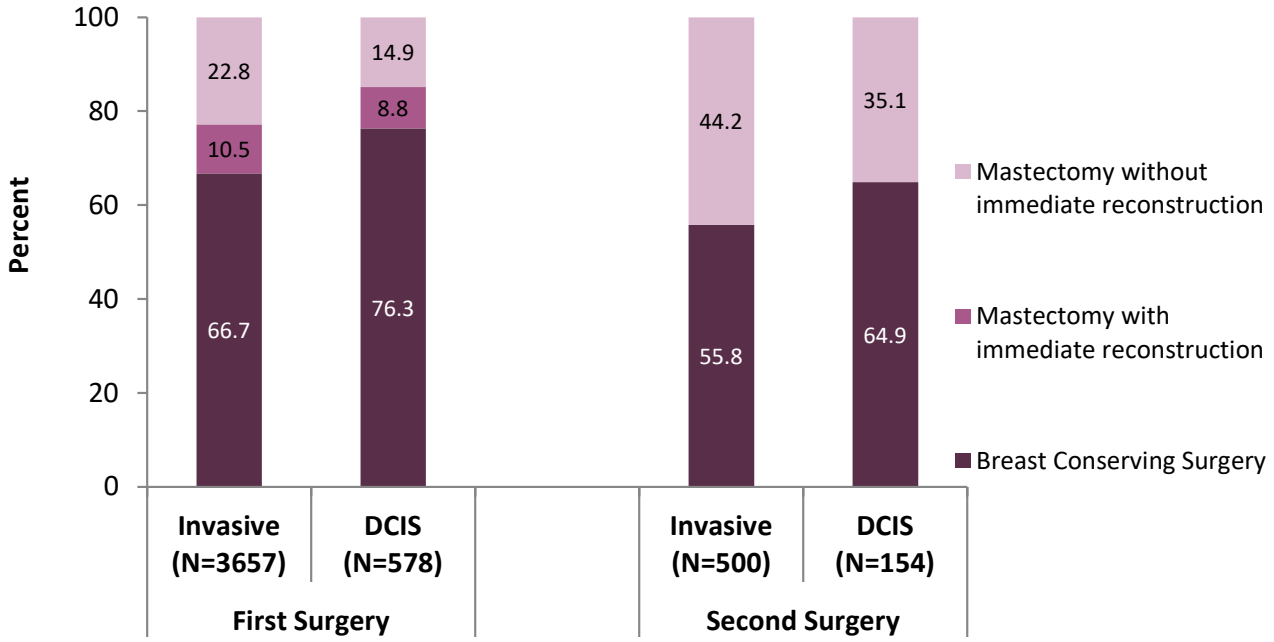


Figure 3.5 Type of resection, by regional health authority of residence at diagnosis, 2010-2014 (invasive breast cancer only)

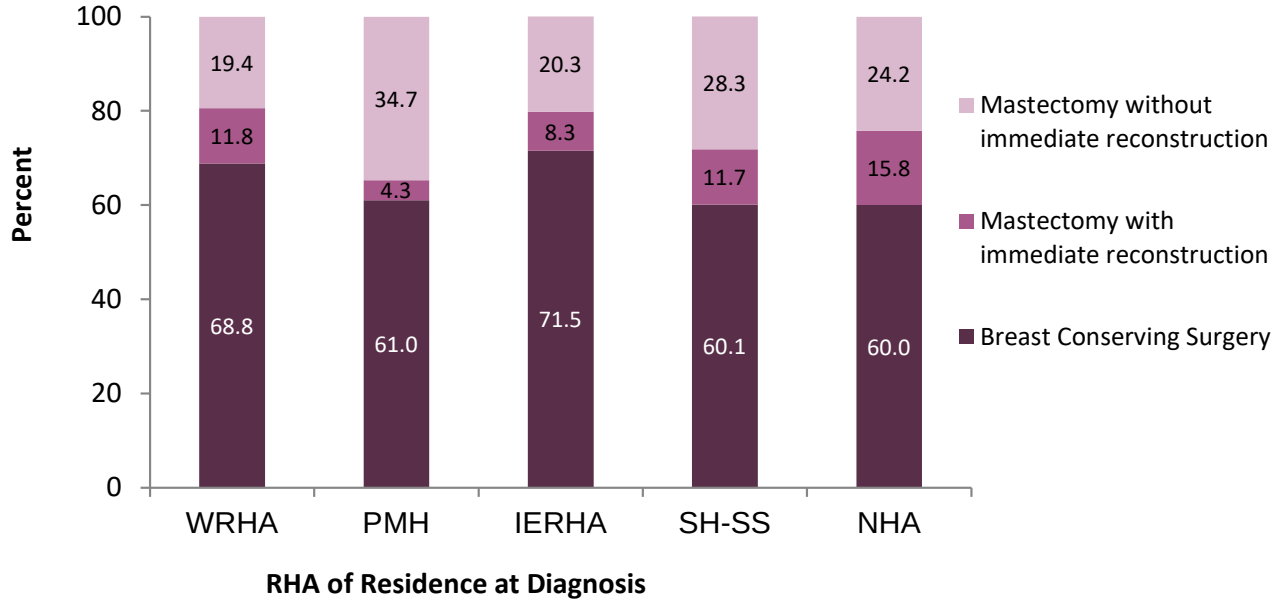
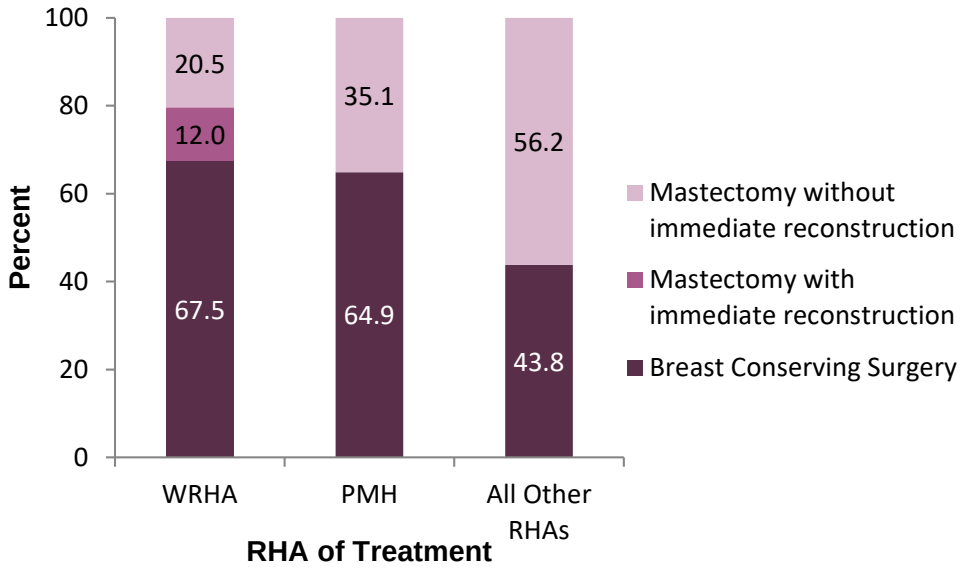


Figure 3.6 Type of resection, by regional health authority of treatment, 2010-2014 (invasive breast cancer only)



What does the data tell us?

First and second surgery choices amongst women who had invasive cancer and DCIS were similar in Manitoba. Comparing to the most recent pan-Canadian data available, Manitoba had the second lowest rate of mastectomies as a first surgery.[4] This suggests that women in Manitoba had appropriate access to BCS. Women with stage III or IV breast cancer who had surgery were the least likely to undergo BCS. Most BCS occurred in the Winnipeg Regional Health Authority (Figure 3.6). A higher percentage of women received a mastectomy without reconstruction if their surgeries occurred outside of the WRHA. BCS requires specialized equipment and pathology laboratory capabilities and only a few rural hospitals in Manitoba currently have these capabilities.

Additional information regarding this indicator including stratification by income quintile, regional health authority, age, and stage is included in Tables 3.11, 3.12, 3.13, and 3.14 at the end of this chapter.

Reconstructive surgery

Indicator definition

Percentage of breast cancer cases treated with a mastectomy within one year of diagnosis that had immediate reconstructive surgery.

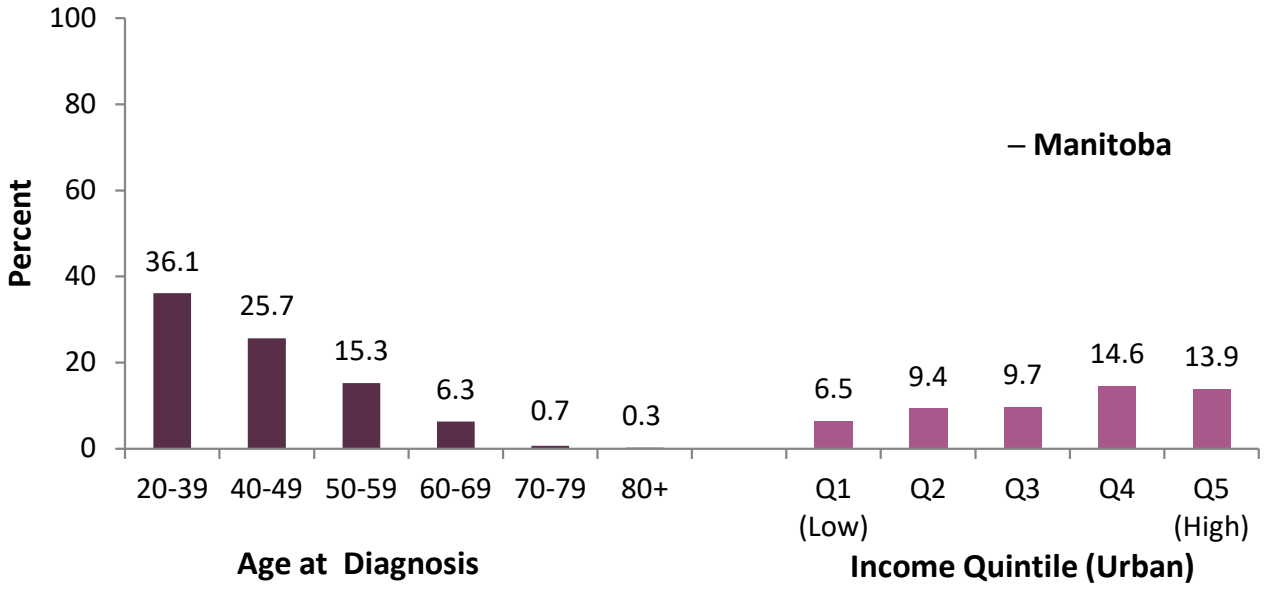
Why is this important to know?

Breast reconstruction can be an important part of the breast cancer patient journey. Immediate reconstruction may reduce psychological morbidity, the need for multiple operations, and is considered safe with relatively low complication rates. Undergoing immediate reconstruction is based on clinical indications and patient preference and is not solely related to access. Immediate reconstruction may also indicate that treatment is occurring in a multidisciplinary setting within an integrated system.

Take away message

- Mastectomy with immediate reconstruction ranged from 8.8% (n=51) for DCIS to 10.4% (n=383) for invasive cases.
- The percentage of women who received immediate reconstruction differed by age and income quintile (Figure 3.7).

Figure 3.7 Percentage of women with invasive cancer who had a mastectomy with immediate reconstruction, by age group and income quintile, 2010-2014



What does the data tell us?

Manitoba's rates of immediate reconstruction for women diagnosed with breast cancer (Invasive: 10.4% and DCIS: 8.8%) between 2010 and 2014, were higher than the Canadian average of 6.6% reported in 2009/2010.[2] Rates of immediate reconstruction are much higher in the United States and have been reported to be upwards of 42%.[5] A more recent Canadian study reported an immediate reconstruction rate of 14%[6] which is close to the rate reported in the WRHA (12%) for invasive cancer. In Manitoba, women with invasive cancer under the age of 50 and women with higher incomes were more likely to undergo a mastectomy with immediate reconstruction. These patterns were also previously found throughout Canada.[2] Manitoba has a strong immediate reconstruction program where plastic surgeons and surgeons associated with the Breast Health Centre work together to ensure resources, including access to operating room time, are available for women who select immediate reconstruction.

Additional information regarding this indicator including stratification by income quintile, RHA, age and stage is included in Table 3.15 at the end of this chapter.

Length of post-operative hospital stay

Indicator definition

Number of days between date of surgery and date of discharge for women diagnosed with breast cancer that underwent surgery within one year of diagnosis.

Why is this important to know?

Length of post-operative stay is related to many factors including type of procedure and the number and severity of post-operative complications. In most instances, BCS should be day surgery. In 2014, according to data from the Canadian Institute for Health Research (CIHI) the average cost of a bilateral mastectomy was $6,755 and the average cost of a unilateral mastectomy was $4,866.[7] The average estimated cost of BCS was $4,399 for invasive cancer and $3,992 for DCIS.[7] These costs included in-hospital expenditures and excluded surgeon reimbursement. Shorter hospital stays, when appropriate, can reduce costs to the healthcare system.

Take away message

- BCS in Manitoba was usually a day procedure (<24 hour hospital stay; Table 3.2).
- The longest post-operative hospital stay amongst women with invasive breast cancer occurred for those who had a mastectomy with immediate reconstruction (median = 3 days, 90th percentile = 5 days).

Table 3.2 Length of post-operative hospital stay for women with invasive breast cancer, 2010-2014

	Mean (days)	Median (days)	90th percentile (days)
BCS	0.2	0	1
Mastectomy with immediate reconstruction	3.6	3	5
Mastectomy without immediate reconstruction	1.8	1	4

**Zero days indicate a hospital stay of less than 24 hours.*

What does the data tell us?

Women in Manitoba diagnosed with breast cancer between 2010 and 2014 who received breast cancer surgery within one year of diagnosis had relatively short hospital stays. According to the most recent CIHI data available from the 2013-2014 fiscal year, the average in-hospital length of stay for women aged 60-79 years in Canada is 1.6 days for a bilateral mastectomy, 1.3 days for a unilateral mastectomy, and 1.2 days for BCS.[7]

Additional information regarding this indicator including stratification by income quintile, RHA, age and stage is included in Tables 3.16 and 3.17 at the end of this chapter.

Surgery in the RHA of residence

Indicator definition

Percentage of women with invasive breast cancer who received their diagnosis and first surgery within one year in their regional health authority of residence.

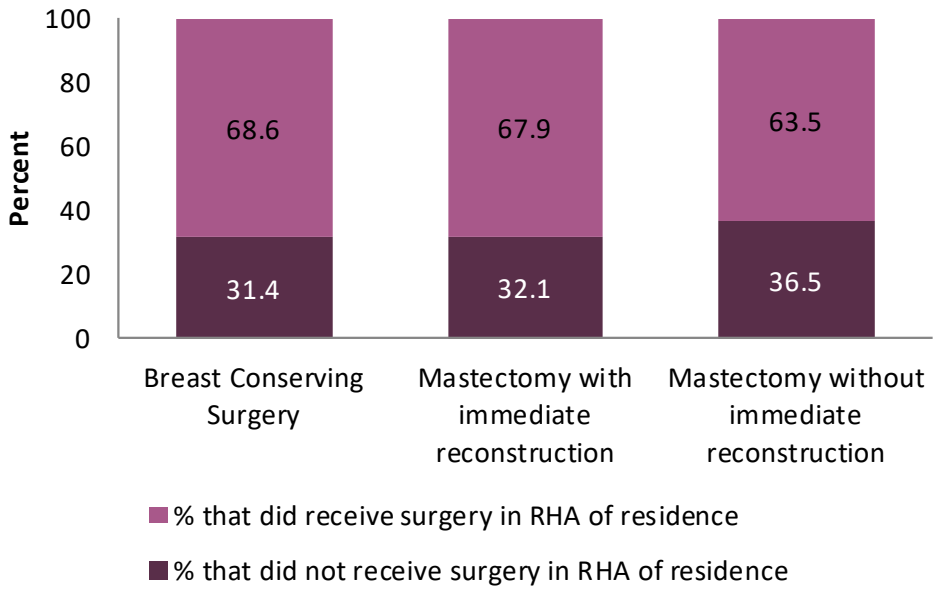
Why is this important to know?

This indicator gives a better idea of where women received surgical procedures and if they received their surgeries close to home. Several factors influence where a woman receives surgical cancer treatment including patient preference and type of procedure performed. For example, immediate reconstruction can only be completed in Winnipeg. Similarly, wire/needle localized lumpectomies and sentinel lymph node biopsies can be performed in some Manitoba hospitals but not others.

Take away message

- Among women with invasive breast cancer, 63.5% to 68.6% of women received surgery in the same RHA in which they lived (Figure 3.8).
- The majority of women (87.6%) diagnosed with invasive breast cancer in Manitoba received surgery in the WRHA.

Figure 3.8 Percentage of women diagnosed with invasive cancer that had their first surgery in the same RHA in which they lived at diagnosis, 2010-2014



What does the data tell us?

The majority of women in Manitoba with invasive breast cancer received their first surgery in the same RHA in which they lived at diagnosis. Most operations for invasive breast cancer were conducted in a hospital located in the WRHA. Most women who received surgery in a different RHA than their residence travelled to Winnipeg for their surgery. A large percentage of women with invasive breast cancer and DCIS (74%) who lived in Prairie Mountain Health (PMH) received their first surgery in PMH. This is likely due to the fact that Brandon has several surgeons who conduct breast cancer surgeries compared to other non-WRHA regional health authorities.

Additional information regarding this indicator is included in Table 3.15 at the end of this chapter.

Quality Performance Indicators

Timeliness of surgery

Indicator definition
Percentage of women diagnosed with invasive breast cancer that had a resection within 30 days of their surgical consult (excludes women who received neoadjuvant chemotherapy).

Why is this important to know?
Many factors influence the timeliness for surgery including operating and recovery room availability, ability to obtain diagnostic results such as a magnetic resonance imaging (MRI) in a timely manner, and patient preference. The fewer the days between a surgical consult and a surgery reduces the psychological burden on the patient and families. This measure aligns with CancerCare Manitoba's wait time and diagnostic pathway for breast cancer.

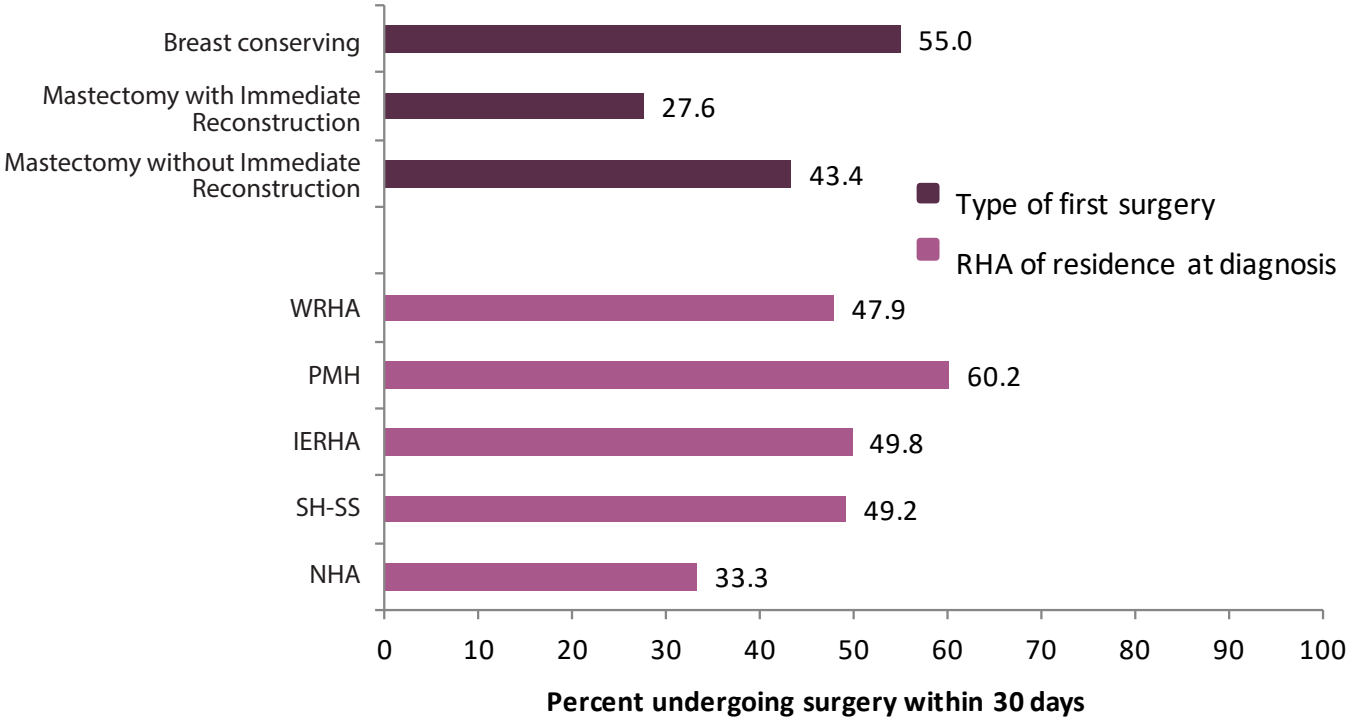
Interpretation of results
A high value for this indicator can be interpreted as a favorable result.

Take away message
- Nearly half of women (49.3%) with invasive breast cancer who had surgery within one year of diagnosis received their surgery within 30 days or less of their surgical consult (Table 3.3; Figure 3.9).
- Ninety percent of women with invasive breast cancer who had surgery within one year of diagnosis received their surgery within 56 days (Table 3.3).
- Women who chose mastectomy with immediate reconstruction waited the longest for their surgery (72.4% waited more than 30 days, median was 41 days, and 90th percentile was 67 days) (Table 3.3).
- Wait time for surgery differed by RHA of residence. Women who lived in the Northern Health Authority (NHA) had longer wait times compared to other RHAs (Figure 3.9).

Table 3.3 Percentage of invasive breast cancer cases that received surgical treatment within 30 days after surgical consult, by type of procedure, 2010-2014

Characteristic	≤ 30 days		Median (days)	90th percentile (days)
	N	%		
Manitoba	1245	49.3	30	56
Type of surgery				
BCS	936	55.0	29	52
Mastectomy without immediate reconstruction	224	43.4	32	57
Mastectomy with immediate reconstruction	85	27.6	41	67

Figure 3.9 Percentage of invasive breast cancer cases that received surgical treatment within 30 days after surgical consult, by type of surgery and RHA of residence, 2010-2014



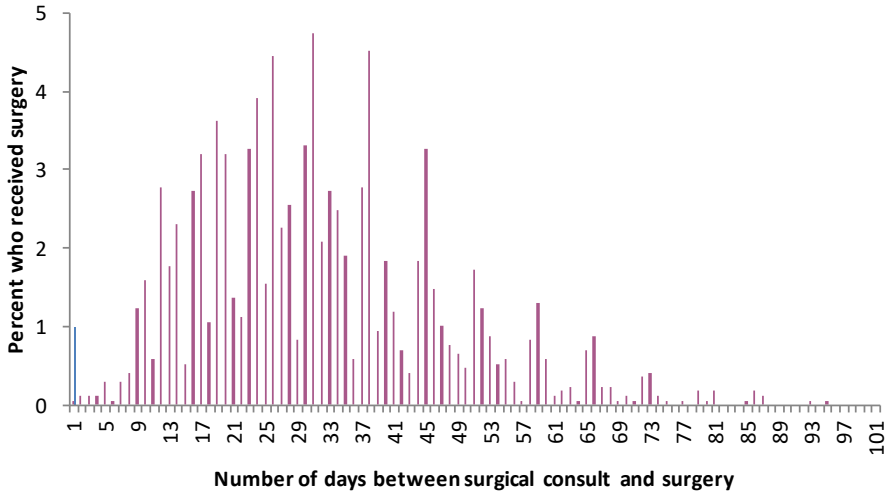
What does the data tell us?

The percentage of women who received their surgery within 30 days of their first surgical consult varied by procedure (27.6% to 55.0%), stage (40.1% to 52.2%) and RHA of residence at diagnosis (33.3% to 60.2%) (Table 3.18). However, the number of days that 90% of women received their surgery within was fairly consistent between groups. It should be noted that a major wait time reduction initiative began during the study time period, with full implementation after the study time period. Therefore, it is important to continue to monitor wait times.

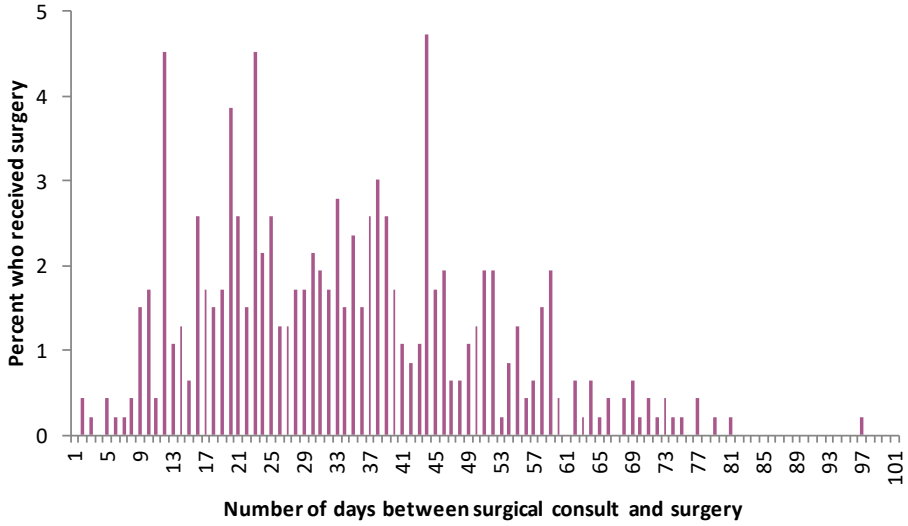
Additional information regarding this indicator including stratification by income quintile, RHA, age and stage is included in Table 3.18 at the end of this chapter.

Figure 3.10 Number of days from surgical consult to first surgery, by surgery type, 2010-2014

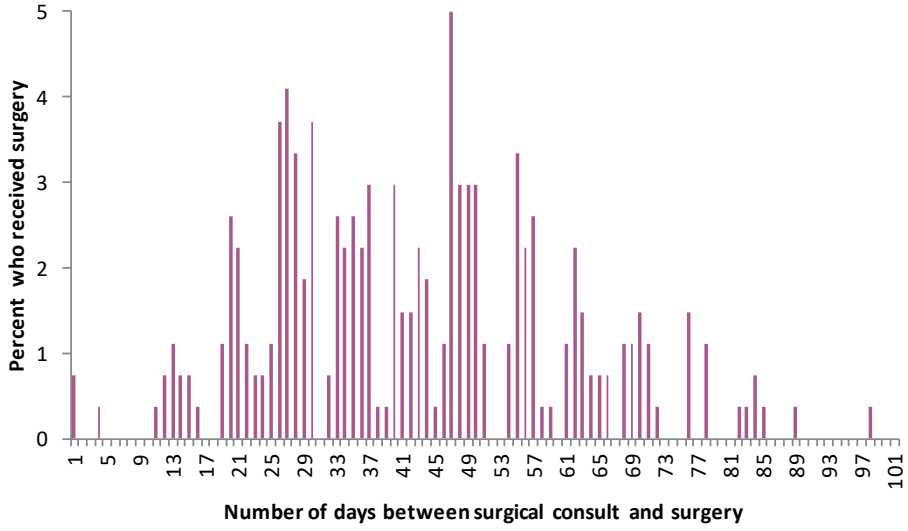
(a) Breast conserving surgery



(b) Mastectomy without immediate reconstruction



(c) Mastectomy with immediate reconstruction



Re-excision

Indicator definition
Percentage of cases with invasive breast cancer or DCIS that had BCS within one year of diagnosis, followed by another surgery within one year.

Why is this important to know?
Re-excision often occurs when there is a positive or close (<2mm) resection margin. Margin status correlates with local recurrence of disease. While re-excision to achieve negative margins may be clinically appropriate, re-excision can also contribute to psychological and economic stress for the patient and her family, increased potential for deformity of the breast, and has the potential to delay adjuvant chemotherapy or radiation therapy.

A re-excision target has been reported by several organizations and endorsed by the American Society of Breast Surgeons (ASBS), European Society of Breast Cancer Specialists (EUSOMA), and the National Consortium of Breast Centers (NCBC).[8] Although there is a lack of universal consensus regarding the utility of this measure as a quality indicator, the degree of variability in re-excision between jurisdictions suggests that there is a performance gap that should be monitored and potentially addressed.[9] As guidelines related to re-excision based on margin status and other factors evolve, it will be important to monitor trends and the impacts of these new guidelines on practice in Manitoba.

Interpretation of results
Low and high values for this indicator may indicate poor surgical quality. For example, very high values may indicate that the amount of tissue removed during the initial surgery was too conservative. Very low values may indicate excessive tissue removal leaving women subject to breast deformity. In addition, guidelines about the appropriate margin size have changed over time, such that an acceptable margin is a target in flux.

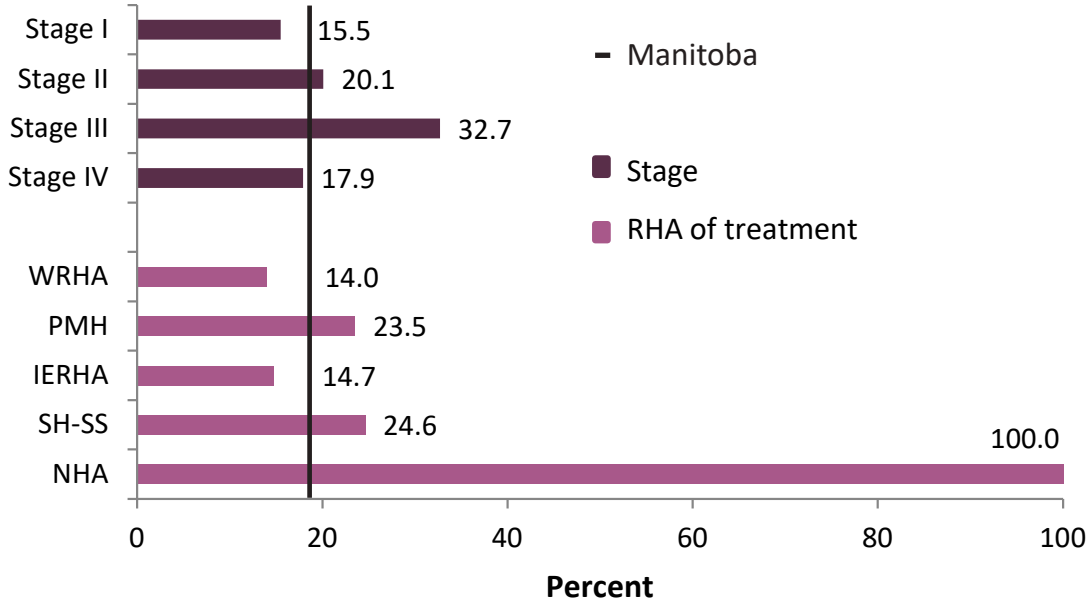
Take away message
- The percentage of women who required re-excision was higher amongst women who had surgery for DCIS compared to invasive cancer (Table 3.4). The Manitoba percentage fell within the range of values reported by other jurisdictions.
- The percentage of women with invasive breast cancer and DCIS who required re-excision differed by stage, RHA of treatment, and income (Figure 3.11).

Table 3.4 Percentage of cases that required a re-excision within one year of BCS, by diagnosis type, 2010-2014

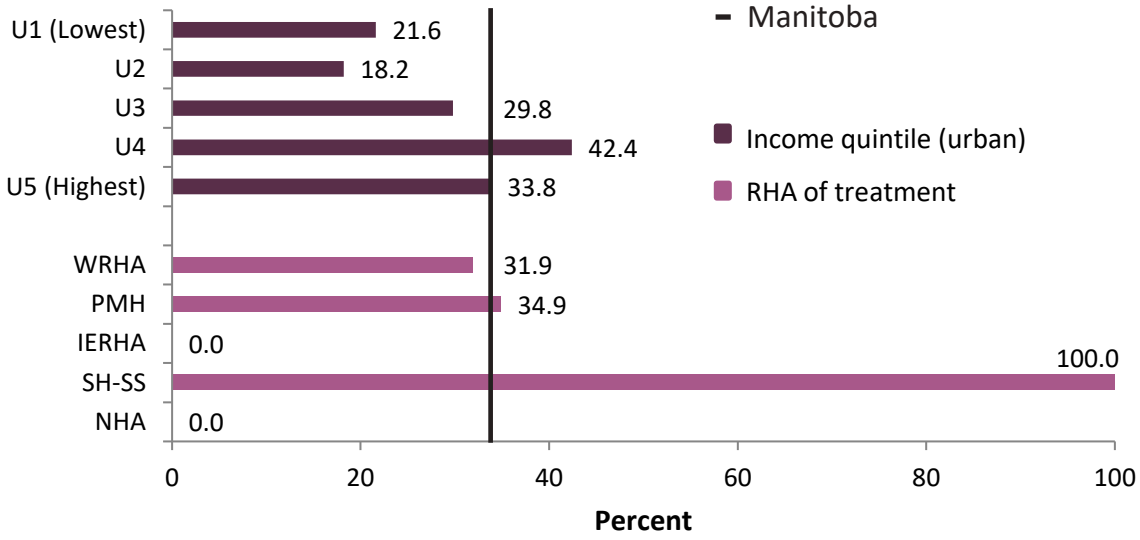
Manitoba Rate	Cases with First Treatment of BCS	Cases with Re-excision N (%)
Invasive breast cancer	2439	450 (18.5)
DCIS	441	143 (32.4)

Figure 3.11 Percentage of breast cancer cases that required re-excision after BCS, 2010-2014

(a) Invasive breast cancer



(b) DCIS



What does the data tell us?

Re-excision in Manitoba varied by RHA of treatment, stage, and income quintile. A previous Manitoba study found that of women with invasive breast cancer who underwent BCS followed by a re-excision between 2009 and 2012, 62.7% had residual disease identified on re-excision.[10] The American Society of Breast Surgeons (ASBS) held a consensus conference in 2015 regarding re-excision rates, and over two-thirds of attendees recommended a target re-excision rate of <20%.[11] Our data suggests that Manitoba had a low-to-average re-excision rate compared to other jurisdictions who report rates between <10% to >50%.[12] The percentage of cases that required re-excision in Manitoba was lower for invasive breast cancer compared to DCIS, and met the target of <20% of cases re-excised recommended at the 2015 ASBS conference. Additional information regarding this indicator including stratification by income quintile, RHA, age and stage is included in Tables 3.19 and 3.20 at the end of this chapter.

Negative axillary clearance

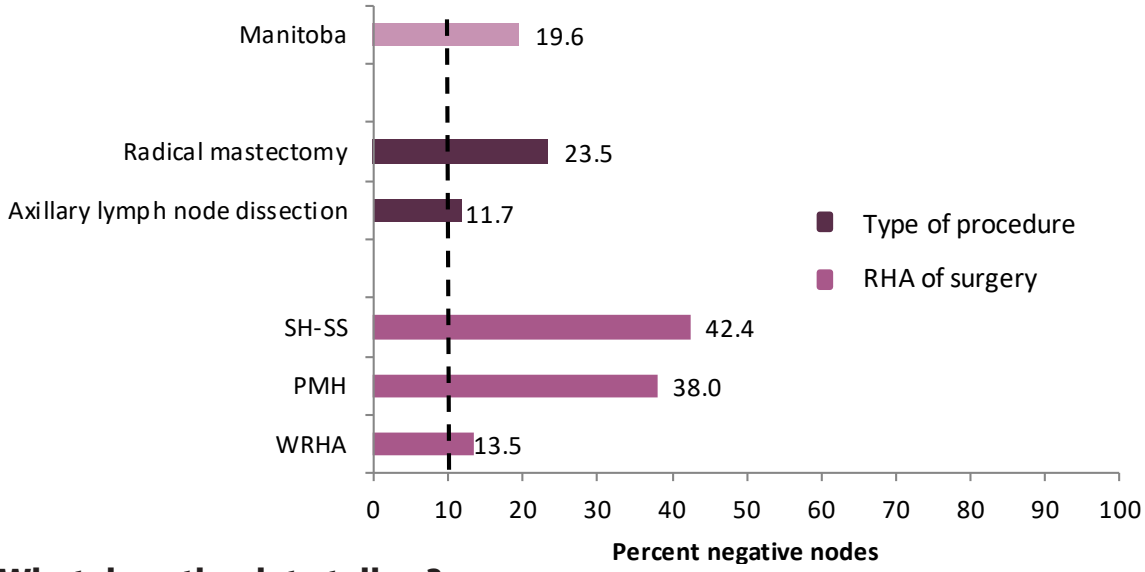
Indicator definition
Percentage of invasive breast cancer cases that did not receive neoadjuvant therapy and underwent axillary clearance within one year of diagnosis with no pathological evidence of nodal metastatic disease.

Why is this important to know?
Surgical axillary lymph node clearance – where all lymph nodes are removed from the armpit - is related to decreased arm mobility and increased lymphedema. There is no clinical evidence supporting surgical axillary clearance when metastatic disease is not present. There is currently no target in Manitoba but in Scotland where there is a robust surgery quality indicators system, the target is <10%.[13]

Interpretation of results
A low value for this indicator is interpreted as a favorable result.

Take away message
- Negative axillary clearance rates varied by RHA of treatment and RHA of residence (Table 3.21).
- The percentage of women who received axillary clearance when they did not have any pathological evidence of nodal disease was 19.6%, which was higher than the Scottish target of <10% (Figure 3.12).[13]

Figure 3.12 Percentage of invasive breast cancer cases who received axillary clearance and had no positive nodes, 2010-2014



What does the data tell us?
Axillary clearance varied by age, income quintile, RHA of residence at diagnosis, RHA of treatment, type of procedure, and stage. The percentage of women who had axillary clearance without positive nodes was more than double in PMH and SH-SS compared to WRHA. Women who had their axillary nodes removed as part of their resection (i.e., radical mastectomy) were more likely to be node-negative compared to women who had an axillary lymph node dissection coded separately. The variability seen may suggest different patterns of practice which require further study to ensure that knowledge of standards and access to equipment are adequate across the province.

Additional information regarding this indicator including stratification by income quintile, RHA, age and stage is included in Table 3.21 at the end of this chapter.

In-hospital post-operative complications

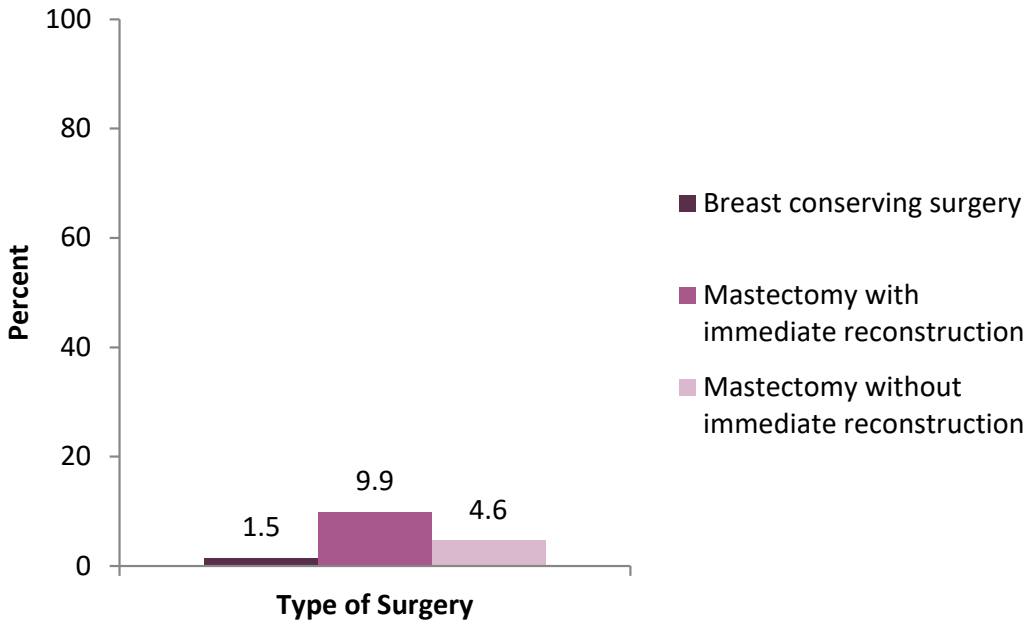
Indicator definition
Percentage of invasive breast cancer and DCIS cases that had at least one in-hospital post-operative complication.

Why is this important to know?
Post-operative complications can impact patient recovery, quality of life, and length of hospital stay. Post-operative complications are also influenced by factors not directly related to the surgical procedure including overall patient health and pre-existing comorbidities.

Interpretation of results
A low value for this indicator can be interpreted as a favorable result.

Take away message
- Overall, very few women had one or more in-hospital post-operative complications recorded (Figure 3.13).
- The highest percentage of complications (9.9%) was seen among those who received mastectomy with immediate reconstruction (Figure 3.13).

Figure 3.13 Percentage of women with invasive breast cancer or DCIS that had at least one in-hospital post-operative complication during the same admission as their first surgery, by type of surgery, 2010-2014



What does the data tell us?

The highest percentage of complications occurred among women who received a mastectomy with immediate reconstruction. This has been found in other studies.[14] A recent U.S. study found that women who had a mastectomy with immediate reconstruction had almost twice the risk of complication compared to women who received a BCS with radiation.[15] In a CIHI report based on breast cancer surgeries between 2007/08 and 2009/10, 7-day and 30-day pan-Canadian complication rates were also low for BCS (2%) and mastectomy (6%).[2]

Additional indicator calculation information

This indicator excludes complications that occurred after women were released from the hospital and only includes complications that were recorded in the hospital record. Therefore, this indicator may underestimate the number of complications that actually occurred and does not assess the severity of complications.

Additional information regarding this indicator is included in Table 3.22 at the end of this chapter.

Table 3.5 Age-standardized incidence rates of invasive breast cancer cases, by cohort characteristics, 2010–2014

Characteristic	Invasive Breast Cancer Cohort		Age-Standardized Incidence Rate per 100,000 (95% CI)
	N	% Manitoba (95% CI)	
Manitoba	3962	100.0	165.0 (159.9,170.2)
Age group			
20-39	139	3.5 (2.9,4.1)	16.4 (13.8,19.4)
40-49	525	13.3 (12.2,14.3)	122.5 (112.3,133.5)
50-59	919	23.2 (21.9,24.5)	210.5 (197.1,224.6)
60-69	1091	27.5 (26.1,28.9)	344.2 (324.1,365.2)
70-79	752	19.0 (17.8,20.2)	393.1 (365.5,422.3)
80+	536	13.5 (12.5,14.6)	315.7 (289.5,343.5)
Income quintile (urban)			
U1 (lowest)	450	11.7 (10.7,12.7)	159.6 (144.6,174.6)
U2	491	12.8 (11.7,13.8)	175.3 (159.8,190.8)
U3	531	13.8 (12.7,14.9)	179.9 (164.6,195.2)
U4	511	13.3 (12.2,14.4)	176.6 (161.1,192.2)
U5 (highest)	501	13.0 (12.0,14.1)	167.7 (152.8,182.6)
Income quintile (rural)			
R1 (lowest)	238	6.2 (5.4,7.0)	164.2 (143.3,185.0)
R2	276	7.2 (6.4,8.0)	154.0 (135.8,172.3)
R3	275	7.2 (6.3,8.0)	148.1 (130.5,165.6)
R4	272	7.1 (6.3,7.9)	152.7 (134.4,171.0)
R5 (highest)	296	7.7 (6.9,8.6)	165.6 (146.0,185.2)
RHA of residence at diagnosis			
WRHA	2402	60.6 (59.1,62.1)	170.1 (163.3,176.9)
PMH	545	13.8 (12.7,14.8)	157.6 (144.2,170.9)
SH-SS	483	12.2 (11.2,13.2)	159.9 (145.6,174.2)
IERHA	433	10.9 (10.0,11.9)	171.5 (155.1,187.8)
NHA	99	2.5 (2.0,3.0)	109.8 (88.4,134.8)
Stage			
Stage I	1764	44.6 (43.0,46.1)	-
Stage II	1447	36.6 (35.1,38.1)	-
Stage III	545	13.8 (12.7,14.8)	-
Stage IV	172	4.3 (3.7,5.0)	-
Unknown	29	0.7 (0.5,1.0)	

All characteristics are calculated at date of diagnosis.
Incidence rates have been age-standardized to the Manitoba Health population from 2010 to 2014.
Table shows column %.

Table 3.6 Invasive breast cancer cases that underwent a resection within one year of diagnosis by cohort characteristics, 2010-2014 (Row Percent)

Characteristic	Had Surgery		Did not Have Surgery	
	N	Age-Standardized % Total (95% CI)	N	Age-Standardized % Total (95% CI)
Manitoba	3658	92.3 (91.3,93.3)	304	7.7 (6.7,8.7)
Age group				
20-49	631	95.0 (93.4,96.7)	33	5.0 (3.3,6.6)
50-59	880	95.8 (94.5,97.1)	39	4.2 (2.9,5.5)
60-69	1042	95.5 (94.3,96.7)	49	4.5 (3.3,5.7)
70-79	705	93.8 (92.0,95.5)	47	6.3 (4.5,8.0)
80+	400	74.6 (70.9,78.3)	136	25.4 (21.7,29.1)
Income quintile (urban)				
U1 (lowest)	401	89.8 (86.5,93.0)	49	10.2 (7.0,13.5)
U2	457	93.9 (91.5,96.3)	34	6.1 (3.7,8.5)
U3	497	93.7 (91.4,96.1)	34	6.3 (3.9,8.6)
U4	479	93.2 (90.6,95.8)	32	6.8 (4.2,9.4)
U5 (highest)	468	93.3 (90.8,95.9)	33	6.7 (4.1,9.2)
Income quintile (rural)				
R1 (lowest)	213	90.2 (85.8,94.5)	25	9.8 (5.5,14.2)
R2	254	92.3 (88.6,95.9)	22	7.7 (4.1,11.4)
R3	260	94.5 (91.3,97.6)	15	5.5 (2.4,8.7)
R4	252	92.6 (89.0,96.3)	20	7.4 (3.7,11.0)
R5 (highest)	278	91.8 (87.9,95.7)	18	8.2 (4.3,12.1)
RHA of residence at diagnosis				
WRHA	2206	92.1 (90.9,93.4)	-	7.9 (6.6,9.1)
PMH	511	93.3 (90.8,95.8)	-	6.7 (4.2,9.2)
SH-SS	446	90.7 (87.6,93.9)	-	9.3 (6.1,12.4)
IERHA	400	93.5 (90.9,96.2)	-	6.5 (3.8,9.1)
NHA	95	94.8 (89.4,100.0)	-	5.2 (0.0,10.6)
Stage				
Stage I	1699	96.9 (96.0,97.8)	65	3.1 (2.2,4.0)
Stage II	1374	96.3 (95.2,97.4)	73	3.7 (2.6,4.8)
Stage III	506	92.5 (89.8,95.2)	39	7.5 (4.8,10.2)
Stage IV	67	31.8 (25.0,38.7)	105	68.2 (61.3,75.0)
Unknown	7	37.0 (15.5.58.5)	22	63.0(41.5,84.5)

All characteristics are calculated at date of diagnosis
Some cells are suppressed due to small counts. Cases not assigned to an income quintile or stage are not presented.
Subgroup proportions (% Total) have been age-standardized to the overall invasive breast cancer cohort.
Invasive breast cancer cases that did not have surgery may have received other types of treatment.

Table 3.7 Invasive breast cancer cases that underwent a resection within one year of diagnosis, by cohort characteristics, 2010-2014 (Column Percent)

Characteristic	Had Surgery		Did Not Have Surgery	
	N	% Total	N	% Total
Manitoba	3658	100.0	304	100.0
Age group				
20-49	631	17.2	33	10.9
50-59	880	24.1	39	12.8
60-69	1042	28.5	49	16.1
70-79	705	19.3	47	15.5
80+	400	10.9	136	44.7
Income quintile (urban)				
U1 (lowest)	401	17.4	49	26.9
U2	457	19.9	34	18.7
U3	497	21.6	34	18.7
U4	479	20.8	32	17.6
U5 (highest)	468	20.3	33	18.1
Income quintile (rural)				
R1 (lowest)	213	16.9	25	25.0
R2	254	20.2	22	22.0
R3	260	20.7	15	15.0
R4	252	20.0	20	20.0
R5 (highest)	278	22.1	18	18.0
RHA of residence at diagnosis				
WRHA	2206	60.3	-	64.5
PMH	511	14.0	-	11.2
SH-SS	446	12.2	-	12.2
IERHA	400	10.9	-	10.8
NHA	95	2.6	-	1.3
Stage				
Stage I	1699	46.6	65	23.0
Stage II	1374	37.7	73	25.9
Stage III	506	13.9	39	13.8
Stage IV	67	1.8	105	37.2

Some cells are suppressed due to small counts. Cases not assigned to an income quintile or stage are not presented.
All characteristics are calculated at date of diagnosis
Invasive breast cancer cases that did not have surgery do not mean that they did not receive any treatment.

Table 3.8 Age-standardized incidence rates of DCIS cases, by cohort characteristics, 2010–2014

Characteristic	DCIS Cohort		Age-Standardized Incidence Rate per 100,000 (95% CI)
	N	% Manitoba (95% CI)	
Manitoba	595	100.0	24.7 (22.7,26.7)
Age group			
20-39	9	1.5 (0.5,2.5)	1.1 (0.5,2.0)
40-49	68	11.4 (8.9,14.0)	15.9 (12.3,20.1)
50-59	179	30.1 (26.4,33.8)	41.0 (35.2,47.5)
60-69	172	28.9 (25.3,32.6)	54.3 (46.5,63.0)
70-79	132	22.2 (18.8,25.5)	69.0 (57.7,81.8)
80+	35	5.9 (4.0,7.8)	20.6 (14.4,28.7)
Income quintile (urban)			
U1 (lowest)	69	11.8 (9.2,14.4)	25.2 (19.6,32.0)
U2	67	11.4 (8.8,14.0)	24.0 (18.6,30.5)
U3	75	12.8 (10.1,15.5)	25.2 (19.8,31.6)
U4	88	15.0 (12.1,17.9)	29.6 (23.7,36.6)
U5 (highest)	107	18.3 (15.1,21.4)	35.2 (28.4,41.9)
Income quintile (rural)			
R1 (lowest)	25	4.3 (2.6,5.9)	17.4 (11.2,25.6)
R2	35	6.0 (4.0,7.9)	19.3 (13.4,26.9)
R3	39	6.7 (4.6,8.7)	21.4 (15.2,29.3)
R4	40	6.8 (4.8,8.9)	21.6 (15.4,29.5)
R5 (highest)	41	7.0 (4.9,9.1)	21.8 (15.5,29.8)
RHA of residence at diagnosis			
WRHA	393	66.1 (62.2,69.9)	27.9 (25.1,30.7)
PMH	69	11.6 (9.0,14.2)	20.3 (15.8,25.7)
SH-SS	57	9.6 (7.2,12.0)	18.7 (14.1,24.2)
IERHA	54	9.1 (6.8,11.4)	20.3 (15.3,26.6)
NHA	22	3.7 (2.2,5.2)	25.2 (15.1,39.4)

Includes cases diagnosed between January 1, 2010 and December 31, 2014.
All characteristics are calculated at date of diagnosis.
Incidence rates have been age-standardized to the Manitoba Health population from 2010 to 2014.
Age-specific rates have not been standardized.
Table shows column %.

Table 3.9 DCIS cases that had surgery within one year of diagnosis, by cohort characteristics, 2010-2014

Characteristic	Had Surgery		Did Not Have Surgery	
	N	Age-Standardized % Total (95% CI)	N	Age Standardized % Total (95% CI)
Manitoba	578	97.1 (95.6,98.7)	17	2.9 (1.3,4.4)
Age group				
20-49	74	96.1 (91.8,100.0)	-	-
50-59	177	98.9 (97.3,100.0)	-	-
60-69	168	97.7 (95.4,99.9)	-	-
70-79	127	96.2 (92.9,99.5)	-	-
80+	32	91.4 (82.1,100.0)	-	-
Income quintile (urban)				
U1 (lowest)	68	98.2 (94.8,100.0)	-	-
U2	66	98.9 (96.8,100.0)	-	-
U3	71	93.6 (86.3,100.0)	-	-
U4	86	98.7 (96.9,100.0)	-	-
U5 (highest)	104	96.3 (91.4,100.0)	-	-
Income quintile (rural)				
R1 (lowest)	24	95.1 (85.7,100.0)	-	-
R2	33	95.7 (89.7,100.0)	-	-
R3	38	96.8 (90.8,100.0)	-	-
R4	38	97.2 (93.0,100.0)	-	-
R5 (highest)	41	100.0 (100.0,100.0)	-	-
RHA of residence at diagnosis				
WRHA	382	97.0 (94.8,99.1)	-	-
PMH	68	98.9 (96.8,100.0)	-	-
SH-SS	56	98.7 (96.0,100.0)	-	-
IERHA	51	94.8 (88.5,100.0)	-	-
NHA	21	96.6 (90.0,100.0)	-	-

Table shows row %.
All characteristics are calculated at date of diagnosis
Subgroup proportions (% Total) have been age-standardized to the overall invasive breast cancer cohort.
Small cell sizes have been suppressed.

Table 3.10 DCIS cases that had surgery within one year of diagnosis, by cohort characteristics, 2010-2014

Characteristic	Had Surgery		Did Not Have Surgery	
	N	% Total	N	% Total
Manitoba	578	100.0	17	100.0
Age group				
20-49	74	12.8	-	-
50-59	177	30.6	-	-
60-69	168	29.1	-	-
70-79	127	22.0	-	-
80+	32	5.5	-	-
Income quintile (urban)				
U1 (lowest)	68	17.2	-	-
U2	66	16.7	-	-
U3	71	18.0	-	-
U4	86	21.8	-	-
U5 (highest)	104	26.3	-	-
Income quintile (rural)				
R1 (lowest)	24	13.8	-	-
R2	33	19.0	-	-
R3	38	21.8	-	-
R4	38	21.8	-	-
R5 (highest)	41	23.6	-	-
RHA of residence at diagnosis				
WRHA	382	66.1	-	-
PMH	68	11.8	-	-
SH-SS	56	9.7	-	-
IERHA	51	8.8	-	-
NHA	21	3.6	-	-

Table shows column %.
Includes cases diagnosed between January 1, 2010 and December 31, 2014; surgeries included occurred between January 1, 2010 and December 31, 2015.
All characteristics are calculated at date of diagnosis
Invasive breast cancer cases that did not have surgery do not mean that they did not receive any treatment.

Table 3.11 Type of first surgery conducted to treat invasive breast cancer cases, by cohort characteristics, 2010-2014

Characteristic	BCS (%)	Mastectomy With Immediate Reconstruction (%)	Mastectomy Without Immediate Reconstruction (%)
Manitoba	2439 (66.7)	383 (10.5)	836 (22.8)
Age group			
20-39	56 (42.1)	48 (36.1)	29 (21.8)
40-49	291 (58.4)	128 (25.7)	79 (15.9)
50-59	590 (67.0)	135 (15.3)	155 (17.6)
60-69	755 (72.5)	66 (6.3)	221 (21.2)
70-80+	747 (67.7)	6 (0.5)	352 (31.8)
Income quintile (urban)			
U1 (lowest)	277 (69.1)	26 (6.5)	98 (24.4)
U2	299 (65.4)	43 (9.4)	115 (25.2)
U3	355 (71.4)	48 (9.7)	94 (18.9)
U4	325 (67.8)	70 (14.6)	84 (17.5)
U5 (highest)	331 (70.7)	65 (13.9)	72 (15.4)
Income quintile (rural)			
R1 (lowest)	129 (60.6)	17 (8.0)	67 (31.5)
R2	157 (61.8)	15 (5.9)	82 (32.3)
R3	162 (62.5)	15 (5.8)	82 (31.7)
R4	151 (59.9)	35 (13.9)	66 (26.2)
R5 (highest)	191 (68.7)	38 (13.7)	49 (17.6)
RHA of residence at diagnosis			
WRHA	1517 (68.8)	261 (11.8)	428 (19.4)
PMH	311 (61.0)	22 (4.3)	177 (34.7)
SH-SS	268 (60.1)	52 (11.7)	126 (28.3)
IERHA	286 (71.5)	33 (8.3)	81 (20.3)
NHA	57 (60.0)	15 (15.8)	23 (24.2)
RHA of first surgery			
WRHA	2148 (67.5)	383 (12.0)	652 (20.5)
PMH	248 (64.9)	n/a	134 (35.1)
All other RHA	32 (43.8)	n/a	41 (56.2)
Out of Province	11 (57.9)	n/a	8 (42.1)
Stage			
Stage I	1342 (79.0)	113 (6.7)	244 (14.4)
Stage II	889 (64.7)	146 (10.6)	338 (24.6)
Stage III	171 (33.8)	111 (21.9)	224 (44.3)
Stage IV	28 (41.8)	12 (17.9)	27 (40.3)

Table shows row percent. Immediate reconstruction is only conducted in the WRHA.
Stage not applicable and unknown, as well as income quintile not found are not presented in the table.

Table 3.12 Type of second surgery conducted to treat invasive breast cancer cases, by cohort characteristics, 2010-2014

Type of Surgery	BCS (%)	Mastectomy With Immediate Reconstruction (%)	Mastectomy Without Immediate Reconstruction (%)
Manitoba	279 (55.8)	n/a	221 (44.2)
Age group			
20-39	10 (45.5)	n/a	12 (54.5)
40-49	34 (42.0)	n/a	47 (58.0)
50-59	74 (56.9)	n/a	56 (43.1)
60-69	94 (64.4)	n/a	52 (35.6)
70-79	45 (57.0)	n/a	34 (43.0)
80+	22 (52.4)	n/a	20 (47.6)
Income quintile (urban)			
U1 (lowest)	29 (58.0)	n/a	21 (42.0)
U2	32 (62.7)	n/a	19 (37.3)
U3	53 (60.9)	n/a	34 (39.1)
U4	34 (59.6)	n/a	23 (40.4)
U5 (highest)	38 (55.9)	n/a	30 (44.1)
Income quintile (rural)			
R1 (lowest)	17 (53.1)	n/a	15 (46.9)
R2	16 (47.1)	n/a	18 (52.9)
R3	24 (54.5)	n/a	20 (45.5)
R4	9 (34.6)	n/a	17 (65.4)
R5 (highest)	25 (56.8)	n/a	19 (43.2)
RHA of residence at diagnosis			
WRHA	171 (59.4)	n/a	117 (40.6)
All other RHA	108 (50.9)	n/a	104 (49.1)
RHA of first surgery			
WRHA	249 (57.5)	n/a	184 (42.5)
All other RHA	30 (44.8)	n/a	37 (55.2)
Stage			
Stage I	139 (60.7)	n/a	90 (39.3)
Stage II	118 (58.7)	n/a	83 (41.3)
Stage III & IV	21 (30.9)	n/a	47 (69.1)

**table shows row percent.*

Table 3.13 Type of first surgery conducted to treat DCIS cases, by cohort characteristics, 2010-2014

Type of Surgery	BCS (%)	Mastectomy With Immediate Reconstruction (%)	Mastectomy Without Immediate Reconstruction (%)
Manitoba	441 (76.3)	51 (8.8)	86 (14.9)
Age group			
20-49	48 (64.9)	18 (24.3)	8 (10.8)
50-59	132 (74.6)	22 (12.4)	23 (13.0)
60-69	139 (82.7)	8 (4.8)	21 (12.5)
70+	122 (78.2)	<6	34 (21.8)
Income quintile (urban)			
U1 (lowest)	- (75.0)	- (11.8)	- (13.2)
U2	- (83.3)	- (3.0)	- (13.6)
U3	- (80.3)	- (5.6)	- (14.1)
U4	- (76.7)	- (7.0)	- (16.3)
R5 (highest)	- (74.0)	- (12.5)	- (13.5)
Income quintile (rural)			
R1 (lowest)	- (79.2)	- (4.2)	- (16.7)
R2	- (75.8)	- (3.0)	- (21.2)
R3	- (73.7)	- (10.5)	- (15.8)
R4	- (71.1)	- (18.4)	- (10.5)
R5 (highest)	- (73.2)	- (12.2)	- (14.6)
RHA of residence at diagnosis			
WRHA	291 (76.2)	33 (8.6)	58 (15.2)
All other RHA	150 (76.5)	18 (9.2)	28 (14.3)
RHA of first surgery			
WRHA	392 (75.0)	51 (9.8)	80 (15.3)
All other RHA	49 (89.1)	n/a	6 (10.9)

Table shows row percent.
Immediate reconstruction is only conducted in the WRHA.
Small cell size counts were suppressed and only proportions are shown for income quintile.

Table 3.14 Type of second surgery conducted to treat DCIS cases by cohort characteristics, 2010-2014

Type of Surgery	BCS (%)	Mastectomy With Immediate Reconstruction (%)	Mastectomy Without Immediate Reconstruction (%)
Manitoba	100 (64.9)	n/a	54 (35.1)
Age group			
20-49	15 (65.2)	n/a	8 (34.8)
50-59	24 (53.3)	n/a	21 (46.7)
60-69	31 (67.4)	n/a	15 (32.6)
70+	30 (75.0)	n/a	10 (25.0)
RHA of residence at diagnosis			
WRHA	62 (66.7)	n/a	31 (33.3)
All other RHA	38 (62.3)	n/a	23 (37.7)
RHA of first surgery			
WRHA	89 (65.4)	n/a	47 (34.6)
All other RHA	11 (61.1)	n/a	7 (38.9)

**Table shows row percent.*
Unable to report income quintile data due to small cell sizes.

Table 3.15 Regional Health Authority (RHA) of residence of invasive breast cancer cases diagnosed that had a surgery within one year of diagnosis, by RHA of first surgery, 2010-2014

Location	BCS (%)	Mastectomy With Immediate Reconstruction (%)	Mastectomy Without Immediate Reconstruction (%)
Diagnosis and surgery in WRHA	1512 (62.1)	260 (67.9)	425 (51.0)
Diagnosis in non-WRHA and surgery in WRHA	644 (26.4)	123 (32.1)	235 (28.2)
Diagnosis and first surgery in same non-WRHA RHA	158 (6.5)	n/a	104 (12.5)
Diagnosis in non-WRHA RHA and surgery in a different non-WRHA RHA	122 (5.0)	n/a	69 8.3
Surgery in Same RHA as Residence			
Yes	1670 (68.6)	260 (67.9)	529 (63.5)
No	766 (31.4)	123 (32.1)	304 (36.5)

Table 3.16 Number of days between surgery date and discharge date for women with invasive breast cancer that had a surgery within one year of diagnosis, 2010-2014

Characteristic	Median (days)	90th percentile (days)
Manitoba	0	3
Type of first surgery		
BCS	0	1
Mastectomy with immediate reconstruction	3	5
Mastectomy without immediate reconstruction	1	4
BCS by RHA of residence at diagnosis		
WRHA	0	1
PMH	0	1
SH-SS	0	2
Mastectomy without immediate reconstruction by RHA of residence at diagnosis		
WHRA	1	3
PMH	2	4
SH-SS	3	6

Table 3.17 Number of days between surgery date and discharge date for women with DCIS that had a surgery within one year of diagnosis, 2010-2014

Characteristic	Median (days)	90th percentile (days)
Manitoba	0	3
Type of first surgery		
BCS	0	0
Mastectomy with immediate reconstruction	3	6
Mastectomy without immediate reconstruction	1	3
BCS by RHA of residence at diagnosis		
WRHA	0	1
All other RHA	0	0
Mastectomy without immediate reconstruction by RHA of residence at diagnosis		
WHRA	1	3
PMH	1	3
All other RHA	3	3

Table 3.18 Number of days between first surgical consult and date of first surgery for women with invasive breast cancer that had surgery within one year of diagnosis, by cohort characteristics 2010-2014

Characteristic	Less than or equal to 30 days		More than 30 days		90th percentile (days)
	N	%	N	%	%
Manitoba	1245	49.3	1281	50.7	56.0
Age group					
20-39	27	32.9	55	67.1	56.0
40-49	176	49.4	180	50.6	58.0
50-59	299	46.7	341	53.3	56.0
60-69	409	54.0	349	46.0	52.0
70-79	227	48.6	240	51.4	55.0
80+	107	48.0	116	52.0	63.0
Income quintile (urban)					
U1 (lowest)	129	46.4	149	53.6	61.0
U2	155	47.0	175	53.0	58.5
U3	171	50.6	167	49.4	50.0
U4	169	49.3	174	50.7	56.0
U5 (highest)	186	53.4	162	46.6	53.0
Income quintile (rural)					
06 R1 (lowest)	57	41.6	80	58.4	61.0
R2	71	46.7	81	53.3	58.0
R3	79	50.3	78	49.7	50.0
R4	88	47.8	96	52.2	58.0
R5 (highest)	107	56.3	83	43.7	51.0
RHA of residence at diagnosis					
WRHA	766	47.9	832	52.1	56.0
PMH	160	60.2	106	39.8	51.0
SH-SS	151	49.2	156	50.8	54.0
IERHA	150	49.8	151	50.2	58.0
NHA	18	33.3	36	66.7	64.0
Stage					
Stage I	609	49.6	618	50.4	55.0
Stage II	496	52.2	454	47.8	57.0
Stage III	140	40.1	209	59.9	55.0
Type of first surgery					
BCS	936	55.0	766	45.0	52.0
Mastectomy with immediate reconstruction	85	27.6	223	72.4	67.0
Mastectomy without reconstruction	224	43.4	292	56.6	57.0

Table excludes tumours diagnosed at Stage IV or unknown stage or tumours which receive neoadjuvant treatment.
Timeliness is calculated from first consult date to date of first surgical procedure.

Table 3.19 Percentage of women diagnosed with invasive breast cancer that had their first surgery within one year or diagnosis followed by at least one re-excision within one year, by cohort characteristics, 2010-2014

Characteristic	Number of women who had BCS first	Number of women who had a re-excision (%)
Manitoba	2439	450 (18.5)
Age group		
20-39	56	20 (35.7)
40-49	291	70 (24.1)
50-59	590	118 (20.0)
60-69	755	133 (17.6)
70-79	483	76 (15.7)
80+	264	33 (12.5)
Income quintile (urban)		
U1 (lowest)	277	46 (16.6)
U2	299	47 (15.7)
U3	355	81 (22.8)
U4	325	48 (14.8)
U5 (highest)	331	60 (18.1)
Income quintile (rural)		
R1 (lowest)	129	28 (21.7)
R2	157	32 (20.4)
R3	162	41 (25.3)
R4	151	23 (15.2)
R5 (highest)	191	39 (20.4)
RHA of residence at diagnosis		
WRHA	1517	258 (17.0)
PMH	311	73 (23.5)
SH-SS	268	66 (24.6)
IERHA	286	42 (14.7)
NHA	57	11 (19.3)
RHA of first surgery		
WRHA	2148	376 (17.5)
PMH	248	57 (23.0)
All other RHA	32	15 (46.8)
Stage		
Stage I	1342	208 (15.5)
Stage II	889	179 (20.1)
Stage III	171	56 (32.7)
Stage IV	28	<6 (-)

Re-excision may be another lumpectomy or a mastectomy. Re-excision is excluded if an intervening cancer diagnosis occurs on the same breast as the first lumpectomy. Cases that received their first BCS outside of Manitoba are excluded from the "RHA of first surgery" group.

Table 3.20 Re-excisions after BCS for DCIS, by cohort characteristics, 2010-2014

Characteristic	Number of women who had BCS first	Number of women who had a re-excision (%)
Manitoba	441	143 (32.4)
Age group		
20-39	-	- (75.0)
40-49	-	- (40.9)
50-59	-	- (29.5)
60-69	-	- (32.4)
70-79	-	- (33.7)
80+	-	- (20.8)
Income quintile (urban)		
U1 (lowest)	51	11 (21.6)
U2	55	10 (18.2)
U3	57	17 (29.8)
U4	66	28 (42.4)
U5 (highest)	77	26 (33.8)
Income quintile (rural)		
R1 (lowest)	19	13 (68.4)
R2	25	8 (32.0)
R3	28	9 (32.1)
R4	27	6 (22.2)
R5 (highest)	30	11 (36.7)
RHA of residence at diagnosis		
WRHA	291	87 (29.9)
PMH	59	24 (40.7)
SH-SS	38	10 (26.3)
IERHA	38	13 (34.2)
NHA	15	9 (60.0)
RHA of first surgery		
WRHA	392	125 (31.9)
All other RHA	49	18 (36.7)

Some cells were suppressed or combined due to small cell sizes in age groups.
Re-excision may be another lumpectomy or a mastectomy.
Re-excision is excluded if an intervening cancer diagnosis occurs on the same breast as the first lumpectomy.

Table 3.21 Invasive breast cancer axillary clearance rate, by cohort characteristics, 2010-2014

Characteristic	Negative nodes		Positive nodes	
	N	%	N	%
Manitoba	137	19.6	563	80.4
Age group				
20-39	-	2.6	-	97.4
40-49	-	13.2	-	86.8
50-59	-	12.1	-	87.9
60-69	-	25.0	-	75.0
70-79	-	26.3	-	73.7
80+	-	29.3	-	70.7
Income quintile (urban)				
U1 (lowest)	9	12.9	61	87.1
U2	20	21.7	72	78.3
U3	11	12.8	75	87.2
U4	10	14.1	61	85.9
U5 (highest)	7	8.4	76	91.6
Income quintile (rural)				
R1 (lowest)	15	24.6	46	75.4
R2	23	35.4	42	64.6
R3	19	31.1	42	68.9
R4	8	16.7	40	83.3
R5 (highest)	10	22.2	35	77.8
RHA of residence at diagnosis				
WRHA	-	11.8	-	88.2
PMH	-	33.3	-	66.7
SH-SS	-	24.0	-	76.0
IERHA	-	21.0	-	79.0
NHA	-	23.5	-	76.5
RHA of first surgery				
WRHA	71	13.5	456	86.5
PMH	52	38.0	85	62.0
SH-SS	14	42.4	19	57.6
Stage				
Stage I	80-	88.9	10-	11.1
Stage II	57-	18.6	249-	81.4
Stage III	0-	0.0	304-	100
Procedure				
Axillary lymph node dissection	27	11.7	204	88.3
Radical mastectomy	110	23.5	359	76.5

Some cells were suppressed or omitted due to small cell sizes or missing data in an RHA, age, and stage.
Radical mastectomy includes axillary lymph node dissection.
Axillary clearance must be within 1 year of diagnosis. Only includes invasive cancers diagnosed at Stage I, II or III.

Table 3.22 Number of in-hospital post-operative complications experienced by women diagnosed with invasive breast cancer, by cohort characteristics, 2010- 2014

Number of Complications	BCS		Mastectomy With Immediate Reconstruction		Mastectomy Without Immediate Reconstruction	
	N	%	N	%	N	%
At least one complication reported	43	1.5	43	9.9	42	4.6
No in-hospital post-op complications reported	2837	98.5	392	90.1	879	95.4

**Includes only complications during admission for first procedure after diagnosis. Excludes procedures for which an admission and separation date were not available. Includes cases of invasive and DCIS combined.*

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CHAPTER 4. COLORECTAL CANCER

Key Findings

- 87.5% of colon cancer patients and 67% of rectal cancer patients were treated with a resection.
- The median number of days between first colonoscopy and surgery was 34 days. Individuals with stage IV colon cancer had the shortest wait time for surgery (21 days).
- Ninety percent of patients with stage II or III colon cancer had ≥12 lymph nodes removed during surgery which meets the national target of 90%.[1]
- The percentage of rectal cancer patients with a positive circumferential resection margin was 3.8%. This is better than that reported by all other provinces in 2010.[2]
- Greater than 95% of patients who had colon cancer resection did not receive a stoma (colostomy or ileostomy) or had a potentially reversible stoma. Fifty-seven percent of patients who had a rectal cancer resection did not have a stoma or had a potentially reversible stoma. Although stomas may impact quality of life, they may be necessary to promote healing and reduce complications after surgery.[3]
- Most colorectal cancer patients (73% of colon and 70% of rectal) had surgery in the same RHA in which they lived.

Recommendations

A community of practice (CoP) model was used to engage in knowledge mobilization efforts. A CoP is defined as a group of individuals that share a common goal of gaining knowledge related to a specific field. Collective learning is achieved through the sharing of information and experiences.[4] Results from this chapter were shared with a colorectal CoP which consisted of surgeons, medical oncologists, and senior administration. The CoP developed recommendations to further understand and address the results in this report. The recommendation is listed below.

- The rates of laparoscopic surgery were lower than anticipated.

  Recommendation (1): Provide educational opportunities and support to surgeons to increase the proportion of laparoscopic surgeries done in Manitoba.

Colorectal Cancer in Manitoba

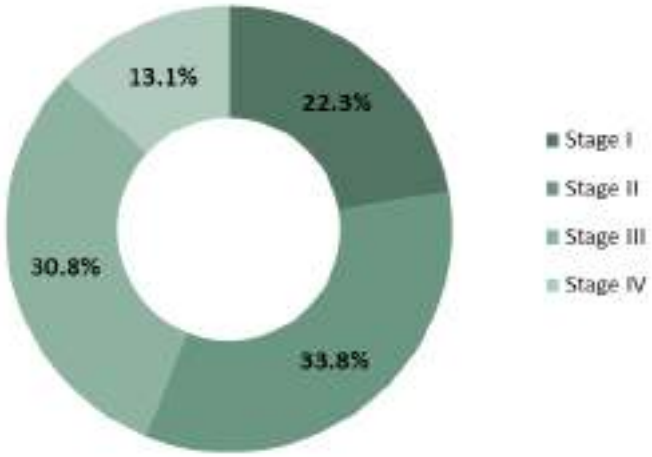
A total of 3,445 Manitobans were diagnosed with colorectal cancer between 2010 and 2014. Both colon and rectal cancer surgery indicators are presented in this chapter, because surgical procedures to treat these cancers are similar and are most often performed by the same surgeons.

In this report, colon cancers include rectosigmoid cancers, which are distal sigmoid cancers in close proximity to the rectum. Rectosigmoid cancers are reported with colon cancers because their treatment and outcomes more closely mirror cancers of the colon rather than rectal cancers.

Colon cancer

A total of 2,459 cases of colon cancer were diagnosed between 2010 and 2014 in Manitoba. The age-standardized incidence rate was 60.3 per 100,000; the highest incidence rate was amongst Manitobans aged over 80 years old (312.5 per 100,000) (Table 4.2). During this period, colon cancer was most commonly diagnosed in people over the age of 60, and the number of new cases was nearly equally distributed among men and women. Approximately 56% of cases occurred in the right side of the colon (Table 4.2). Cancer stage classifies cancers by the size and spread of the cancer, regional lymph node involvement, and metastases. Early stage tumours have a better prognosis and a higher likelihood of cure compared to later stage tumours. Over 64% of colon cancers diagnosed in Manitoba between 2010 and 2014 were stage II or III (Figure 4.1).

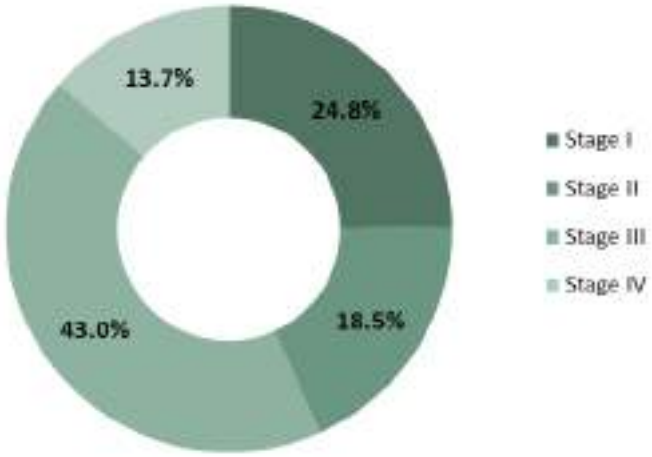
Figure 4.1 Stage distribution of colon cancer in Manitoba, 2010-2014



Rectal Cancer

There were 986 cases of rectal cancer diagnosed in Manitoba between 2010 and 2014. The age-standardized incidence rate was higher among males than females (age-standardized rate 33.2 per 100,000 for men versus 15.9 per 100,000 for women). In Manitoba, rectal cancer was most commonly diagnosed at stage III (43.0% of cases), whereas 24.8% of cases were diagnosed at stage I (Figure 4.2).

Figure 4.2 Stage distribution of rectal cancer in Manitoba, 2010-2014



Additional information, including age-standardized population rates and stratifications by age, sex, RHA, income quintile, and stage are included in Tables 4.2 and 4.5 at the end of this chapter.

Description of Surgical Procedures Used to Treat Colorectal Cancer

Local excision

Local excision involves removing a tumour and a small amount of surrounding tissue without removing the involved organ. Whether a tumour is amenable to treatment by local excision depends on a number of factors including tumour size, morphology, location, and stage. For colorectal cancers, there are three main types of local excisions: polypectomies, standard transanal excisions, and Transanal Endoscopic Microsurgery (TEM).

A polypectomy involves removal of a polyp from inside the colon, usually during a colonoscopy. It is usually performed as a day procedure and does not require an abdominal incision. Due to the relatively non-invasive nature of polypectomies, they are excluded from the surgical indicators presented in this report.

Standard transanal excisions and TEM can be used to treat selected rectal polyps and early rectal cancers. TEM share similarities to standard transanal excision, but involves specialized equipment and surgical techniques. These procedures are performed in hospitals as day or overnight procedures. They are performed per orifice through the anal opening and do not require an abdominal incision. Standard transanal excisions and TEM are included in surgical indicators presented in this report.

Colectomy

A colectomy is a surgical procedure in which all or part of the colon is removed along with the tumour. A colectomy requires an incision in the abdomen. It can be performed either open (using a standard sized incision) or laparoscopically (through mini-incisions, also known as minimally invasive surgery). A total colectomy involves removing the entire colon, while partial colectomies or segmental colectomies involve removing only part of the colon. When a partial or segmental colectomy is performed, descriptors such as right, left, or sigmoid are used to describe the specific area that was removed. The majority of patients who undergo surgery for stage II and III colon cancers have a colectomy.

Proctectomy

A proctectomy is a surgical procedure that removes all or part of the rectum along with the tumour. The two main types of proctectomies are low anterior resection (LAR) and abdominoperineal resection (APR). An LAR is usually conducted when the tumour is located in the upper portions of the rectum. In this procedure, the anal sphincter muscles are kept intact. An APR is performed when the tumour is located in the lower part of the rectum. In this procedure, the anal sphincter muscles are removed along with the rectum.

Resection

In this chapter, a resection comprises the following procedures: standard transanal excisions, Transanal Endoscopic Microsurgery (TEMS), colectomy, and proctectomy.

Colostomy, Ileostomy, and bypass

A colostomy is a surgical procedure in which one end of the colon is brought through an incision in the abdominal wall to the surface of the skin. Similarly, an ileostomy is a surgical procedure in which the small intestine is brought out through the abdominal surface. The opening in the abdominal wall is called a stoma. With either a colostomy or ileostomy, an external pouch or bag (referred to as a stoma appliance) is adhered to the surrounding skin to collect bowel contents or stool.

A stoma is created for a number of different reasons and may be permanent or potentially reversible. In some cases, they are performed in conjunction with tumour removal to facilitate healing for later internal bowel re-connection, or alternatively when internal re-connections are not safe or impossible to perform.

In other cases they are performed alone to avoid or alleviate tumour-related complications. These can be as a bridge to potentially curative treatment or for palliative purposes.

A bypass is a surgical procedure in which a section of the bowel is bypassed internally, and is typically palliative.

Lymph node dissection / Lymphadenectomy
Lymph nodes surrounding a tumour may be removed during a colon or rectal cancer resection (colectomy or proctectomy). The lymph nodes that are removed are then examined to determine whether the cancer has metastasized. This information enables formal staging, helps direct treatment, and provides more accurate prognosis.

Descriptive Indicators

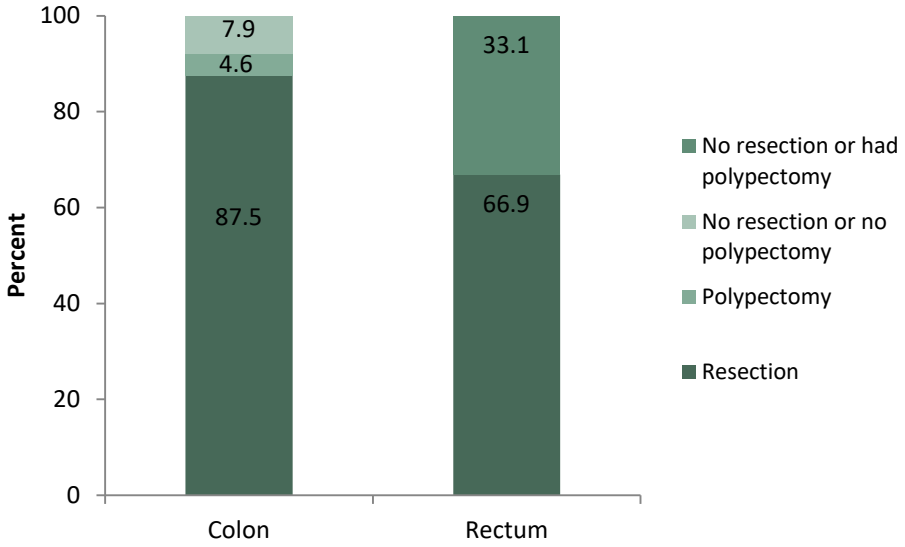
Colorectal cancer surgery

Indicator definition
Percentage of colorectal cancer cases that underwent a colorectal cancer resection within one year of diagnosis

Why is this important to know?
Surgical resection offers the best chance of cure for patients with colorectal cancers; therefore, a high percentage of individuals typically receive a colorectal resection. This indicator also provides information that can be used for planning purposes.

Take away message
- The majority of colon (87.5%) and rectal (67%) cancer cases were treated with surgical resection within one year of diagnosis (Figure 4.3).
- 4.6% (colon) and 4.8% (rectum) of early-stage cancer cases had a polypectomy as their first surgical treatment (Figure 4.3).

Figure 4.3 Percentage of colorectal cancer cases treated with resection within one year of diagnosis, 2010-2014



What does the data tell us?

The majority of colon cancer cases (92.1%) were treated with a resection or polypectomy (Figure 4.3). Less than 8% of colon cancer patients did not receive a resection or polypectomy, the majority of whom had stage IV metastatic disease where surgery may not have been appropriate. There were no major differences in the percentage of resections amongst different age groups, sex, income quintiles, or residence. Most rectal cancer cases that were diagnosed at stage IV did not receive a resection or a polypectomy.

Additional information can be found in Tables 4.3, 4.4, and 4.6 at the end of this chapter.

Surgical procedure

Indicator definition

Number and percentage of colorectal cancer cases that had a resection within one year after or on date of diagnosis by type of surgical procedure.

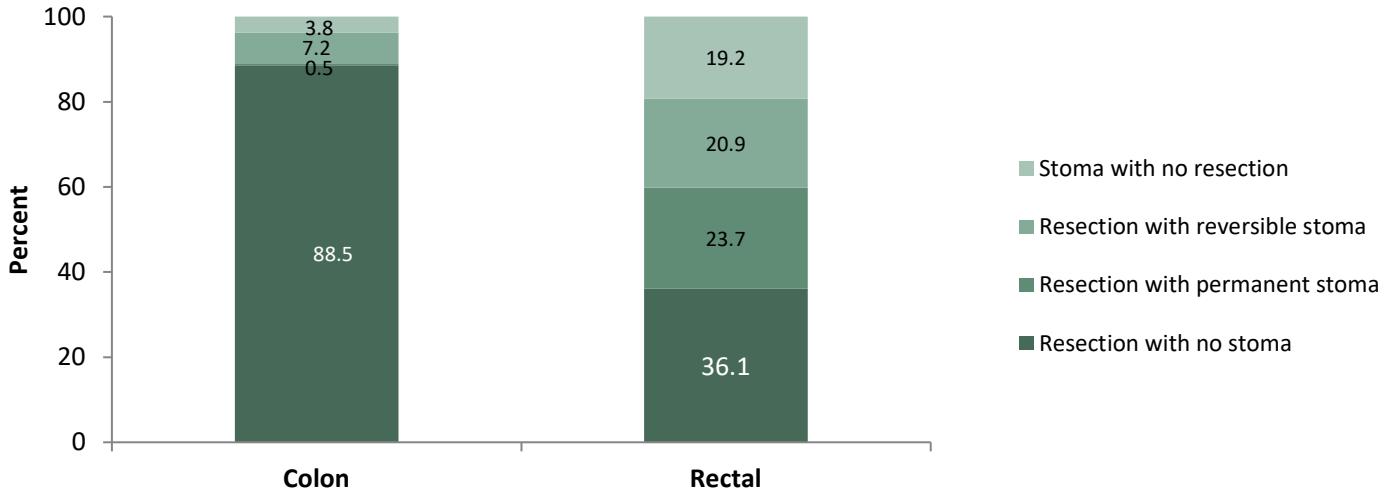
Why is this important to know?

This indicator describes the types of surgical procedures used to treat colorectal cancer in Manitoba. Creating a stoma can affect patient quality of life and increase some health care costs related to stoma supplies and ongoing care. It may also require a subsequent operation to reverse the procedure. Even though the creation of a stoma may impact a patient's quality of life, it may be necessary in order to prevent anastomotic leakage and allow the bowel to heal appropriately after.[3]

Take away message

- The majority of colon cancer cases that had a resection within one year after diagnosis (88.5%) were treated with a resection without the formation of a stoma (Figure 4.4).
- 44.6% of rectal cancer cases that had a resection within one year after diagnosis had a permanent or potentially reversible stoma created (Figure 4.4).

Figure 4.4 Type of first surgical procedure conducted to treat colon and rectal cancer, 2010-2014



What does the data tell us?

The majority of Manitobans (88.5%) with colon cancer who underwent a resection did not have a stoma (Figure 4.4). Of those who had a colon resection and received a stoma, the majority had reversible stomas. The percentage of patients who had a resection of the colon with a permanent stoma was less than 1% (Figure 4.4). Many people (44.6%) with rectal cancer who had a resection within one year of diagnosis received stomas as part of their surgical treatment. Approximately one-half of these stomas were likely performed to facilitate healing from surgery, and were potentially reversible. The percentage of patients with rectal cancer who had a resection within one year of diagnosis and had permanent stoma was 23.7% (Figure 4.4). In Canada, between 2007/8 and 2011/12, among patients who had a rectal cancer resection, 36.9% had a permanent stoma created.[5] The majority of patients who received a stoma with no resection had stage III or IV disease. The stomas in these cases were often created for palliative purposes.

Additional information about type of procedure, including stratifications by age, income quintile, RHA, and stage, can be found in Tables 4.7, 4.8, 4.10, and 4.11 at the end of this chapter.

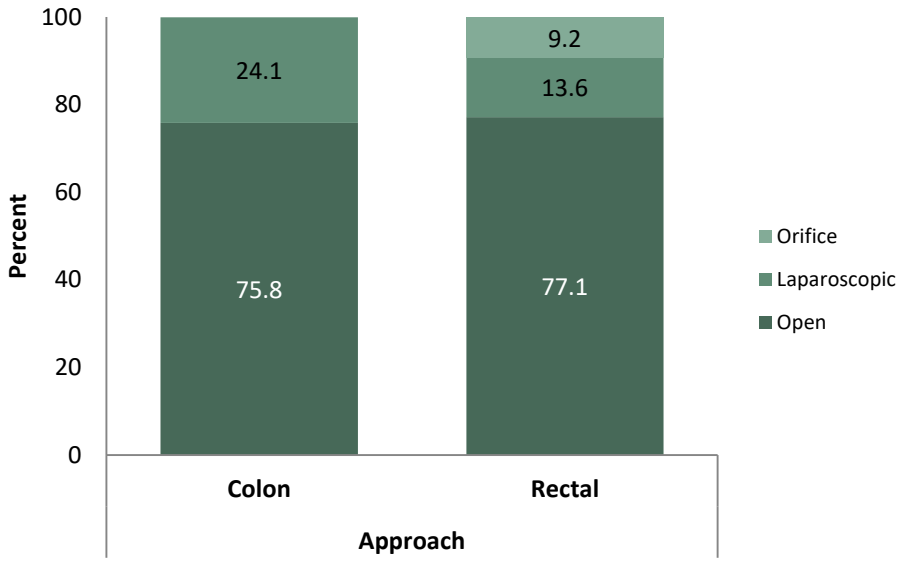
Surgical approach

Indicator definition
Percentage of resections completed within one year of diagnosis for invasive colorectal cancer cases by type of surgical approach.

Why is this important to know?
Laparoscopic surgery has become more popular due to evidence of less pain, shorter hospital stays, faster recovery time, and quicker return to pre-surgery activities.[6,7] Laparoscopic surgery is more commonly used to treat colon cancers than rectal cancers. There are no differences in oncologic outcomes between open and laparoscopic colon cancer resection.[8] Laparoscopic surgery is used selectively for some rectal cancers. The selection of surgical approach is impacted by many factors including location and size of tumour, spread of disease, patient's health and preferences, and surgical expertise. This indicator describes the extent of use of newer surgical approaches used to treat colorectal cancer in Manitoba.

Take away message
- The majority of surgeries for colorectal cancer (75.8% for colon and 77.1% for rectal) were open procedures (Figure 4.5).

Figure 4.5 Surgical approach used to conduct surgical resection of colon and rectal cancers, 2010-2014



What does the data tell us?
A large percentage (75.8% - colon and 77.1% - rectal) of Manitobans with colorectal cancer and resection within one year after diagnosis had an open surgical resection to remove their tumour (Figure 4.5). Compared to 2010 estimates in the United States, Manitoba had a lower laparoscopic resection rate for colon cancer (22.8% in MB vs 31.2% from the US National Inpatient Database).[9,10] These rates should be interpreted with caution because the Manitoba sample did not exclude urgent or emergency surgeries which tend to be performed using an open approach.

Information about surgical approach, including stratification by RHA of first surgery can be found in Table 4.9 at the end of this chapter.

Surgery in the same RHA as diagnosis

Indicator definition

Percentage of Manitobans with colorectal cancer who received diagnosis and surgery (within one year) in the RHA of residence.

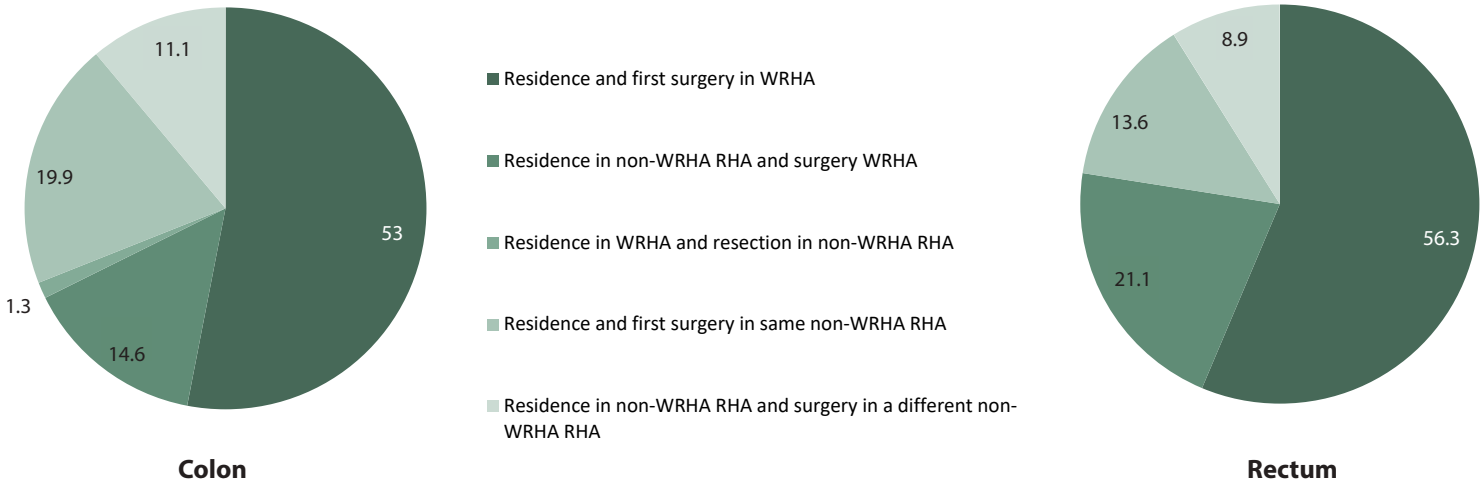
Why is this important to know?

This indicator provides information on where individuals receive surgical procedures and if they receive their surgeries close to home. Several factors influence where a patient receives his/her surgical cancer treatment including patient preference and type of procedure performed. This can affect planning of health care resources and patient supports.

Take away message

- Most patients underwent surgical resection in the same RHA in which they resided (73% of colon and 70% of rectal) (Figure 4.6).
- 67.6% of colon resections and 77.4% of rectal resections occurred in the WRHA (Figure 4.6).

Figure 4.6 Percentage of Manitobans with colon or rectal cancer who had their first surgery in the same RHA in which they lived at diagnosis, 2010-2014



What does the data tell us?

Unlike some other cancer surgeries that are primarily conducted in the WRHA (e.g. lung and ovarian cancer surgery), colon and rectal procedures are conducted throughout Manitoba. Surgeons located in the WRHA conducted over half (67.6% for colon and 77.4% for rectal) of all colorectal cancer surgeries in Manitoba. Approximately 30% of Manitobans with colorectal cancer between 2010 and 2014 travelled to a different RHA to receive their first surgery (Figure 4.6).

Length of post-operative hospital stay

Indicator definition

Median number of days and 90th percentile from surgery date to hospital discharge date for colorectal cancer cases that underwent surgery within one year of diagnosis.

Why is this important to know?

The length of post-operative stay is determined by a number of patient and treatment related factors. Examples of patient factors include age and overall health.[11] Treatment factors include the specific type of procedure and the surgical approach. Other factors such as number and severity of post-operative complications also influence length of post-operative hospital stay. If clinically indicated, shorter hospital stays have the potential to reduce costs to the healthcare system and enable more efficient use of resources.

Take away message

- Median length of stay was shorter for procedures conducted laparoscopically compared to open for both colon (6 days vs 8 days) and rectal (6 days vs 9 days) cancers (Table 4.1).

Table 4.1 Length of stay for colon and rectal cancers, by procedure and approach, 2010-2014

	Colon		Rectal	
	Median (days)	90th Percentile (days)	Median (days)	90th Percentile (days)
Procedures				
Resection with no stoma	7	14	6	12
Resection with stoma	13	32	9	17
Surgical approach				
Open	8	15	9	16
Laparoscopic	6	12	6	11

What does the data tell us?

The median length of hospital stay was longer for procedures that involved the formation of a stoma (rectal: 9 days), compared to those that only included a resection (rectal: 6 days) (Table 4.1). The increased length of stay was likely because patients who required a stoma may have had advanced disease and because of the time necessary for patients to learn how to manage their stomas. Laparoscopic colon and rectal surgeries had shorter median hospital stays than open surgeries. The median length of stay was similar to what is reported in other countries. A large randomized clinical trial in Australia reported a median length of hospital stay of 8 days for both laparoscopic and open rectal resections.[12]

Additional information about length of hospital stay for colorectal cancer resections can be found in Tables 4.19 and 4.20 at the end of this chapter.

Hospital readmissions

Indicator definition

30-day hospital readmission rate for Manitobans diagnosed with colorectal cancer that underwent a resection within one year of diagnosis.

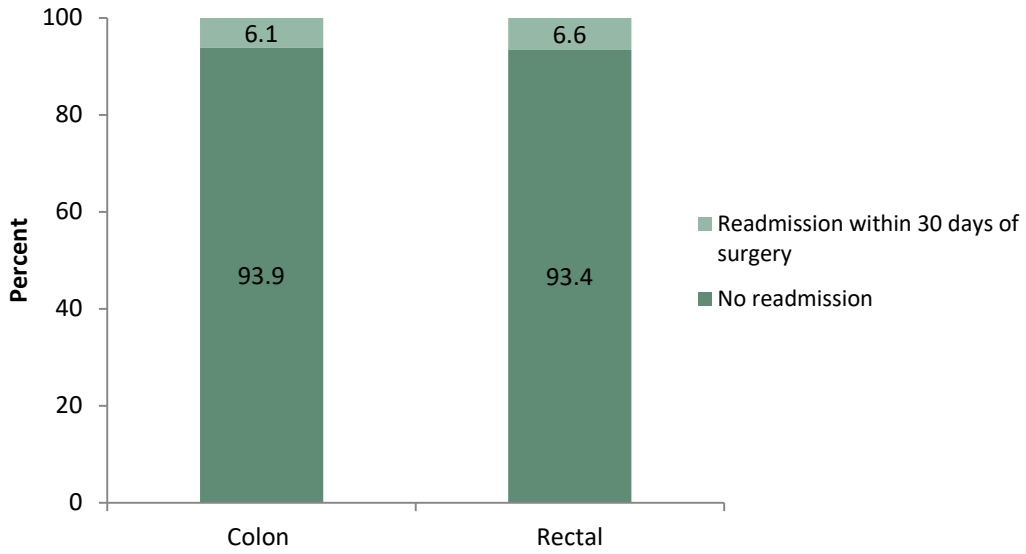
Why is this important to know?

Reducing readmissions may reduce healthcare costs. Hospital readmissions are a widely used, yet controversial indicator of quality when not adjusted for other factors.[13] A recent study from Ontario estimated that the average cost of a hospital readmission after colon or rectal cancer was $8,715.[14] Reducing readmissions would also be beneficial to patients because readmission after surgery may delay adjuvant therapy. Hospital readmissions are related to many factors including post-operative complications and pre-existing co-morbidities.[13]

Take away message

- Relatively few patients were readmitted within 30-days after colon (6.1%) and rectal (6.6%) cancer surgery (Figure 4.7).

Figure 4.7 Percentage of colorectal cancer patients who underwent a resection within one year of diagnosis and were readmitted to hospital within 30-days, 2010-2014



What does the data tell us?

Few patients were readmitted to the hospital after their colorectal cancer surgery. Manitoba colon data was very similar to that reported in Ontario between 2008 and 2012; in Ontario, 7.1% of individuals were readmitted within 30 days.[14] Manitoba also had slightly lower readmissions for rectal cancer (7.2% in Manitoba vs 10.7% in Ontario).[14] In a 2015 meta-analysis, 30-day readmission rates varied greatly between hospitals and countries and ranged between 9% and 25%.[15]

Quality Performance Indicators

Timeliness of surgery

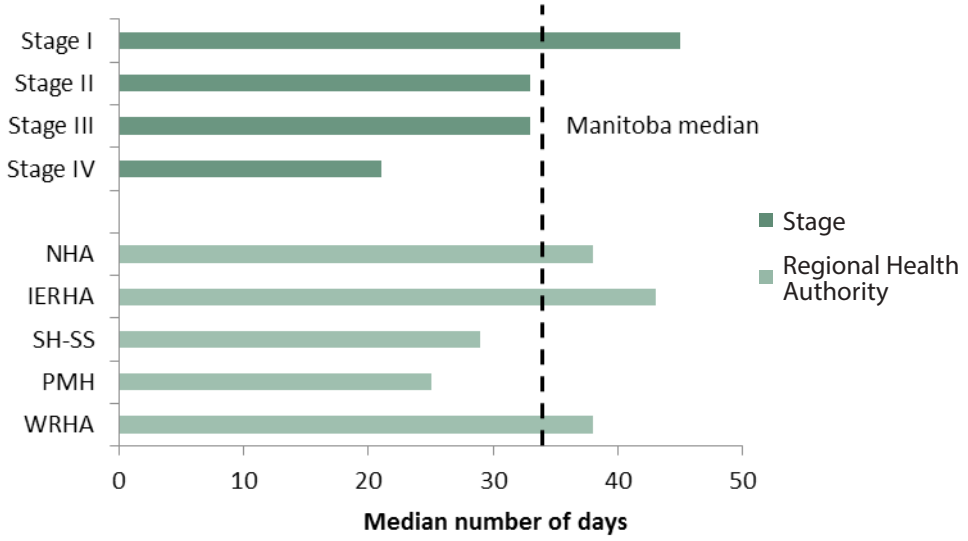
Indicator definition
Number of days between colonoscopy and first resection for colon cancer cases that had surgery within one year of diagnosis

Why is this important to know?
This measure is based on the Cancer Patient Journey Initiative to reduce wait times for cancer treatments in Manitoba. Many factors influence the timeliness of surgery including the time for biopsy specimens to be reviewed, ability to obtain diagnostic results required for surgery such as a CT or MRI scan in a timely manner, time to referral to appropriate specialists, timeliness of specialist appointments, operating-room availability, and patient preference. Reducing the time between diagnosis and surgery may reduce the psychological burden on patients and their families.

Interpretation of results
A low value for this indicator can be interpreted as a favorable result.

Take away message
- The median number of days between colonoscopy and first resection was 34 (Figure 4.8).
- Timeliness of surgery varied by stage and regional health authority (Figure 4.8).

Figure 4.8 Median number of days between colonoscopy and first resection by stage and regional health authority of residence, 2010-2014



What does the data tell us?

Stage IV colon cancer cases had the shortest wait for surgery compared to all other stages. Manitobans who resided in Prairie Mountain Health (PMH) and Southern Health – Santé Sud (SH-SS) regional health authorities had the shortest wait times in Manitoba. It is unclear why wait times in PMH and SH-SS were lower, but it may have been due to less competition for resources such as CT scans and operating room time compared to the WRHA.

Additional indicator calculation information

This indicator excluded individuals who did not have a colonoscopy recorded in hospital records within a year prior to their resection, those who received neo-adjuvant therapy, and those who had multiple scopes.

Additional information about timeliness of colon resections can be found in Table 4.14 at the end of this chapter.

Lymph node removal and examination

Indicator definition

Percentage of cases with colon cancer that had a resection within one year of diagnosis and ≥12 lymph nodes removed and pathologically examined.

Why is this important to know?

The removal of an adequate number of lymph nodes is critical for proper staging and impacts adjuvant (e.g. chemotherapy) treatment planning. Staging and adjuvant treatment planning both directly impact the prognosis of a patient. This indicator reflects current surgical guidelines, and is regularly reported as part of the Canadian Partnership Against Cancer (CPAC) pan-Canadian System Performance Report.[1] The removal of at least 12 lymph nodes provides a threshold at which the chance of false negative nodal staging is reduced.

Interpretation of results

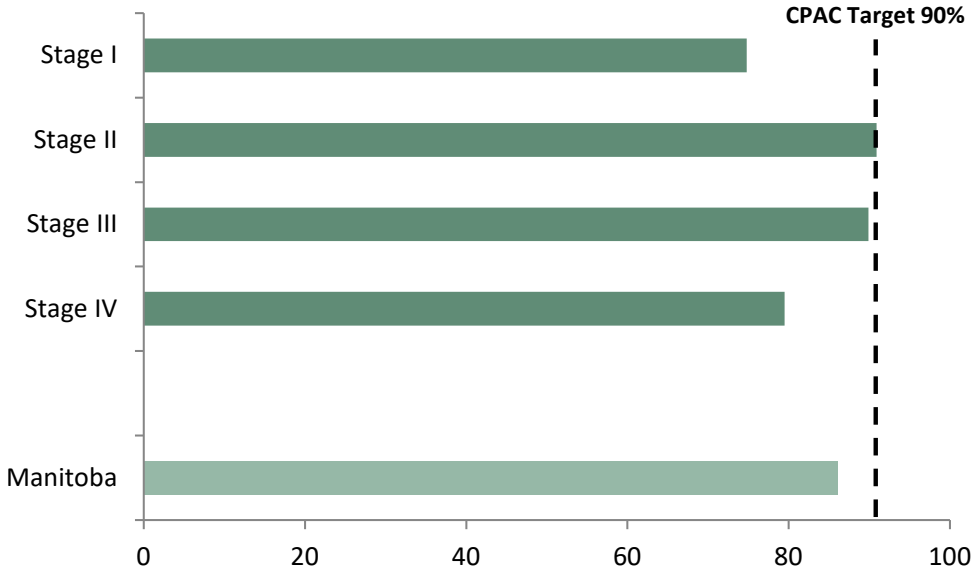
A value greater than 90% can be interpreted as a favorable result.

Target : >90% of patients have at least 12 lymph nodes removed and pathologically examined (CPAC Target).

Take away message

- Manitoba was close to meeting the CPAC target (86.1%) for all stages combined (Figure 4.9). All Manitobans aged 20-49 years old and those diagnosed at stage II and III met the >90% target (Table 4.15).
- Fewer stage I and stage IV cases had at least 12 lymph nodes removed compared to those diagnosed at stage II and III.

Figure 4.9 Percentage of colon cancer cases who received a resection within one year of diagnosis with ≥12 lymph nodes removed during resection and examined, 2010-2014



What does the data tell us?

Manitoba was close to achieving the national target for removing at least 12 lymph nodes in over 90% of cases, which represents approximately 10% improvement since 2008.[16] Compared to the most recent Pan-Canadian data released in 2017 by CPAC based on 2012 diagnoses, Manitoba has improved and is amongst the top performing provinces.[1] Cancers diagnosed at stage I and IV were less likely to have at least 12 lymph nodes removed. Some stage IV surgeries may have been palliative resections where the removal of a large number of lymph nodes was not required. Stage I includes TEM, where lymph nodes are not always removed during the procedure. The percentage of cases that had at least 12 lymph nodes removed did not differ by RHA of residence, RHA of surgery, or sex.

Additional information about lymph node removal and examination, including stratification by age, sex, income quintile, RHA and stage, can be found in Table 4.15 at the end of this chapter.

Positive circumferential resection margin

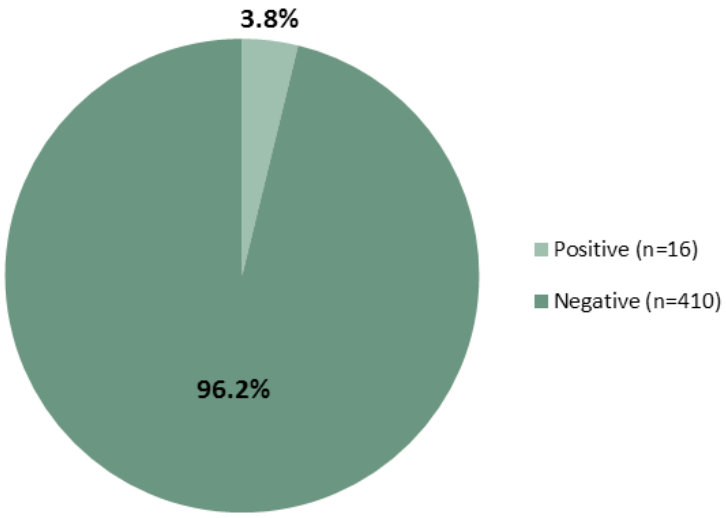
Indicator definition
Percentage of rectal cancer cases diagnosed at stage II or III that had resections resulting in a positive circumferential resection margin (CRM).

Why is this important to know?
Circumferential resection margin (CRM) status is determined by pathologists after a section of the rectum has been surgically removed. The surgical margin is defined as the outer edge of the tissue removed during surgery. A negative CRM indicates that no cancerous tissues were present at the margin or within 1mm of the margin.[2] A positive CRM is associated with a higher chance of cancer recurrence.[17] This indicator is an important and routinely used measure of surgical quality for rectal cancers.[2,18]

Interpretation of results
A low value for this indicator can be interpreted as a favorable result.

Take away message
- Positive circumferential resection margins were rare (3.8%) for rectal cancers diagnosed between 2010 and 2014 that had resection within the first year after diagnosis (Figure 4.10).

Figure 4.10 Percentage of rectal cancer cases diagnosed at stage II or III that had surgery within one year of diagnosis that had a positive circumferential resection margin, 2010-2014



What does the data tell us?
Manitoba had a low positive circumferential resection margin rate. According to 2010 data reported in 2015 by CPAC, Manitoba has the lowest CRM rate amongst all provinces.[16]

Additional data consideration

Approximately 52% of rectal cancer cases diagnosed at stage II or III between 2010 and 2014 that were treated with a surgical resection had information recorded related to circumferential margin in the Manitoba Cancer Registry. An analysis was conducted to determine if there was a difference between cases with and without CRM information; no differences in age, sex, RHA of treatment, RHA of diagnosis, or stage were found. Therefore, it is likely that the true positive CRM rate for Manitoba during this period is similar to that reported above.

Additional information about circumferential resection margin, including stratification by sex and RHA of residence at time of diagnosis can be found in Table 4.16 at the end of this chapter.

In-hospital post-operative complications

Indicator definition

Number and percentage of colorectal cancer cases that underwent a resection and had at least one post-operative complication recorded in their hospital record.

Why is this important to know?

Post-operative complications can impact patient recovery, quality of life, and in-hospital length of stay. Post-operative complications can be influenced by factors not directly related to the surgical procedure including overall patient health and pre-existing comorbidities.

Interpretation of results

A low value for this indicator can be interpreted as a favorable result.

Take away message

- Among Manitobans who underwent a resection, 36.0% of colon and 33.6% of rectal cancer patients had at least one in-hospital complication recorded (Tables 4.17 and 4.18).
- The percentage of Manitobans with a complication after a colorectal resection increased with age group (Colon 20-49:27.7% vs 80+: 45.9% and rectal 20-49: 23.0% vs 80+: 39.2%; Figures 4.11 and 4.12, respectively).

Figure 4.11 Percentage of Manitobans with colon cancer who received a resection within one year of diagnosis that had at least one documented in-hospital complication, 2010-2014

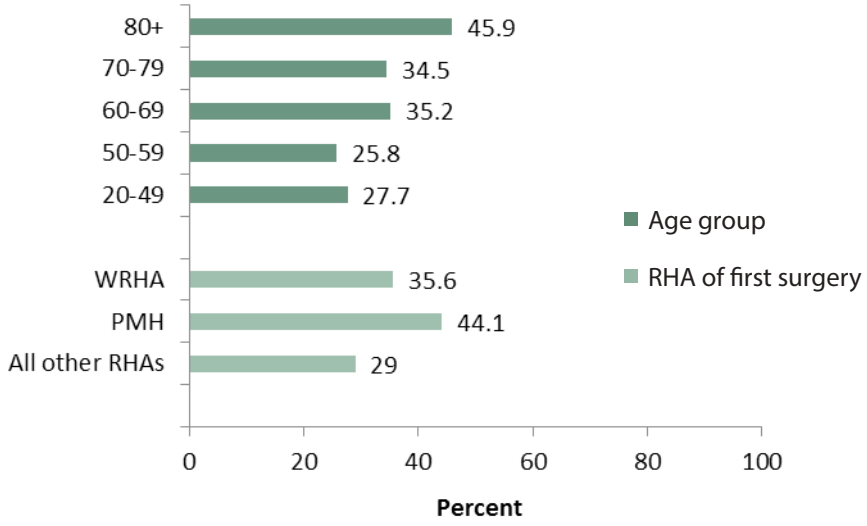
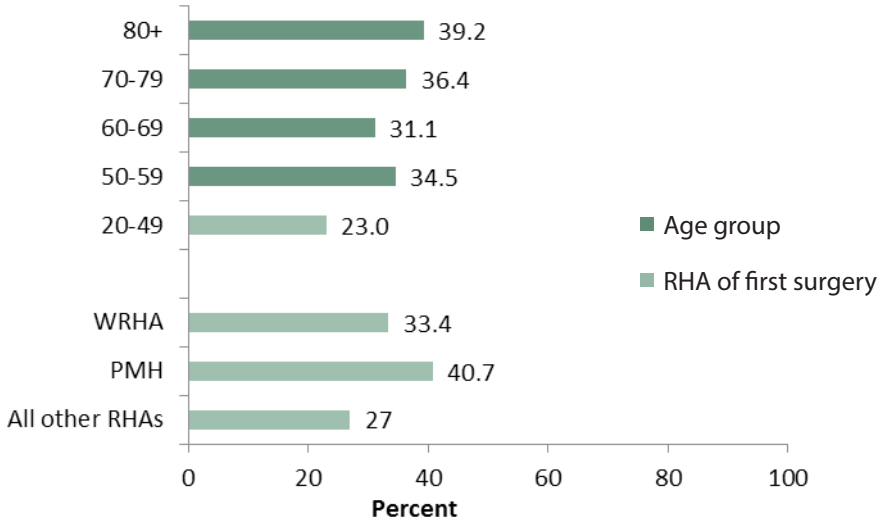


Figure 4.12 Percentage of Manitobans with rectal cancer who received a resection within one year of diagnosis that had at least one documented in-hospital complication, 2010-2014



What does the data tell us?

Variation in post-operative complications exists in Manitoba - the percentage of colorectal cancer patients who had surgery within the first year after diagnosis and had at least one post-operative complication increased with age. Other studies have also shown that patients over the age of 65 had higher complication rates compared to those under 65.[19] Older adults are more likely to have pre-existing comorbidities that may affect post-operative complication rates. Males had more post-operative in-hospital complications than females for rectal cancer resections (36.7% and 28.2%, respectively) (Table 4.18). Other studies have also found that males are more likely than females to experience post-operative complications.[19] It is unclear why rural RHAs in Manitoba seem to have lower complication rates, but two possible reasons could include: Differences in practice for recording complications in the hospital record; or a tendency of rural surgeons to perform surgeries that have reduced risk of complications.

Additional indicator calculation information

This indicator excluded complications that occurred after the patient was released from the hospital, and only included complications that were recorded in their hospital record; hence the number of complications that actually occurred may be underestimated. In addition, we are unable to assess the severity of complications.

Additional information about in-hospital post-operative complications, including stratification by age, sex, income quintile, RHA and stage can be found in Tables 4.17 and 4.18 at the end of this chapter.

Table 4.2 Number, percentage and age-standardized incidence rates of colon cancer cases by cohort characteristics, 2010-2014

Characteristic	Colon Cancer Cohort		Age-Standardized Incidence Rate per 100,000 (95% CI)
	N	% Manitoba (95%* CI)	
Manitoba	2459	n/a	60.3 (58.1,62.6)
Age group			
20-39	31	1.3 (0.8,1.7)	2.0 (1.4,2.8)
40-49	124	5.0 (4.2,5.9)	15.6 (13.1,18.5)
50-59	339	13.8 (12.4,15.1)	41.2 (37.1,45.7)
60-69	608	24.7 (23.0,26.4)	107.0 (99.0,115.4)
70-79	725	29.5 (27.7,31.3)	226.7 (211.3,242.9)
80+	632	25.7 (24.0,27.4)	312.5 (291.6,334.4)
Sex			
Male	1264	51.4 (49.4,53.4)	69.4 (65.8,73.0)
Female	1195	48.6 (46.6,50.6)	53.0 (50.2,55.8)
Income Quintile (Urban)			
U1 (Lowest)	308	12.8 (11.5,14.2)	65.0 (58.2,71.7)
U2	281	11.7 (10.4,13.0)	60.9 (54.2,67.5)
U3	300	12.5 (11.2,13.8)	58.5 (52.2,64.7)
U4	255	10.6 (9.4,11.9)	53.6 (47.2,59.9)
U5 (Highest)	272	11.3 (10.1,12.6)	56.0 (49.7,62.3)
Income quintile (rural)			
R1 (Lowest)	182	7.6 (6.5,8.6)	74.0 (64.2,83.9)
R2	206	8.6 (7.5,9.7)	65.0 (56.9,73.2)
R3	232	9.7 (8.5,10.8)	66.7 (58.6,74.8)
R4	189	7.9 (6.8,8.9)	60.7 (52.6,68.9)
R5 (Highest)	176	7.3 (6.3,8.4)	68.1 (58.1,78.2)
RHA of residence at diagnosis			
WRHA	1344	54.7 (52.8,56.7)	56.6 (53.8,59.4)
PMH	428	17.4 (15.9,18.9)	67.5 (61.5,73.5)
SH-SS	307	12.5 (11.2,13.8)	60.1 (53.9,66.4)
IERHA	286	11.6 (10.4,12.9)	67.2 (60.0,74.5)
NHA	90	3.7 (2.9,4.4)	73.6 (57.8,89.3)
Stage			
Stage I	543	22.3 (20.7,24.0)	12.3 (11.3,13.3)
Stage II	821	33.8 (31.9,35.6)	17.9 (16.7,19.1)
Stage III	750	30.8 (29.0,32.7)	16.2 (15.0,17.3)
Stage IV	318	13.1 (11.7,14.4)	11.8 (10.9,12.8)
Site of Tumour			
Left colon	1069	44.1 (42.2,46.1)	25.8 (24.4,27.3)
Right colon	1353	55.9 (53.9,57.8)	33.0 (31.3,34.6)

**column percent*

Table 4.3 Number and percent of colon cancer cases that underwent a resection within one year of diagnosis by cohort characteristics, 2010-2014

Characteristic	Had a Resection		Had Polypectomy		Did Not Have a Resection or Polypectomy	
	N	% Total (95% CI)	N	% Total (95% CI)	N	% Total (95% CI)
Manitoba	2151	87.5 (86.2,88.8)	113	4.6 (3.8,5.4)	195	7.9 (6.9,9.0)
Age group						
20-49	134	86.5 (81.1,91.8)	6	3.9 (0.8,6.9)	15	9.7 (5.0,14.3)
50-59	289	85.3 (81.5,89.0)	20	5.9 (3.4,8.4)	30	8.8 (5.8,11.9)
60-69	543	89.3 (86.9,91.8)	25	4.1 (2.5,5.7)	40	6.6 (4.6,8.6)
70-79	642	88.6 (86.2,90.9)	30	4.1 (2.7,5.6)	53	7.3 (5.4,9.2)
80+	543	85.9 (83.2,88.6)	32	5.1 (3.4,6.8)	57	9.0 (6.8,11.3)
Sex						
Male	1105	87.2 (85.3,89.0)	59	4.7 (3.5,5.9)	100	8.1 (6.6,9.7)
Female	1046	87.8 (86.0,89.7)	54	4.5 (3.3,5.6)	95	7.7 (6.2,9.2)
Income quintile (urban)						
U1 (lowest)	266	86.5 (82.6,90.3)	13	4.1 (1.9,6.3)	29	9.5 (6.2,12.8)
U2	244	87.3 (83.4,91.1)	14	4.8 (2.3,7.3)	23	8.0 (4.8,11.1)
U3	261	86.7 (82.8,90.6)	12	4.3 (1.9,6.7)	27	9.0 (5.7,12.3)
U4/U5 (highest)	469	89.1 (86.4,91.7)	22	4.2 (2.5,6.0)	36	6.7 (4.6,8.9)
Income quintile (rural)						
R1 (lowest)	157	86.7 (81.8,91.6)	12	6.1 (2.7,9.5)	13	7.2 (3.4,11.0)
R2	176	85.4 (80.6,90.3)	10	5.0 (2.0,8.1)	20	9.6 (5.5,13.6)
R3	198	85.1 (80.4,89.7)	12	5.3 (2.4,8.3)	22	9.6 (5.8,13.5)
R4	174	91.6 (87.6,95.7)	9	4.8 (1.7,7.9)	6	3.6 (0.8,6.4)
R5 (highest)	155	87.9 (83.0,92.8)	7	4.0 (1.1,7.0)	14	8.1 (4.0,12.2)
RHA of residence at diagnosis						
WRHA	1170	87.1 (85.3,88.9)	60	4.5 (3.4,5.6)	114	8.4 (6.9,9.9)
non-WRHA	977	87.9 (86.0,89.8)	53	4.7 (3.5,6.0)	81	7.4 (5.8,8.9)
RHA of first surgery						
WRHA	1430	100	n/a	n/a	n/a	n/a
PMH	364	100	n/a	n/a	n/a	n/a
SH-SS	188	100	n/a	n/a	n/a	n/a
IERHA	114	100	n/a	n/a	n/a	n/a
NHA	31	100	n/a	n/a	n/a	n/a
Stage						
Stage I	414	76.1 (72.5,79.8)	107	19.7 (16.3,23.1)	22	4.2 (2.5,5.9)
Stage II/III	1497	95.3 (94.2,96.4)	0	n/a	74	4.7 (3.6,5.8)
Stage IV	234	73.8 (68.9,78.6)	0	n/a	84	26.2 (21.4,31.1)
Site of tumour						
Left colon	854	79.8 (77.3,82.2)	85	7.9 (6.3,9.5)	130	12.3 (10.3,14.3)
Right colon	1267	93.8 (92.5,95.0)	27	2.0 (1.3,2.8)	59	4.2 (3.1,5.3)

**row percent*

Table 4.4 Number and percent of colon cancer cases that underwent a resection within one year of diagnosis by cohort characteristics, 2010-2014

Characteristic	Had a Resection		Had Polypectomy		Did Not Have a Resection or Polypectomy	
	N	% Total	N	% Total	N	% Total
Manitoba	2151	n/a	113	n/a	195	n/a
Age group						
20-49	134	6.2	6	5.3	15	7.7
50-59	289	13.5	20	17.7	30	15.4
60-69	543	25.2	25	22.1	40	20.5
70-79	642	29.9	30	26.6	53	27.2
80+	543	25.2	32	28.3	57	29.2
Sex						
Male	1105	51.4	59	52.2	100	51.3
Female	1046	48.6	54	47.8	95	48.7
Income quintile (urban)						
U1 (lowest)	266	21.5	13	21.3	29	25.2
U2	244	19.7	14	23.0	23	20.0
U3	261	21.0	12	19.7	27	23.5
U4/U5 (highest)	469	37.8	22	36.0	36	31.3
Income quintile (rural)						
R1 (lowest)	157	18.3	12	24.0	13	17.3
R2	176	20.5	10	20.0	20	26.7
R3	198	23.0	12	24.0	22	29.3
R4	174	20.2	9	18.0	6	8.0
R5 (highest)	155	18.0	7	14.0	14	18.7
RHA of residence at diagnosis						
WRHA	1170	54.5	60	53.1	114	58.5
non-WRHA	977	45.5	53	46.9	81	41.5
RHA of first surgery						
WRHA	1430	66.5	n/a	n/a	n/a	n/a
PMH	364	16.9	n/a	n/a	n/a	n/a
SH-SS	188	8.7	n/a	n/a	n/a	n/a
IERHA	114	5.3	n/a	n/a	n/a	n/a
NHA	31	1.4	n/a	n/a	n/a	n/a
Out of province	24	1.1	n/a	n/a	n/a	n/a
Stage						
Stage I	414	19.3	107	100	22	12.2
Stage II/III	1497	69.8	0		74	41.1
Stage IV	234	10.9	0		84	46.7
Site of Tumour						
Left colon	854	40.3	85	75.9	130	68.8
Right colon	1267	59.7	27	24.1	59	31.2

**column percent*

Table 4.5 Number, percentage and age-standardized incidence rates of rectal cancer cases by cohort characteristics, 2010-2014

Characteristic	Rectal Cancer Cohort		Age-Standardized Incidence Rate per 100,000 (95% CI)
	N	% Manitoba (95%* CI)	
Manitoba	986	n/a	24.0 (22.6,25.4)
Age group			
20-29	9	0.9 (0.3,1.5)	1.0 (0.5,1.9)
30-39	11	1.1 (0.5,1.8)	1.8 (1.0,3.0)
40-49	79	8.0 (6.3,9.7)	9.5 (7.6,11.8)
50-59	214	21.7 (19.1,24.3)	26.7 (23.4,30.4)
60-69	278	28.2 (25.4,31.0)	49.8 (44.4,55.7)
70-79	243	24.6 (22.0,27.3)	79.9 (70.9,89.7)
80+	152	15.4 (13.2,17.7)	73.3 (63.4,84.4)
Sex			
Male	629	63.8 (60.8,66.8)	33.2 (30.7,35.6)
Female	357	36.2 (33.2,39.2)	15.9 (14.4,17.5)
Income quintile (urban)			
U1 (lowest)	104	10.8 (8.8,12.8)	25.6 (21.3,30.0)
U2	136	14.1 (11.9,16.3)	30.4 (25.7,35.1)
U3	107	11.1 (9.1,13.1)	20.5 (16.7,24.2)
U4	103	10.7 (8.7,12.7)	19.9 (16.2,23.7)
U5 (highest)	121	12.6 (10.5,14.7)	23.5 (19.4,27.5)
Income quintile (rural)			
R1 (lowest)	88	9.1 (7.3,11.0)	33.1 (26.8,40.4)
R2	87	9.0 (7.2,10.9)	27.0 (21.6,32.3)
R3	81	8.4 (6.7,10.2)	25.9 (21.1,31.6)
R4	71	7.4 (5.7,9.0)	20.5 (16.1,25.8)
R5 (highest)	64	6.7 (5.1,8.2)	21.2 (16.4,27.1)
RHA of residence at diagnosis			
WRHA	544	55.3 (52.2,58.4)	23.1 (21.3,24.9)
PMH	151	15.3 (13.1,17.6)	25.0 (21.3,28.7)
SH-SS	144	14.6 (12.4,16.8)	26.8 (22.7,30.9)
IERHA	110	11.2 (9.2,13.2)	24.1 (19.8,28.4)
NHA	35	3.6 (2.4,4.7)	24.5 (17.2,33.9)
Stage			
Stage I	239	24.8 (22.1,27.5)	5.4 (4.8,6.1)
Stage II	178	18.5 (16.0,20.9)	4.0 (3.4,4.6)
Stage III	415	43.0 (39.9,46.2)	9.2 (8.3,10.0)
Stage IV	132	13.7 (11.5,15.9)	4.6 (4.0,5.2)

**column %*

Table 4.6 Number and percent of rectal cancer cases that underwent a resection within one year of diagnosis by cohort characteristics, 2010-2014

Characteristic	Had a Resection		Did Not Have a Resection or Had Polypectomy	
	N	% Total (95% CI)	N	% Total (95% CI)
Manitoba	660	66.9 (64.0,69.9)	326	33.1 (30.1,36.0)
Age group				
20-49	62	62.6 (53.1,72.2)	37	37.4 (27.8,46.9)
50-59	152	71.0 (64.9,77.1)	62	29.0 (22.9,35.1)
60-69	181	65.1 (59.5,70.7)	97	34.9 (29.3,40.5)
70-79	165	67.9 (62.0,73.8)	78	32.1 (26.2,38.0)
80+	100	65.8 (58.2,73.3)	52	34.2 (26.7,41.8)
Sex				
Male	421	67.0 (63.3,70.7)	208	33.0 (29.3,36.7)
Female	239	66.8 (61.9,71.7)	118	33.2 (28.3,38.1)
Income quintile (urban)				
U1 (lowest)	65	62.8 (53.5,72.1)	39	37.2 (27.9,46.5)
U2	100	73.4 (65.9,80.9)	36	26.6 (19.1,34.1)
U3	74	69.0 (60.1,77.8)	33	31.0 (22.2,39.9)
U4	69	67.4 (58.3,76.4)	34	32.6 (23.6,41.7)
U5 (highest)	81	67.3 (58.9,75.6)	40	32.7 (24.4,41.1)
Income quintile (rural)				
R1 (lowest)	57	64.9 (54.9,74.9)	31	35.1 (25.1,45.1)
R2	53	60.9 (50.6,71.2)	34	39.1 (28.8,49.4)
R3	52	63.4 (52.8,74.0)	29	36.6 (26.0,47.2)
R4	96	71.0 (63.3,78.7)	39	29.0 (21.3,36.7)
RHA of residence at diagnosis				
WRHA	373	68.8 (64.8,72.7)	171	31.2 (27.3,35.2)
non-WRHA	287	65.0 (60.5,69.5)	153	35.0 (30.5,39.5)
RHA of first surgery				
WRHA	504	100	n/a	n/a
PMH	83	100	n/a	n/a
SH-SS	33	100	n/a	n/a
IERHA	27	100	n/a	n/a
NHA	7	100	n/a	n/a
Stage				
Stage I	168	69.9 (64.0,75.8)	71	30.1 (24.2,36.0)
Stage II/III	433	73.0 (69.4,76.6)	160	27.0 (23.4,30.6)
Stage IV	53	40.7 (32.2,49.1)	79	59.3 (50.9,67.8)

**row percent*

Table 4.7 Number and percent of colon cancer cases by type of procedure, 2010-2014

Procedures	Number (N = 2235)	Percent
Resection with no stoma	1979	88.5
Resection with permanent stoma	12	0.5
Resection with reversible stoma	160	7.2
Stoma with no resection	84	3.8

Table 4.8 Characteristics of type of surgical procedure conducted to treat colon cancer, 2010-2014

Characteristic	Resection With No Stoma N (%)	Resection With Stoma* N (%)
All surgeries	1979 (92.0)	172 (8.0)
20-49	120 (89.6)	14 (10.4)
50-59	273 (94.5)	16 (5.5)
60-69	495 (91.2)	48 (8.8)
70-79	595 (92.7)	47 (7.3)
80+	496 (91.3)	47 (8.7)
RHA of residence at diagnosis		
WRHA	1061 (90.7)	109 (9.3)
PMH	346 (94.3)	21 (5.7)
All other RHA	568 (93.1	42 (6.9)
RHA of first surgery		
WRHA	1296 (90.6)	134 (9.4)
PMH	340 (93.4)	24 (6.6)
All other RHA	319 (95.8)	14 (4.2)
Stage		
Stage I	393 (94.9)	21 (5.1)
Stage II	738 (93.3)	53 (6.7)
Stage III	655 (92.8)	51 (7.2)
Stage IV	187 (79.9)	47 (20.1)

**Resection with permanent stoma (n = 12) and potentially reversible stomas (n=160) were combined due to small cell sizes.*

Table 4.9 Number and percent of colon cancer cases by approach, 2010-2014

Characteristic	Open		Laparoscopic	
	N	Percent	N	Percent
All resections	1632	75.8	519	24.2
RHA of First Surgery				
WRHA	1056	73.8	374	26.2
PMH	309	84.9	55	15.1
All other RHAs	267	74.8	90	25.2

Table 4.10 Number and percent of rectal cancer cases by type of procedure and approach, 2010-2014

Characteristic	N	Percent
All resections	660	100.0
Surgical Approach		
Open	509	77.1
Laparoscopic	90	13.6
Orifice*	61	9.2
Procedures		
Resection with no stoma	295	36.1
Resection with permanent stoma	194	23.7
Resection with reversible stoma	171	20.9
Stoma with no resection	157	19.2

**Includes transanal endoscopic micro-surgery (TEMS). Over 90% of per orifice procedures were conducted in the WRHA.*

Table 4.11 Characteristics of type of surgical procedure conducted to treat rectal cancer, 2010-2014

Characteristic	Resection with no stoma n (%)	Resection with stoma n (%)
All surgeries	295 (44.7)	365 (55.3)
20-49	23 (37.1)	39 (62.9)
50-59	61 (40.1)	91 (59.9)
60-69	79 (43.6)	102 (56.4)
70-79	77 (46.7)	88 (53.3)
80+	55 (55.0)	45 (45.0)
Income quintile (urban)		
U1 (lowest)	23 (35.4)	42 (64.6)
U2	45 (45.0)	55 (55.0)
U3	35 (47.3)	39 (52.7)
U4	32 (46.4)	37 (53.6)
U5 (highest)	34 (42.0)	47 (58.0)
Income quintile (rural)		
R1 (lowest)	25 (43.9)	32 (56.1)
R2	27 (50.9)	26 (49.1)
R3	24 (46.2)	28 (53.8)
R4	23 (45.1)	28 (54.9)
R5 (highest)	22 (48.9)	23 (51.1)
RHA of residence at diagnosis		
WRHA	163 (43.7)	210 (56.3)
PMH	44 (45.4)	53 (54.6)
All other RHAs	88 (46.3)	102 (53.7)
RHA of first surgery		
WRHA	219 (43.5)	285 (56.5)
PMH	35 (42.2)	48 (57.8)
All other RHAs	37 (55.2)	30 (44.8)
Stage		
Stage I	126 (75.0)	42 (25.0)
Stage II	59 (47.2)	66 (52.8)
Stage III	93 (30.2)	215 (69.8)
Stage IV	15 (28.3)	38 (71.7)

Table 4.12 Regional Health Authority of residence at diagnosis by RHA of first surgery for colon cancer cases, 2010-2014

Location	N	Percent
Residence at diagnosis and resection in WRHA	1141	53.0
Residence at diagnosis in non-WRHA and resection in WRHA	314	14.6
Residence at diagnosis WRHA and resection in non-WRHA RHA	29	1.3
Residence at diagnosis and resection in same non-WRHA RHA	429	19.9
Residence at diagnosis in non-WRHA RHA and resection in a different non-WRHA RHA	238	11.1

Table 4.13 Regional Health Authority of residence at diagnosis by RHA of first surgery for rectal cancer cases, 2010-2014

Location	N	Percent
Residence at diagnosis and resection in WRHA	372	56.3
Residence at diagnosis in non-WRHA and resection in WRHA	139	21.1
Residence at diagnosis and resection in same non-WRHA RHA*	90	13.6
Residence at diagnosis in non-WRHA RHA and resection in a different non-WRHA RHA	59	8.9

**Residence at diagnosis and resection in WRHA includes diagnosis and resection in WRHA and diagnosis in WRHA and resection in non-WRHA (due to small numbers).*

Table 4.14 Median number of days and 90th percentile in days between first colonoscopy and first resection for colon cancer cases, 2010-2014

Characteristic	N	Median (days)	90th percentile (days)
Manitoba	1470	34	84
Age group			
20-49	73	24	80
50-59	191	35	74
60-69	367	32	78
70-79	462	35.5	86
80+	377	35	97
Sex			
Male	745	34	80
Female	725	34	91
Income quintile (urban)			
U1 (lowest)	177	36	87
U2	166	35	88
U3	175	35	82
U4	161	35	71
U5 (highest)	158	36	104
Income quintile (rural)			
R1 (lowest)	112	31	97
R2	122	29	70
R3	146	29	80
R4	113	37	81
R5 (highest)	108	34.5	80
RHA of residence at diagnosis*			
WRHA	782	38	88
PMH	259	25	62
SH-SS	205	29	79
IERHA	175	43	98
NHA	45	38	108
Stage*			
Stage I	261	45	104
Stage II	580	33	79
Stage III	490	33.5	81
Stage IV	136	21	81

**Cases with unknown RHA of residence at diagnosis or stage were not included in the table*

Table 4.15 Number and percent of colon cancer cases that had ≥12 lymph nodes removed during their first surgery and examined, 2010-2014

Characteristic	≥ 12 lymph nodes		< 12 lymph nodes	
	N	%	N	%
Manitoba	1841	86.1	298	13.9
Age group				
20-49	121	91.0	12	9.0
50-59	245	86.0	40	14.0
60-69	469	86.4	74	13.6
70-79	553	86.7	85	13.3
80+	453	83.9	87	16.1
Sex				
Male	926	84.3	172	15.7
Female	915	87.9	126	12.1
Income quintile (urban)				
U1 (lowest)	230	86.5	36	13.5
U2	211	86.8	32	13.2
U3	222	86.7	37	14.3
U4	195	88.2	26	11.8
U5 (highest)	206	84.1	39	15.9
Income quintile (rural)				
R1 (lowest)	123	78.8	33	21.2
R2	155	88.6	20	11.4
R3	170	86.7	26	13.3
R4	150	86.7	23	13.3
R5 (highest)	136	88.3	18	11.7
RHA of residence at diagnosis				
WRHA	1003	86.1	162	13.9
PMH	313	85.8	52	14.2
SH-SS	239	87.2	35	12.8
IERHA	217	85.1	38	14.9
NHA	65	85.5	11	14.5
RHA of first surgery				
WRHA	1224	85.9	201	14.1
PMH	312	86.4	49	13.6
SH-SS	166	88.8	21	11.2
IERHA + NHA	126	86.9	19	13.1
Stage				
Stage I	308	74.8	104	25.2
Stage II	716	90.9	72	9.1
Stage III	634	89.9	71	10.1
Stage IV	182	79.5	47	20.5

Table 4.16 Number and percent of rectal cancer cases that had a resection within one year of diagnosis and had a positive circumferential margin, 2010-2014

Characteristic	Positive		Negative	
	N	%	N	%
Manitoba	13	3.8	327	96.2
Sex				
Male	6	2.7	213	97.3
Female	7	5.8	114	94.2

Table 4.17 Number of in-hospital post-operative complications experienced by patients with colon cancer who had a resection within one year of diagnosis, 2010-2014

Characteristic	N	Percent
Manitoba	762	36.0
Age group		
20-49	36	27.7
50-59	72	25.8
60-69	189	35.2
70-79	220	34.5
80+	245	45.9
Sex		
Male	407	37.4
Female	355	34.5
Income quintile (urban)		
U1 (lowest)	117	44.2
U2	102	41.8
U3	82	31.8
U4	72	32.6
U5 (highest)	67	27.7
Income quintile (rural)		
R1 (lowest)	64	41.6
R2	65	37.1
R3	66	34.9
R4	58	34.7
R5 (highest)	46	30.3
RHA of residence at diagnosis		
WRHA	400	34.5
PMH	155	43.3
SH-SS	112	41.0
IERHA	70	28.1
NHA	24	32.4
RHA of first surgery		
WRHA	507	35.6
PMH	160	44.1
All other RHAs	95	29.0
Stage		
Stage I	126	30.7
Stage II	294	37.6
Stage III	238	34.3
Stage IV	102	44.9

Table 4.18 Number of in-hospital post-operative complications experienced by patients with rectal cancer who had a resection within one year of diagnosis, 2010- 2014

Characteristic	N	Percent
Manitoba	218	33.6
Age group		
20-49	14	23.0
50-59	51	34.5
60-69	56	31.1
70-79	59	36.4
80+	38	39.2
Sex		
Male	152	36.7
Female	66	28.2
Income quintile (urban)		
U1 (lowest)	22	33.8
U2	32	32.3
U3	25	34.2
U4	22	32.4
U5 (highest)	24	30.4
Income quintile (rural)		
R1 (lowest)	24	42.9
R2	17	33.3
R3	17	34.0
R4	15	29.4
R5 (highest)	17	38.6
RHA of residence at diagnosis		
WRHA	116	31.4
PMH	39	42.9
SH-SS	39	41.5
IERHA	15	20.8
NHA	9	40.9
RHA of first surgery		
WRHA	167	33.4
PMH	33	40.7
All other RHAs	18	26.9
Stage		
Stage I	36	22.1
Stage II	50	40.0
Stage III	112	37.0
Stage IV	18	34.0

Table 4.19 Median number of days and 90th percentile for in-hospital length of stay for colon cancer cases treated with surgery within one year of diagnosis, 2010-2014

Characteristic	Median (days)	90th Percentile (days)
All resections	8	14
Surgical approach		
Open	8	15
Laparoscopic	6	12
Procedures		
Resection with no stoma	7	14
Resection with stoma (permanent or reversible)	13	32

Table 4.20 Median number of days and 90th percentile between hospital admission date and discharge date for rectal cancer cases treated with surgery within one year of diagnosis, 2010-2014

Characteristic	Median (days)	90th Percentile (days)
All resections	8	16
Surgical approach		
Open	9	16
Laparoscopic	6	11
Procedures		
Resection with no stoma	6	12
Resection with stoma (permanent or reversible)	9	17

Table 4.21 Number and percentage of hospital readmissions amongst colon and rectal cancer cases that were treated with a surgery within one year of diagnosis, 2010-2014

At least one readmission within 30 days of resection	N	Percent
Colon	129	6.1
Rectum	42	6.6

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CHAPTER 5. LUNG CANCER

Key Findings

- Many patients with lung cancer are not eligible for surgery due to pre-existing conditions. Sixty-five percent of stage I and stage II non-small cell lung cancer (NSCLC) cases had surgery which is similar to other jurisdictions.[1,2]
- Lung cancer resections performed using minimally invasive Video-Assisted Thorascopic Surgery (VATS) increased from 28.8% in 2010 to 62.6% in 2014. This is similar to other national and international rates.[3]
- The 30-day mortality rate after lung cancer surgery was 0.84%. This is slightly lower than published rates from other countries (1-4%).[4-7]
- Nearly all surgeries (92.7%) were conducted in the WRHA.

Recommendations

A community of practice (CoP) model was used to engage in knowledge mobilization efforts. A CoP is defined as a group of individuals that share a common goal of gaining knowledge related to a specific field. Collective learning is achieved through the sharing of information and experiences.[8] Results from this report were shared with a lung community of practice which consisted of surgeons, radiation oncologists, and senior administration. The community of practice developed several recommendations to further understand and address the results in this report. The recommendations are listed below.

- There is a lack of data around nodal stations sampled preoperatively or intraoperatively. This data are needed to assess adequacy of nodal staging for lung cancer.

  Recommendation (1): Start collecting detailed staging data in the Manitoba Cancer Registry or through Surgical Synoptic Reporting.

- Surgery rates for stage I and II patients start to decrease around age 65. This decrease should have happened closer to age 80. It is possible that some patients who did not receive surgery in this time period were suitable candidates and should have received a curative surgery.

  Recommendation (2): Measure surgery rates by age, over time to understand if there is a change in practice over time. Identify the percentage of patients who are receiving stereotactic body radiotherapy (SBRT) and explore how it affects surgery rates.

- Data are needed around chemotherapy rates among stage I and II lung cancer patients and surgical wait times.

  Recommendation (3): Measure the percentage of stage I and II patients referred to chemotherapy.

  Recommendation (4): Measure surgical wait times from decision to treat and/or diagnosis date to surgery.

- Current peri-operative care and diagnostic work up processes need improvement.

  Recommendation (5): Explore inefficiencies in diagnostic pathways in peri-operative care in Manitoba and develop solutions to address them.

- Future research should focus on the following:
  1) Are all Stage I and II patients being assessed by thoracic surgery for curative operation?
  2) Did the surgery meet quality criteria and existing standards?
  3) Did the patient receive high-quality post-operative care?

  Recommendation (6): Future quality improvement projects should focus on monitoring these areas and implement changes as needed.

Lung Cancer in Manitoba

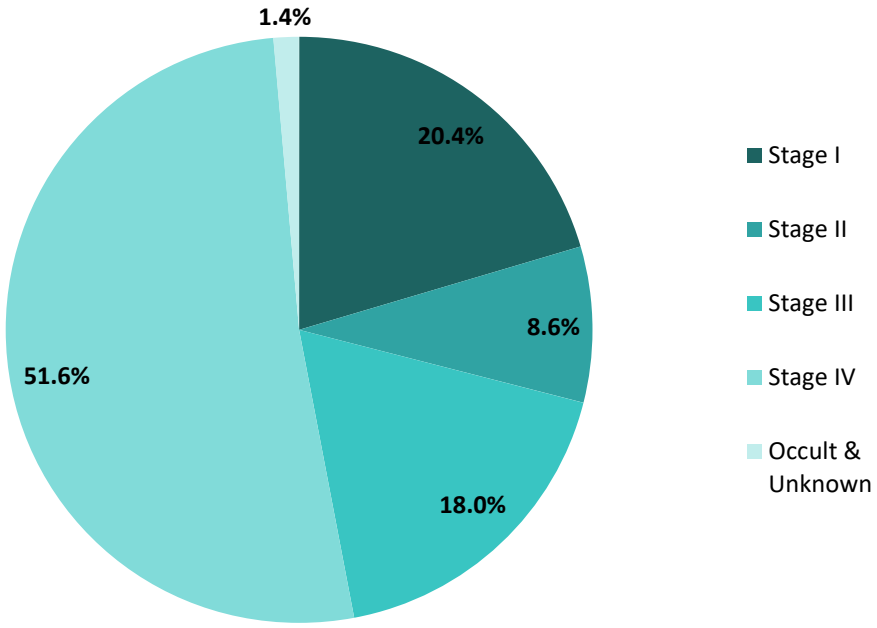
There are two main types of lung cancer: Non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC). Treatment modalities for NSCLC and SCLC cancer are different.

Non-small cell lung cancer (NSCLC)
NSCLC includes adenocarcinoma, squamous cell and large cell carcinoma, along with other rarer subtypes of cancer, and accounts for 89.7% of lung cases diagnosed in Manitoba between 2010 and 2014. Individuals diagnosed with early-stage NSCLC may be candidates for surgery.

Small cell lung cancer (SCLC)
SCLC made up 10.3% of cancers diagnosed in Manitoba during the study period. SCLC is usually not treated with a surgical intervention. SCLCs are treated primarily with chemotherapy with the addition of radiation therapy for some patients.

Epidemiology

Figure 5.1 Stage distribution of lung cancer in Manitoba, 2010-2014



There were 4,249 cases of lung cancer diagnosed in Manitoba between January 1, 2010 and December 31, 2014 (Table 5.3). Approximately 90% of these cases were NSCLC and over 50% of the cases were stage IV (Figure 5.1). Lung cancer cases were equally distributed by sex and 57.0% of Manitobans with lung cancer lived in the Winnipeg Regional Health Authority (WRHA).

A higher percentage of individuals with lung cancer who lived in urban areas were in the lowest income quintile than in the highest income quintile. This may be due to the relationship between smoking rates and income level found in previous research.[9] Income quintile splits a population into five groups based on income; it is a measure of socioeconomic status.[10]

Additional information regarding the epidemiology of lung cancer in Manitoba is found in Tables 5.3 - 5.6 at the end of this chapter.

Description of Surgical Procedures Used to Treat Lung Cancer

Sublobar resections
Data used for this report does not distinguish between wedge resections or segmentectomies – the two procedures are grouped into one category called sublobar resections as they are similar. Only a portion of lung lobe tissue along with the tumour is removed and both procedures are used to treat early-stage NSCLC.

Wedge resection
This type of surgery removes a small wedge or pie shaped portion of lung tissue from one lobe. The surgery is used to treat early-stage NSCLC in people who have a limited pulmonary reserve and are not candidates for a lobectomy.

Segmentectomy
A segmentectomy removes a larger anatomic segment of lung tissue than a wedge resection with division of the segmental bronchus, artery, and vein but does not remove a whole lobe. Segmentectomy may be used to treat early-stage NSCLC in people who have a limited pulmonary reserve and are not candidates for a lobectomy.

Lobectomy / bilobectomy
A lobectomy removes one lobe of the lung and a bilobectomy removes two adjacent lobes of the right lung. This type of resection is conducted when the tumour is confined to one lobe or sometimes two lobes on the right side. Lobectomy is not indicated for people who have poor pulmonary reserve.

Pneumonectomy
A pneumonectomy completely removes either the right or left lung. A pneumonectomy may be performed if the tumour is located in the middle of the lung, involves more than one lobe, and/or invades the main bronchus, artery, and veins of the lung such that a lobectomy would not be curative. In addition to removing the lung, an extrapleural pneumonectomy removes portions of the diaphragm, pericardium, and pleura. In some instances, extrapleural pneumonectomy may be used to treat mesothelioma, a cancer of the pleura or lining of the chest cavity and lung. Pneumonectomy is not indicated for people who have poor pulmonary reserve.

Mediastinal lymph node resection/evaluation
A mediastinal lymph node resection is a resection of lymph node basins where fluid drains from the tumour site; it is usually conducted in conjunction with lung cancer resection. The removal and subsequent pathological staging of the lymph nodes provides important information necessary for staging, treatment planning and prognosis, as well as having potential therapeutic benefit.

Video-assisted thoracic surgery (VATS)
VATS is a less invasive surgical approach than traditional open lung resections. 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 resection.

Lung Cancer Surgery

Indicator definition

Number and percentage of lung cancer cases treated with surgery with curative intent within one year of diagnosis.

Why is this important to know?

Surgical removal of a lung tumour is the primary treatment modality that has the potential to cure early-stage NSCLC. Surgery is not a common treatment for SCLC. The type and stage of lung cancer, personal preference, and overall patient health influence whether a patient receives surgery. As elderly patients are more likely to have other major comorbid illnesses, they are less likely to be candidates for surgery. This indicator does not measure appropriateness of treatment.

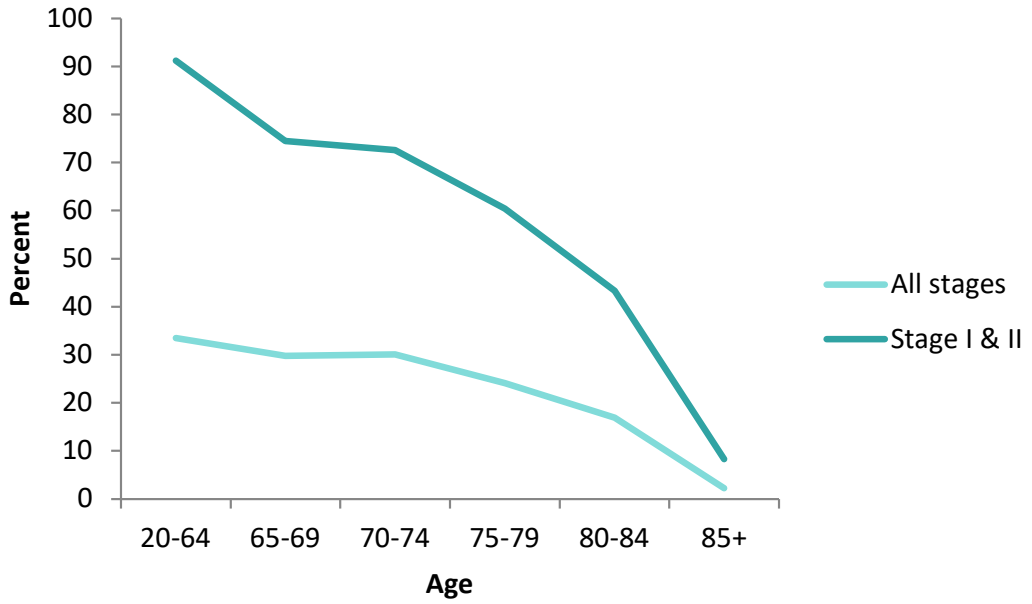
Take away message

- Surgery is more common in stage I and II NSCLC cases compared to stage III and IV (as surgery is the main curative treatment for early-stage tumors (Table 5.1).
- The percentage of cases treated surgically generally declines with increasing age group at diagnosis (Figure 5.2).

Table 5.1 Percentage of non-small cell lung cancer (NSCLC) cases that received a surgical procedure with curative intent within one year of diagnosis, 2010-2014

Stage at Diagnosis	Had surgery		Did not have surgery	
	Number of cases	% Total	Number of cases	% Total
All stages	951	25.0	2,860	75.0
Stage I & II	778	65.0	419	35.0

Figure 5.2 Percentage of NCSLC cases that received a surgical procedure, by age group and stage at diagnosis, 2010-2014



What does the data tell us?

The percentage of NCSLC cases treated surgically differed depending on stage and age. Stage I and II cases (Table 5.1) and younger patients (Figure 5.2) were more likely to receive surgery. Ontario reported similar patterns between 2010 and 2012, where 58.9% of stage I and II lung cancer patients received a surgery, with lower rates among older patients.[1] In Scotland, a country that has a robust surgical oncology indicators framework, 69% of stage I and II NSCLC cases diagnosed in 2013/2014 received surgery, which exceeds their national target of >50%.[2]

Additional information about this indicator, including stratifications by income quintile and regional health authority, are found in Tables 5.7 – 5.10 at the end of this chapter.

Surgical procedure

Indicator definition

Number and percentage of NSCLC cases treated with a surgical resection within one year of diagnosis by type of surgical procedure.

Why is this important to know?

This indicator provides information about the types of surgical procedures used to treat lung cancer. Lobectomy is the standard of care for early-stage NSCLC. However, in select cases, a sublobar resection may be performed if a patient has limited pulmonary reserve. Sublobar resection may be curative in early-stage NSCLC and there are ongoing studies to determine this.

Take away message

- The majority (62.0%) of NSCLC cases treated surgically received a lobectomy (Figure 5.3).
- The distribution of each type of surgical procedure stayed the same between 2010 and 2014 (Figure 5.4).

Figure 5.3 Type of surgical procedure used to treat NSCLC cases, 2010-2014

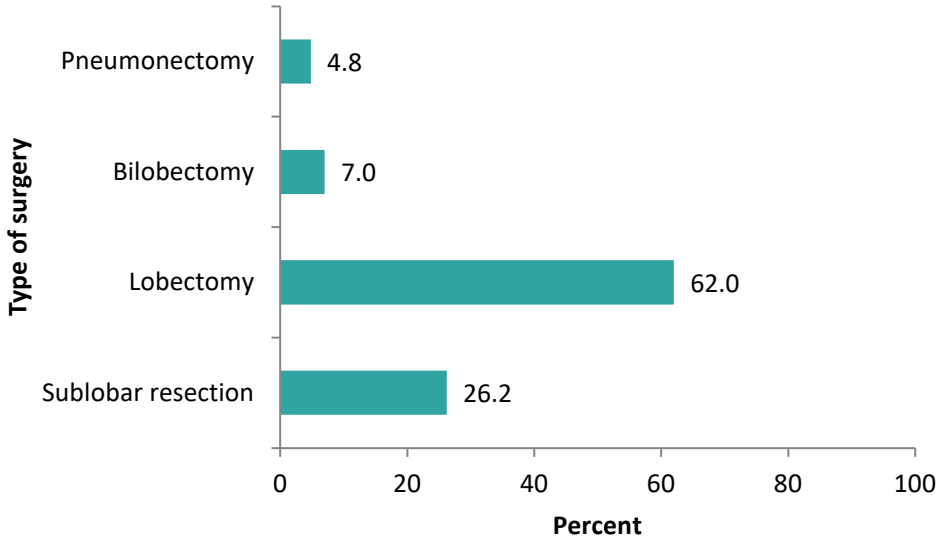
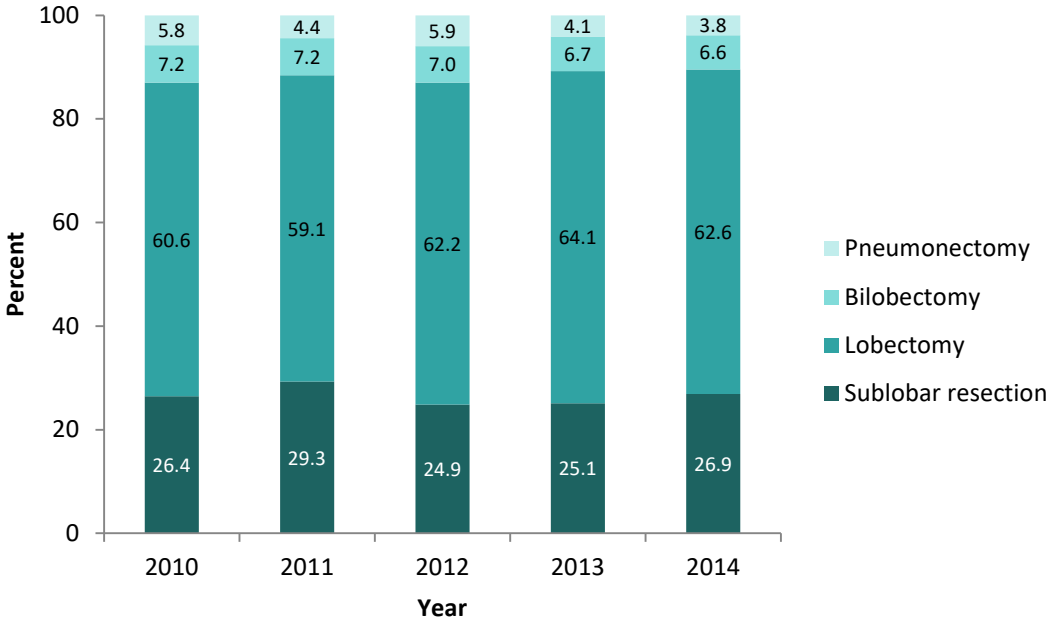


Figure 5.4 Type of surgical procedure used to treat NSCLC cases by year of diagnosis, 2010-2014



What does the data tell us?

The most common surgical procedure used to treat NSCLC was lobectomy, followed by sublobar resection, which includes segmentectomies and wedge resections (Figure 5.3). Very few pneumonectomies and bilobectomies were performed annually. The percentage of each type of surgical procedure used has stayed fairly consistent over time.

Additional information about type of procedures can be found in Tables 5.11 and 5.13 at the end of this chapter.

Surgical approach

Indicator definition

Number and percentage of surgeries with a curative intent completed within one year of diagnosis by surgical approach.

Why is this important to know?

Lung cancer surgery can be completed via the traditional open approach or Video-Assisted Thorascopic Surgery (VATS). VATS is a minimally invasive surgical approach for lung surgery. Several small incisions are made in the patient's chest and surgical instruments and a small camera are inserted through the incisions to complete the surgery. With an open approach, a large incision is made in the chest wall to perform the procedure. If a patient is a good candidate for VATS, the minimally invasive surgery may reduce length of hospital stay, speed up recovery, and have improved outcomes related to local recurrence rate.[3, 11] VATS surgeries were first offered in Manitoba in 2009.

Take away message

- Video-Assisted Thoracoscopic Surgery (VATS) use has increased during the study period (28.8% for cancers diagnosed in 2010 to 62.6% for cancers diagnosed in 2014) (Figure 5.5).
- 50% of sublobar resections and lobectomies were completed using VATS (Figure 5.6).
- As of 2014, a similar percentage of surgeries in Manitoba and United States surgical centers who participate in the Society of Thoracic Surgeons (STS) National Database (a database in the United States that contains information about thoracic surgery amongst major thoracic surgery centers) were completed using VATS.[3]

Figure 5.5 Type of surgical approach used during NSCLC surgeries, by year, 2010-2014

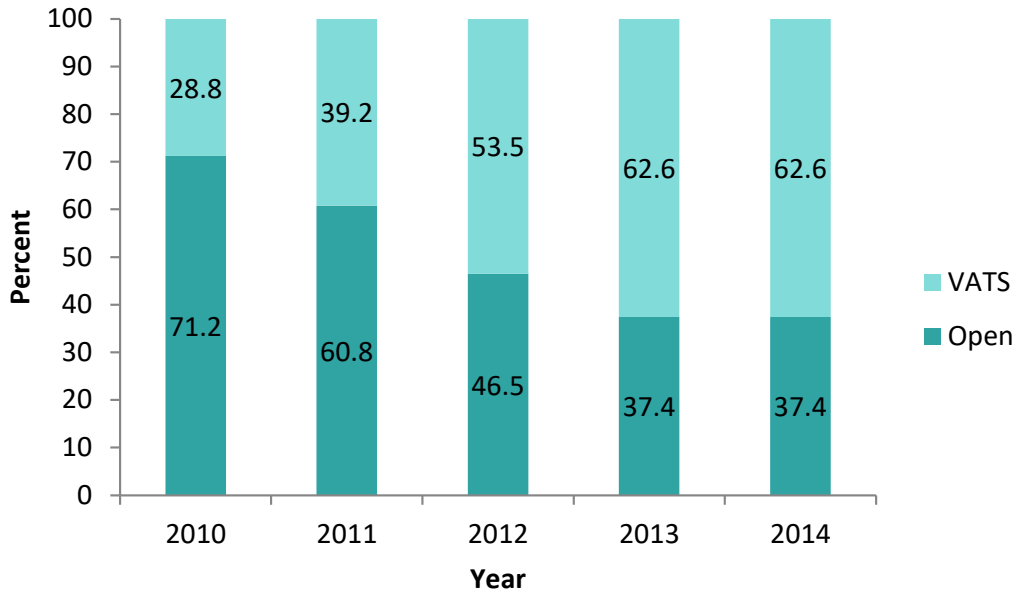


Figure 5.6 Type of surgical approach used during NSCLC surgeries, by type of surgery, 2010-2014

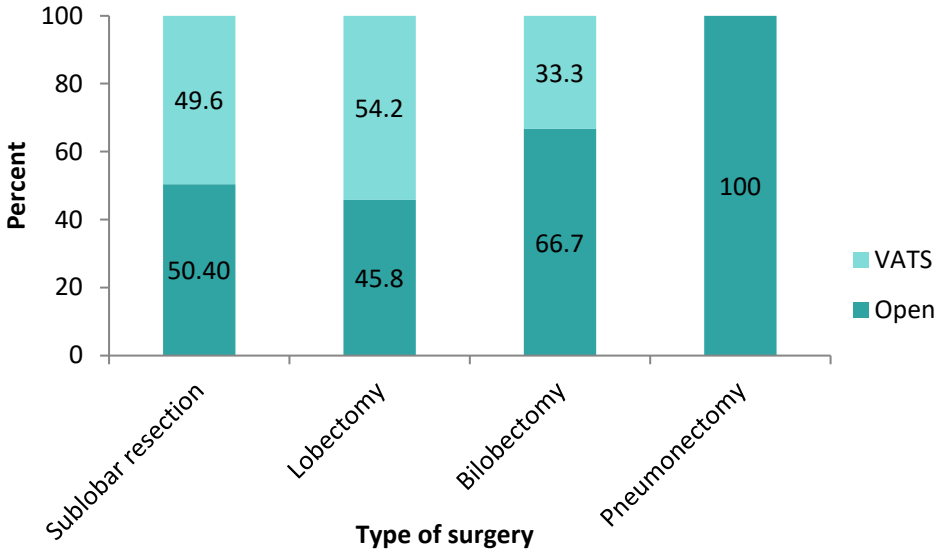


Figure 5.7 Type of surgical approach used in lobectomies for NSCLC, by year, 2010-2014

What does the data tell us?

In Manitoba, VATS was most commonly used for sublobar resections and lobectomies (Figure 5.6). The percentage of surgeries completed using VATS increased from 29% in 2010 to 63% in 2014 (Figure 5.5). This trend is prominent among lobectomies where only 33.3% of cases in 2010 were completed using VATS compared to 64% in 2014 (Figure 5.7). This increase in the use of VATS is similar to that seen in other countries such as the United States, Japan, Denmark, and the United Kingdom.[3] As of 2014, according to the STS National Database over 65% of patients undergo a lung cancer surgery using VATS.[3] The percentage reported by the STS is similar to that seen in Manitoba.

Additional information about type of procedures can be found in Tables 5.11 - 5.13 at the end of this chapter.

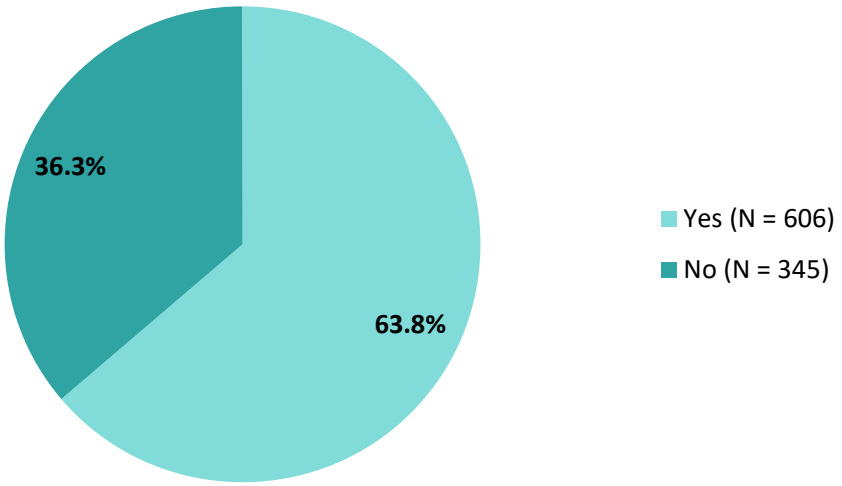
Diagnosis and surgery in the RHA of residence

Indicator definition
Percentage of NSCLC cases that had a lung resection within one year of diagnosis in the same RHA in which they lived at diagnosis.

Why is this important to know?
This indicator provides information about how far Manitobans travelled to receive their lung cancer surgery. Currently, lung cancer resections are only provided in Brandon and Winnipeg. Research has shown that patients at high-volume centers have better outcomes than patients who receive surgery at low-volume centers.[1, 2] Factors that influence where a patient receives cancer surgery include patient preference, type of procedure performed, and availability of specialists.

Take away message
- 36.3% (n = 345) of patients who had lung cancer surgery travelled from another RHA to Brandon or Winnipeg for their treatment (Figure 5.8).

Figure 5.8 Percentage of surgeries completed in the same RHA as a patient's residence, 2010-2014



What does the data tell us?
The majority of patients who had lung cancer received their surgical treatment in the same RHA in which they lived. This is because approximately 70% of Manitoba's population, and therefore a majority of individuals with lung cancer, reside in Winnipeg or Brandon where lung cancer treatment is provided. Individuals who live in the Southern, Interlake-Eastern, and Northern RHAs must travel to Brandon or Winnipeg for lung cancer surgery.

Hospital readmissions

Indicator definition

Percentage of NSCLC cases that underwent a surgery with curative intent within one year of diagnosis that were readmitted to hospital within 30 days of surgery.

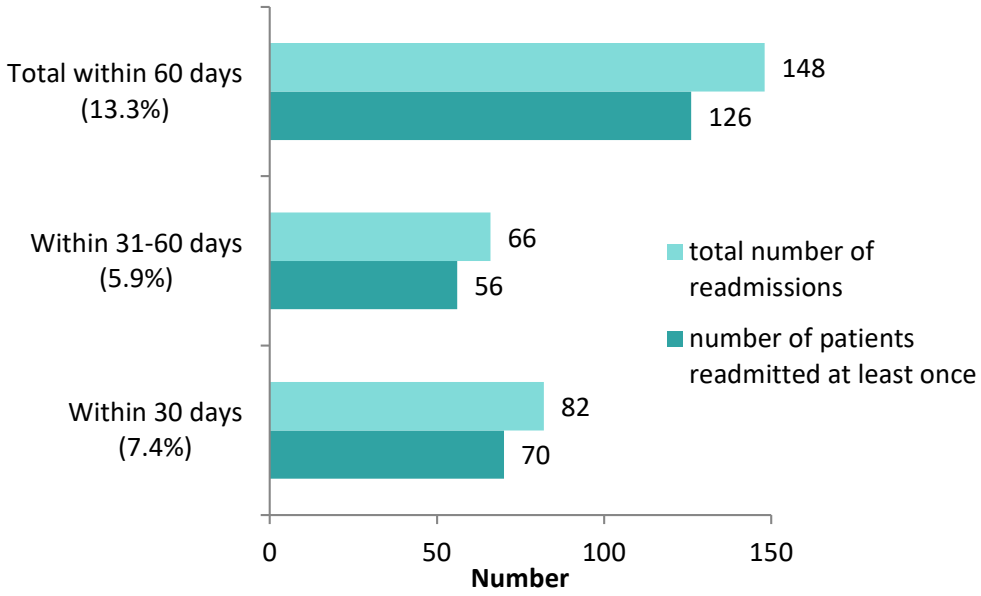
Why is this important to know?

Hospital readmissions are related to many factors including post-operative complications and pre-existing co-morbidities. Reducing readmissions is important for improved patient quality of life as well as reducing healthcare costs. Studies have also shown that readmission is related to an increased risk of post-operative mortality.[4] However, because we were unable to adjust for factors that may impact readmissions, this indicator cannot assess the appropriateness of readmission. The Cancer Quality Council of Ontario regularly reports unplanned hospital visits after surgery which is a similar measure.[13] In Manitoba, we are unable to determine if a readmission was planned or unplanned.

Take away message

- 7.4% of NSCLC cases were readmitted within 30 days of surgery.
- Hospital readmission after lung cancer surgery in Manitoba was similar to that reported in other jurisdictions during the same time period.[4,13]

Figure 5.9 Thirty and sixty day hospital readmissions among patients who received surgery for NSCLC, 2010-2014



What does the data tell us?

The majority of readmissions occurred within 30 days of surgery versus 60 days of surgery (Figure 5.9). The percentage of individuals readmitted within 30 days in Manitoba was slightly higher than the 5.9% reported in Ontario for 2014/15 – 2015/16. [13] However, since Ontario only included lobectomy and bilobectomies and the time periods are different, the rates are not directly comparable. A United States study that used 2006-2011 Surveillance, Epidemiology, and End Results (SEER) data found a readmission rate of 12.8% after lung cancer surgery.[4]

Additional information about hospital readmissions can be found in Table 5.16 at the end of this chapter.

Key Performance Indicators

Length of post-operative hospital stay (LOS)

Indicator definition

Number of days (median and 90th percentile) from surgery to hospital discharge for patients diagnosed with NSCLC that undergo surgery with curative intent within one year of diagnosis.

Why is this important to know?

Length of post-operative stay is related to many factors including type of procedure, surgical approach, pre-existing co-morbidities, and number and severity of post-operative complications.[14] LOS is a common quality indicator for lung cancer and is reported annually by the STS, various organizations in Europe, and individual studies.[14, 15] Shorter hospital stays, when appropriate, have the potential to reduce costs to the healthcare system.

Interpretation of results

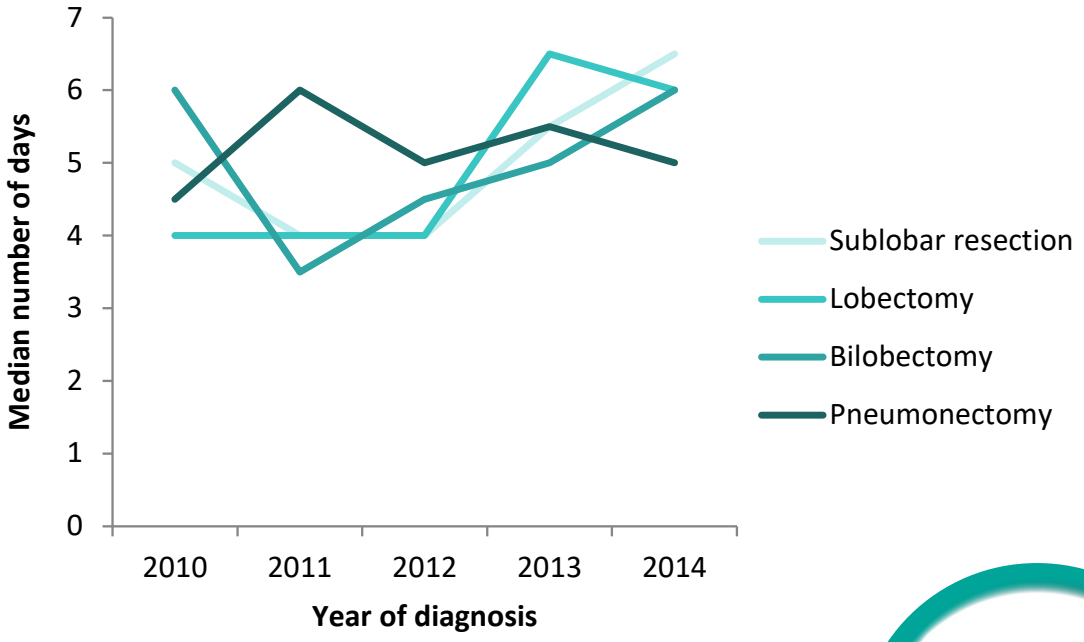
A low value for this indicator can be interpreted as a favorable result.

Take away message

- LOS is shorter for VATS (Figure 5.10b) compared to open surgical procedures (Figure 5.10a).
- LOS is similar to that reported in the United States STS National Database and in Canada.[3, 12, 15]

Figure 5.10 Median number of days from surgery to hospital discharge by type of surgery, by year, 2010-2014

(a) Open procedures



Median LOS Open - 5 days

VATS - 3 days

(b) VATS procedures

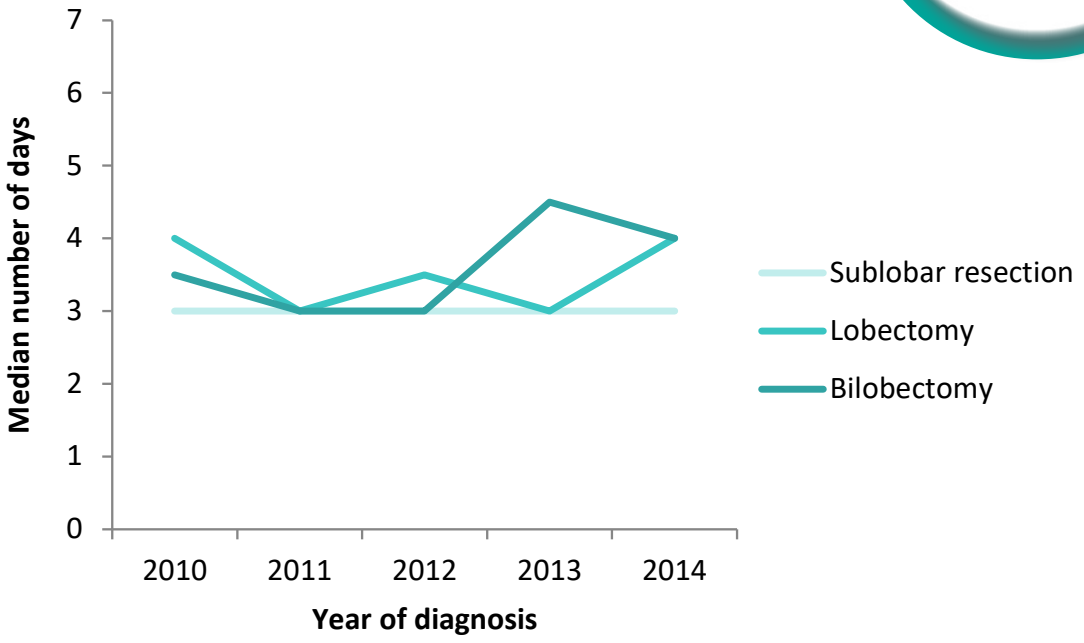


Table 5.2 Median length of post-operative hospital (LOS) stay by type of surgery, 2010-2014

	Sublobar resection	Lobectomy	Bilobectomy	Pneumonectomy
Manitoba	4 days	4 days	4 days	5 days

What does the data tell us?

The median LOS was shorter when the surgery was performed using VATS (Open approach = 5 days vs VATS = 3 days). A review of research published between 1995 and 2017 also indicates that VATS reduces the LOS. Data indicates that the median LOS for open procedures increased slightly between 2010 and 2014 for all types of lung surgeries. There was no change in LOS for procedures conducted by VATS between 2010 and 2014. The overall median LOS remained constant at four days which is the same result reported by the STS National Database for surgeries completed between July 1, 2012 and June 30, 2015.[15] Median LOS was also similar to what was reported in a recent pan-Canadian report (from 7 days in 2004 to 5 days in 2012).[12]

Additional information about LOS can be found in Tables 5.14 and 5.15 at the end of this chapter.

Post-operative mortality rate

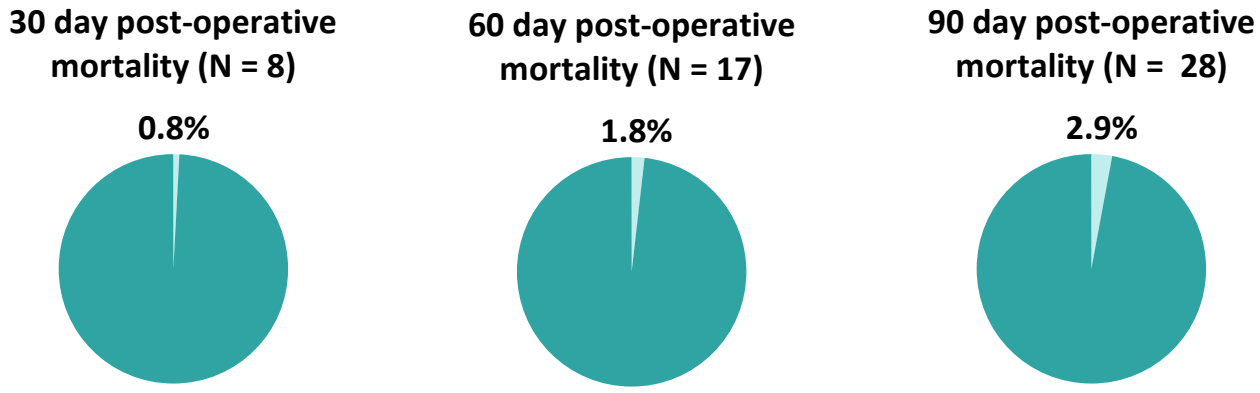
Indicator definition
Percentage of individuals diagnosed with NSCLC who had a resection within one year of diagnosis and died within 30, 60, or 90 days after surgery.

Why is this important to know?
Post-operative mortality is a measure of the quality and safety of the surgery and related services. Post-operative mortality may also be influenced by disease severity and the presence of co-morbidities, as well as regionalization of surgical services and surgeon expertise.12 Post-operative mortality rate is a common surgical quality indicator used around the world including Canada.[5, 6, 12]

Interpretation of results
A very low value for this indicator can be interpreted as a favorable result.

Take away message
- 30-day post-operative mortality was low in Manitoba during the study period.

Figure 5.11 Percentage of individuals diagnosed with NSCLC who died within 30, 60, or 90 days after surgery, 2010-2014



What does the data tell us?

30-, 60-, and 90-day post-operative mortality was 0.8%, 1.8%, and 2.9% respectively (Figure 5.11). Scotland reported a 30-day population-based mortality rate of 1% during an overlapping time period and the national target is <5%.[6] Other published reports have reported 30-day post-operative mortality rates between 2% and 4%.[4, 5, 7] All causes of death were included in this indicator. Therefore, it is possible that the causes of deaths reported were not directly attributable to surgery. Individuals who had emergency or urgent surgeries were included.

Table 5.3 Percentage and age-standardized incidence rates of lung cancer cases by cohort characteristics, 2010-2014

Characteristic	Lung Cancer Cohort		Age-Standardized Incidence Rate per 100,000 (95% CI)
	N	% Manitoba (95% CI)	
Manitoba	4249	100.0	93.5 (90.4, 96.1)
Age group			
20-54	318	7.5 (6.7,8.3)	10.5 (9.4,11.7)
55-64	895	21.1 (19.8,22.3)	117.1 (109.5,125.0)
65-69	669	15.7 (14.6,16.8)	246.4 (228.1,265.8)
70-74	700	16.5 (15.4,17.6)	351.3 (325.8,378.3)
75-79	670	15.8 (14.7,16.9)	425.1 (393.5,458.6)
80-84	516	12.1 (11.2,13.1)	406.3 (372.0,442.9)
85 +	481	11.3 (10.4,12.3)	343.0 (313.0,375.1)
Sex			
Male	2089	49.2 (47.7,50.7)	102.0 (97.6,106.4)
Female	2160	50.8 (49.3,52.3)	87.4 (83.7,91.1)
Income quintile (urban)			
U1 (lowest)	740	17.4 (16.3,18.6)	139.0 (128.9,149.2)
U2	575	13.5 (12.5,14.6)	112.6 (103.4,121.9)
U3	515	12.1 (11.1,13.1)	92.7 (84.7,100.7)
U4	389	9.2 (8.3,10.0)	75.5 (67.9, 83.1)
U5 (highest)	330	7.8 (7.0,8.6)	63.7 (56.7,70.6)
Income quintile (rural)			
R1 (lowest)	286	6.7 (6.0,7.5)	99.9 (88.3,111.5)
R2	338	8.0 (7.1,8.8)	91.9 (82.0,101.7)
R3	371	8.7 (7.9,9.6)	98.4 (88.3,108.4)
R4	303	7.1 (6.4,7.9)	86.2 (76.4,96.0)
R5 (highest)	279	6.6 (5.8,7.3)	96.5 (84.5,108.5)
RHA of residence at diagnosis			
WRHA	2416	56.9 (55.4,58.3)	91.9 (88.3,95.6)
PMH	698	16.4 (15.3,17.5)	99.4 (92.0,106.8)
SH-SS	494	11.6 (10.7,12.6)	84.3 (76.8,91.7)
IERHA	482	11.3 (10.4,12.3)	96.1 (87.4,104.8)
NHA	159	3.7 (3.2,4.3)	118.1 (98.0,138.3)
Stage			
Occult	9	0.2 (0.1,0.4)	0.2 (0.1,0.4)
Stage I	868	20.4 (19.2,21.6)	19.1 (17.8,20.4)
Stage II	365	8.6 (7.7,9.4)	8.0 (7.2,8.9)
Stage III	766	18.0 (16.9,19.2)	16.9 (15.7,18.0)
Stage IV	2192	51.6 (50.1,53.1)	48.0 (46.0,50.0)
Unknown	49	1.2 (0.8,1.5)	1.1 (0.8,1.4)
Tumour location			
Left	1682	39.6 (38.1,41.1)	37.0 (35.2,38.7)
Right	2421	57.0 (55.5,58.5)	53.1 (51.0,55.2)
Unknown	146	3.4 (2.9,4.0)	3.2 (2.7, 3.7)

**Includes cases diagnosed between January 1, 2010 and December 31, 2014. All characteristics are calculated at date of diagnosis. Incidence rates have been age and sex standardized to the Manitoba Health population from 2010 to 2014. Age-specific rates have not been standardized.*
Table shows column %.

Table 5.4 Percentage and age-standardized incidence rates of non-small cell lung cancer (NSCLC) cases by cohort characteristics, 2010-2014

Characteristic	NSCLC Cohort		Age-Standardized Incidence Rate per 100,000 (95% CI)
	N	% Manitoba (95% CI)	
Manitoba	3811	100	84.0 (81.0,86.3)
Age group			
20-54	275	7.2 (6.4,8.0)	9.1 (8.1,10.2)
55-64	787	20.7 (19.4,21.9)	103.0 (95.9,110.4)
65-69	578	15.2 (14.0,16.3)	212.9 (195.9,231.0)
70-74	612	16.1 (14.9,17.2)	307.2 (283.3,332.5)
75-79	606	15.9 (14.7,17.1)	384.5 (354.5,416.4)
80-84	492	12.9 (11.8,14.0)	387.4 (353.9,423.2)
85 +	461	12.1 (11.1,13.1)	328.8 (299.4,360.2)
Sex			
Male	1886	49.5 (47.9,51.1)	92.5 (88.3,96.7)
Female	1925	50.5 (48.9,52.1)	77.6 (74.1,81.1)
Income quintile (urban)			
U1 (lowest)	661	17.3 (16.1,18.5)	123.4 (113.9,133.0)
U2	509	13.4 (12.3,14.4)	99.6 (90.9,108.3)
U3	460	12.1 (11.0,13.1)	82.8 (75.2,90.4)
U4	350	9.2 (8.3,10.1)	68.1 (60.9,75.3)
U5 (highest)	300	7.9 (7.0,8.7)	58.3 (51.6,65.0)
Income quintile (rural)			
R1 (lowest)	257	6.7 (5.9,7.5)	89.7 (78.7,100.7)
R2	308	8.1 (7.2,8.9)	83.6 (74.2,92.9)
R3	331	8.7 (7.8,9.6)	87.8 (78.3,97.3)
R4	273	7.2 (6.3,8.0)	77.8 (68.5,87.0)
R5 (highest)	249	6.5 (5.7,7.3)	86.5 (75.1,97.9)
RHA of residence at diagnosis			
WRHA	2171	57.0 (55.4,58.5)	82.5 (79.1,86.0)
PMH	617	16.2 (15.0,17.4)	87.5 (80.6,94.5)
SH-SS	454	11.9 (10.9,12.9)	77.5 (70.4,84.7)
IERHA	425	11.2 (10.2,12.2)	85.2 (77.0,93.4)
NHA	144	3.8 (3.2,4.4)	109.3 (89.7,128.9)
Stage			
Stage I	851	22.3 (21.0,23.7)	18.7 (17.5,20.0)
Stage II	346	9.1 (8.2,10.0)	7.6 (6.8,8.4)
Stage III	650	17.1 (15.9,18.3)	14.3 (13.2,15.4)
Stage IV	1910	50.1 (48.5,51.7)	41.8 (40.0,43.7)
Tumour location			
Left	1513	39.7 (38.1,41.3)	33.3 (31.6,34.9)
Right	2164	56.8 (55.2,58.4)	47.5 (45.5,49.5)
Unknown	134	3.5 (2.9,4.1)	2.9 (2.4,3.4)

Includes cases diagnosed between January 1, 2010 and December 31, 2014. All characteristics are calculated at date of diagnosis. Incidence rates have been age and sex standardized to the Manitoba Health population from 2010 to 2014. Age-specific rates have not been standardized. Table shows column %.

Table 5.5 Percentage and age-standardized incidence rates of small cell lung cancer (SCLC) cases by cohort characteristics, 2010-2014

Characteristic	SCLC Cohort		Age-Standardized Incidence Rate per 100,000 (95% CI)
	N	% Manitoba (95% CI)	
Manitoba	438	100	9.6 (8.7,10.5)
Age group			
20-54	43	9.8 (7.0,12.6)	1.4 (1.0,1.9)
55-64	108	24.7 (20.6,28.7)	14.1 (11.6,17.1)
65-69	91	20.8 (17.0,24.6)	33.5 (27.0,41.2)
70-74	88	20.1 (16.3,23.8)	44.2 (35.4,54.4)
75-79	64	14.6 (11.3,17.9)	40.6 (31.3,51.9)
80-84	24	5.5 (3.3,7.6)	18.9 (12.1,28.1)
85 +	20	4.6 (2.6,6.5)	14.3 (8.7,22.0)
Sex			
Male	203	46.3 (41.7,51.0)	9.5 (8.2,10.8)
Female	235	53.7 (49.0,58.3)	9.8 (8.5,11.0)
Income quintile (urban)			
U1 (lowest)	79	18.0 (14.4,21.6)	15.6 (12.3,19.5)
U2	66	15.1 (11.7,18.4)	13.0 (10.1,16.6)
U3	55	12.6 (9.5,15.7)	9.9 (7.5,12.9)
U4	39	8.9 (6.2,11.6)	7.4 (5.3,10.2)
U5 (highest)	30	6.8 (4.5,9.2)	5.4 (3.6,7.7)
Income quintile (rural)			
R1 (lowest)	29	6.6 (4.3,8.9)	10.2 (6.8,14.6)
R2	30	6.8 (4.5,9.2)	8.3 (5.6,11.8)
R3	40	9.1 (6.4,11.8)	10.6 (7.6,14.4)
R4	30	6.8 (4.5,9.2)	8.5 (5.7,12.1)
R5 (highest)	30	6.8 (4.5,9.2)	10.0 (6.6,14.5)
RHA of residence at diagnosis			
WRHA	245	55.9 (51.3,60.6)	9.4 (8.2,10.6)
PMH	81	18.5 (14.9,22.1)	11.9 (9.4,14.7)
SH-SS	40	9.1 (6.4,11.8)	6.7 (4.8,9.2)
IERHA	57	13.0 (9.9,16.2)	10.9 (8.3,14.2)
NHA	15	3.4 (1.7,5.1)	8.9 (4.7,15.1)
Stage			
Stage I	17	3.9 (2.1,5.7)	0.4 (0.2,0.6)
Stage II	19	4.3 (2.4,6.2)	0.4 (0.3,0.7)
Stage III	116	26.5 (22.4,30.6)	2.5 (2.1,3.0)
Stage IV	282	64.4 (59.9,68.9)	6.2 (5.5,6.9)
Tumour location			
Left	169	38.6 (34.0,43.1)	3.7 (3.2,4.3)
Right	257	58.7 (54.1,63.3)	5.6 (4.9,6.3)
Unknown	12	2.7 (1.2,4.3)	0.3 (0.1,0.5)

Includes cases diagnosed between January 1, 2010 and December 31, 2014. All characteristics are calculated at date of diagnosis. Incidence rates have been age and sex standardized to the Manitoba Health population from 2010 to 2014. Age specific rates have not been standardized. Table shows column %. Cases whose income quintiles were not available, and occult and unknown stages are not presented.

Table 5.6 Income quintile and Regional Health Authority (RHA) of residence at diagnosis by stage amongst non-small cell lung cancer (NSCLC) cases in Manitoba, 2010-2014

Characteristic	Stage I N (%)	Stage 2 N (%)	Stage 3 N (%)	Stage 4 N (%)	Total N (%)
Manitoba					
Income quintile (urban)					
U1 (lowest)	157 (29.6)	50 (27.2)	113 (29.2)	330 (28.7)	650 (28.9)
U2	114 (21.5)	44 (23.9)	82 (21.2)	262 (22.8)	502 (22.3)
U3	114 (21.5)	37 (20.1)	76 (19.6)	230 (20.0)	457 (20.3)
U4	71 (13.4)	29 (15.8)	70 (18.1)	174 (15.1)	344 (15.3)
U5 (highest)	75 (14.1)	24 (13.0)	46 (11.9)	153 (13.3)	298 (13.2)
Income quintile (rural)					
R1 (lowest)	48 (16.2)	29 (18.7)	51 (21.1)	124 (17.6)	252 (18.0)
R2	70 (23.6)	39 (25.2)	63 (26.0)	134 (19.0)	306 (21.9)
R3	65 (21.9)	33 (21.3)	47 (19.4)	181 (25.6)	326 (23.3)
R4	59 (19.9)	27 (17.4)	42 (17.4)	144 (20.4)	272 (19.4)
R5 (highest)	55 (18.5)	27 (17.4)	39 (16.1)	123 (17.4)	244 (17.4)
Residence at diagnosis					
Urban (Winnipeg/Brandon)	544 (63.9)	190 (54.9)	405 (62.3)	1189 (62.3)	2328 (62.0)
Rural	307 (36.1)	156 (45.1)	245 (37.7)	721 (37.8)	1429 (38.0)

Cases whose income quintiles were not available, occult and unknown stage are not included in the table.

Table 5.7 Percentage of non-small cell lung cancer (NCSLC) cases that had surgery within one year of diagnosis by cohort characteristics, 2010-2014

Characteristic	Had Surgery		Did Not Have Surgery	
	N	% Total (95% CI)	N	% Total (95% CI)
Manitoba	951	25.0	2860	75.0
Age group				
20-54	87	31.6 (28.7,34.6)	188	68.4 (66.7,70.1)
55-64	269	34.2 (31.2,37.2)	518	65.8 (64.1,67.6)
65-69	172	29.8 (26.9,32.7)	406	70.2 (68.6,71.9)
70-74	184	30.1 (27.2,33.0)	428	69.9 (68.3,71.6)
75-79	146	24.1 (21.4,26.8)	460	75.9 (74.3,77.5)
80-84	83	16.9 (14.5,19.3)	409	83.1 (81.8,84.5)
85+	10	2.2 (1.2,3.1)	451	97.8 (97.3,98.4)
Sex				
Male	410	21.7 (19.1,24.4)	1476	78.3 (76.7,79.8)
Female	541	28.1 (25.2,31.0)	1384	71.9 (70.2,73.5)
Income quintile (urban)				
U1 (lowest)	148	22.4 (19.7,25.0)	513	77.6 (76.1,79.1)
U2	126	24.8 (22.0,27.5)	383	75.2 (73.7,76.8)
U3	134	29.1 (26.2,32.0)	326	70.9 (69.2,72.5)
U4	94	26.9 (24.0,29.7)	256	73.1 (71.5,74.8)
U5 (highest)	79	26.3 (23.5,29.1)	221	73.7 (72.1,75.3)
Income Quintile (rural)				
R1 (lowest)	51	19.8 (17.3,22.4)	206	80.2 (78.7,81.6)
R2	81	26.3 (23.5,29.1)	227	73.7 (72.1,75.3)
R3	77	23.3 (20.6,25.9)	254	76.7 (75.2,78.3)
R4	76	27.8 (25.0,30.7)	197	72.2 (70.5,73.8)
R5 (highest)	67	26.9 (24.1,29.7)	182	73.1 (71.5,74.7)
RHA of residence at diagnosis				
WRHA	549	25.3 (22.5,28.1)	1622	74.7 (73.1,76.3)
PMH	145	23.5 (20.8,26.2)	472	76.5 (74.9,78.1)
SH-SS	123	27.1 (24.3,29.9)	331	72.9 (71.3,74.5)
IERHA	100	23.5 (20.8,26.2)	325	76.5 (74.9,78.0)
NHA	34	23.6 (20.9,26.3)	110	76.4 (74.8,77.9)
RHA of surgery				
WRHA	882	n/a	n/a	n/a
PMH	69	n/a	n/a	n/a
Stage				
Stage I	566	66.5 (63.5,69.5)	285	33.5 (31.8,35.2)
Stage II	212	61.3 (58.2,64.4)	134	38.7 (36.9,40.5)
Stage III	128	19.7 (17.2,22.2)	522	80.3 (78.9,81.8)
Stage IV	44	2.3 (1.4,3.3)	1866	97.7 (97.1,98.2)

Row percent

Table 5.8 Percentage of non-small cell lung cancer (NCSLC) that had surgery within one year of diagnosis by cohort characteristics, 2010-2014

Characteristic	Had Surgery		Did Not Have Surgery	
	N	% Total	N	% Total
Manitoba	951	25.0	2860	75.0
Age group				
20-54	87	9.1	188	6.6
55-64	269	28.3	518	18.1
65-69	172	18.1	406	14.2
70-74	184	19.3	428	15.0
75-79	146	15.4	460	16.1
80-84	83	8.7	409	14.3
85+	10	1.1	451	15.8
Sex				
Male	410	43.1	1476	51.6
Female	541	56.9	1384	48.4
Income quintile (urban)				
U1 (lowest)	148	15.6	513	17.9
U2	126	13.2	383	13.4
U3	134	14.1	326	11.4
U4	94	9.9	256	9.0
U5 (highest)	79	8.3	221	7.7
Income quintile (rural)				
R1 (lowest)	51	5.4	206	7.2
R2	81	8.5	227	7.9
R3	77	8.1	254	8.9
R4	76	8.0	197	6.9
R5 (highest)	67	7.0	182	6.4
RHA of residence at diagnosis				
WRHA	549	57.7	1622	56.7
PMH	145	15.2	472	16.5
SH-SS	123	12.9	331	11.6
IERHA	100	10.5	325	11.4
NHA	34	3.6	110	3.8
RHA of surgery				
WRHA	882	92.7	n/a	n/a
PMH	69	7.3	n/a	n/a
Stage				
Stage I	566	59.6	285	10.2
Stage II	212	22.3	134	4.8
Stage III	128	13.5	522	18.6
Stage IV	44	4.6	1866	66.5

Column percent

Table 5.9 Percentage of stage I and II non-small cell lung cancer (NCSLC) cases that had surgery within one year of diagnosis by cohort characteristics, 2010-2014

Characteristic	Had Surgery		Did Not Have Surgery	
	N	% Total (95% CI)	N	% Total (95% CI)
Manitoba	778	65.0	419	35.0
Age group				
20-64	279	91.2 (89.2,93.2)	27	8.8 (6.1,11.5)
65-69	140	74.5 (71.4,77.5)	48	25.5 (21.4,29.7)
70-74	159	72.6 (69.5,75.7)	60	27.4 (23.1,31.7)
75-79	116	60.4 (57.0,63.9)	76	39.6 (34.9,44.3)
80-84	74	43.3 (39.8,46.8)	97	56.7 (52.0,61.5)
85+	10	8.3 (6.3,10.2)	111	91.7 (89.1,94.4)
Sex				
Male	332	64.1 (60.7,67.5)	186	35.9 (31.3,40.5)
Female	446	65.7 (62.3,69.0)	233	34.3 (29.8,38.9)
Income quintile (urban)				
U1 (lowest)	126	60.9 (57.4,64.3)	81	39.1 (34.5,43.8)
U2	101	63.9 (60.5,67.3)	57	36.1 (31.5,40.7)
U3	110	72.8 (69.7,76.0)	41	27.2 (22.9,31.4)
U4	71	71.0 (67.8,74.2)	29	29.0 (24.7,33.3)
U5 (highest)	67	67.7 (64.4,71.0)	32	32.3 (27.8,36.8)
Income quintile (rural)				
R1 (lowest)	44	57.1 (53.7,60.6)	33	42.9 (38.1,47.6)
R2	64	58.7 (55.3,62.2)	45	41.3 (36.6,46.0)
R3	63	64.3 (60.9,67.7)	35	35.7 (31.1,40.3)
R4	61	70.9 (67.7,74.1)	25	29.1 (24.7,33.4)
R5 (highest)	55	67.1 (63.8,70.4)	27	32.9 (28.4,37.4)
RHA of residence at diagnosis				
WRHA	449	66.6 (63.3,69.9)	225	33.4 (28.9,37.9)
PMH	117	58.2 (54.7,61.7)	84	41.8 (37.1,46.5)
SH-SS	98	67.6 (64.3,70.9)	47	32.4 (27.9,36.9)
IERHA	85	65.4 (62.0,68.7)	45	34.6 (30.1,39.2)
NHA	29	61.7 (58.3,65.1)	18	38.3 (33.6,43.0)
RHA of surgery				
WRHA	727	n/a	n/a	n/a
PMH	51	n/a	n/a	n/a
Tumour location				
Left	308	62 (58.6,65.4)	189	38 (33.4,42.7)
Right	469	67.1 (63.8,70.4)	230	32.9 (28.4,37.4)

**row percent ; 20-54 and 55-64 age groups were combined due to small cell sizes.*

Table 5.10 Percentage of stage I and II non-small cell lung cancer (NCSLC) cases that had surgery within one year of diagnosis by cohort characteristics, 2010-2014

Characteristic	Had Surgery		Did Not Have Surgery	
	N	% Total	N	% Total
Manitoba	778	65.0	419	35.0
Age group				
20-64	279	35.9	27	6.4
65-69	140	18.0	48	11.5
70-74	159	20.4	60	14.3
75-79	116	14.9	76	18.1
80-84	74	9.5	97	23.2
85+	10	1.3	111	26.5
Sex				
Male	332	42.7	186	44.4
Female	446	57.3	233	55.6
Income quintile (urban)				
U1 (lowest)	126	16.2	81	19.3
U2	101	13.0	57	13.6
U3	110	14.1	41	9.8
U4	71	9.1	29	6.9
U5 (highest)	67	8.6	32	7.6
Income quintile (rural)				
R1 (lowest)	44	5.7	33	7.9
R2	64	8.2	45	10.7
R3	63	8.1	35	8.4
R4	61	7.8	25	6.0
R5 (highest)	55	7.1	27	6.4
RHA of residence at diagnosis				
WRHA	449	57.7	225	53.7
PMH	117	15.0	84	20.0
SH-SS	98	12.6	47	11.2
IERHA	85	10.9	45	10.7
NHA	29	3.7	18	4.3
RHA of surgery				
WRHA	727	93.4	n/a	n/a
PMH	51	6.6	n/a	n/a
Tumour location				
Left	308	39.6	189	45.1
Right	469	60.3	230	54.9

**Column percent ; 20-54 and 55-64 age groups were combined due to small cell sizes.*

Table 5.11 Characteristics of surgical procedures conducted to treat non-small cell lung cancer (NCSLC), 2010-2014

Characteristic	Had Surgery	
	N	%
Manitoba	951	25.0
Type of lung surgery		
Sublobar resection	252	26.2
Lobectomy	587	62.0
Bilobectomy	66	7.0
Pneumonectomy	46	4.8
Surgical approach		
Open	485	51.0
VATS	466	49.0
Surgery in same RHA as residence		
Yes	606	63.8
No	345	36.2
Year of diagnosis		
2010	208	21.9
2011	181	19.0
2012	185	19.5
2013	195	20.5
2014	182	19.1
Year of surgery		
2010	203	21.3
2011	182	19.1
2012	186	19.6
2013	189	19.9
2014	184	19.3
2015	7	0.7

Table 5.12 Characteristics of non-small cell lung cancer (NCSLC) surgeries by year

	2010 N (%)	2011 N (%)	2012 N (%)	2013 N (%)	2014 N (%)	Total N (%)
Manitoba	208	181	185	195	182	951
Approach						
Open	148 (71.2)	110 (60.8)	86 (46.5)	73 (37.4)	68 (37.4)	485 (50.9)
VATS	60 (28.8)	71 (39.2)	99 (53.5)	122 (62.6)	114 (62.6)	466 (49.1)
Open						
Stage I	80 (54.1)	58 (52.7)	30 (34.9)	35 (48.6)	21 (30.9)	224 (46.3)
Stage II	37 (25.0)	30 (27.3)	34 (39.5)	14 (19.4)	26 (38.2)	141 (29.1)
Stage III and IV	31 (20.9)	22 (20.0)	22 (25.6)	23 (31.9)	21 (30.9)	119 (24.6)
VATS						
Stage I	44 (73.3)	52 (73.2)	72 (72.7)	91 (74.6)	83 (72.8)	342 (73.4)
Stage II	8 (13.3)	13 (18.3)	14 (14.1)	19 (15.6)	17 (14.9)	71 (15.2)
Stage III and IV	8 (13.3)	6 (8.5)	13 (13.1)	12 (9.8)	14 (12.3)	53 (11.4)

Table 5.13 Characteristics of type of surgical procedure conducted to treat non-small cell lung cancer (NCSLC), 2010-2014

Characteristic	Sublobar Resection N (%)	Lobectomy N (%)	Bilobectomy N (%)	Pneumonectomy N (%)	Total N
Manitoba	252 (26.2)	587 (62.0)	66 (7.0)	46 (4.8)	951
Stage (column %)					
Stage I	170 (67.5)	359 (61.2)	27 (40.9)	10 (21.7)	566
Stage II	34 (13.5)	145 (24.7)	19 (28.8)	14 (30.4)	212
Stage III and IV	48 (19.1)	82 (14.0)	20 (30.3)	22 (47.8)	172
Year of diagnosis (row %)					
2010	55 (26.4)	126 (60.6)	15 (7.2)	12 (5.8)	208
2011	53 (29.3)	107 (59.1)	13 (7.2)	8 (4.4)	181
2012	46 (24.9)	115 (62.2)	13 (7.0)	11 (5.9)	185
2013	49 (25.1)	125 (64.1)	13 (6.7)	8 (4.1)	195
2014	49 (26.9)	114 (62.6)	12 (6.6)	7 (3.8)	182
Approach (column %)					
Open	127 (50.4)	269 (45.8)	44 (66.7)	46 (100.0)	486
VATS	125 (49.6)	318 (54.2)	22 (33.3)	0 (0.0)	465

Unknown stage is not shown in table.

Table 5.14 Length of stay for non-small cell lung cancer (NSCLC) cases that had a surgery with curative intent within one year of diagnosis as measured by median number of days, 90th percentile in days, and percentage that have a hospital stay over 14 days long, 2010-2014

Characteristic	Median	90th Percentile	Stay >14 days N (%)
Manitoba	4	10	43 (4.6)
Type of surgery			
Sublobar resection	4	9	- (3.6)
Lobectomy	4	10	- (5.2)
Bilobectomy	4	10	- (1.6)
Pneumonectomy	5	13	- (6.7)
Approach			
Open	5	11	27 (5.7)
VATS	3	8	16 (3.5)
Diagnosis year			
2010	4	10	- (5.5)
2011	4	10	- (4.5)
2012	4	8	- (2.7)
2013	4	11	- (5.7)
2014	4	10	- (4.5)

Cells suppressed due to small N

Table 5.15 Length of stay for Manitobans diagnosed with non-small cell lung cancer (NSCLC) that had a surgery with curative intent within one year of diagnosis as measured by median number of days, 90th percentile in days, and percentage that have a hospital stay over 14 days long by approach, type of surgery, and year, 2010-2014

(a) Open approach

	2010	2011	2012	2013	2014
Median	4	4	4	6	6
90th percentile	11	12	10	13	13
Sublobar resection					
Median	5	4	4	5.5	6.5
90th percentile	9	10	9	20	9
Lobectomy					
Median	4	4	4	6.5	6
90th percentile	8	10	10	17	14.5
Bilobectomy					
Median	6	3.5	4.5	5	6
90th percentile	18	9	11	8	10
Pneumonectomy					
Median	4.5	6	5	5.5	5
90th percentile	37.5	25	8	9	19

(b) VATS approach

	2010	2011	2012	2013	2014
Median	4	3	3	3	4
90th percentile	7	9	6	8	8
Sublobar resection					
Median	3	3	3	3	3
90th percentile	11	9	6	8	7
Lobectomy					
Median	4	3	3.5	3	4
90th percentile	6	9	6	8	8
Bilobectomy					
Median	3.5	3	3	4.5	4
90th percentile	4	6	3	11	10

Table 5.16 Percentage of hospital readmissions for cases of non-small cell lung cancer (NSCLC) cases that were treated with a surgery with curative intent within one year of diagnosis, 2010-2014

	Had Surgery	
	Number	% of Total Cases
Number of cases with at least one readmission		
Within 30 days	70	7.4
Within 31-60 days	56	5.9
Within 1-60 days	126	13.3
Total number of readmissions		
Within 30 days	82	n/a
Within 31-60 days	66	n/a
Within 1-60 days	148	n/a

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CHAPTER 6. OVARIAN CANCER

Key Findings

- The majority of women with ovarian cancer (91.7%) had surgery. The percentage of women who had surgery varied from 100% for stage I cases to 81.8% for stage IV cases.
- Most women (88.3%) received their first ovarian cancer surgery from a gynecologic oncologist. Current guidelines recommend that all women with ovarian cancer have their surgery conducted by a gynecologic oncologist.[1,2]
- One-quarter (25.7%) of women who had surgery for ovarian cancer had at least one post-operative complication. Complications included minor and major issues.
- Nearly all surgeries (97%) were conducted in the Winnipeg Regional Health Authority (WRHA).

Recommendations

A community of practice (CoP) model was used to engage in knowledge mobilization efforts. A CoP is defined as a group of individuals that share a common goal of gaining knowledge related to a specific field. Collective learning is achieved through the sharing of information and experiences.[3] Results from this report were shared with an ovarian community of practice which consisted of surgeons practicing in the Winnipeg Regional Health Authority. The community of practice developed a recommendation to further understand and address the results in this report. The recommendation is listed below.

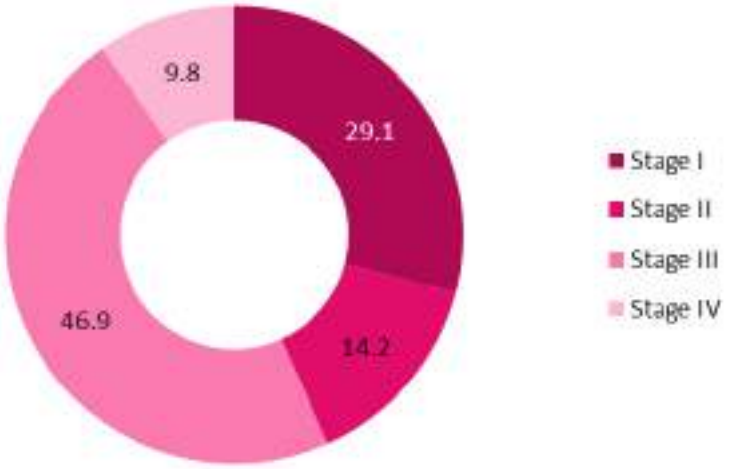
- Guidelines recommend that ovarian cancer surgical procedures should be conducted by a gynecologic oncologist. Almost 12 percent of ovarian cancer surgeries are being conducted by non- gynecologic oncologists.

  Recommendation (1): Provide educational opportunities throughout the province to educate family physicians, general surgeons, radiologists etc. about when to refer patients to a gynecologic oncologist.

Ovarian Cancer in Manitoba

Between 2010 and 2014, 404 ovarian cancer cases were diagnosed among Manitoba women. For this report, ovarian cancer includes cancers that originated in the ovary, peritoneum, fallopian tube, broad and round ligaments, and uterine adnexa. These sites were included because research suggests cancers in these areas develop from precursor lesions with similar origins, are treated the same, and are often included in ovarian cancer clinical trials.[4]

Figure 6.1 Stage distribution of ovarian cancer in Manitoba, 2010-2014



The age-standardized incidence rate for ovarian cancer in Manitoba during the study period was 16.8 per 100,000 women (Table 6.2) which was slightly higher than the 2010 Canadian rate of 14.4 per 100,000.[5] Incidence was the highest amongst women 50-59 years of age (4.8 per 100,000) (Table 6.2). The highest age-standardized rate by stage was 7.6 per 100,000 women for stage III (Table 6.2). The age-standardized rates by stage in Manitoba were similar to other provinces when comparing to 2011-2015 data.[6] In Manitoba, 56.7% of cases were diagnosed at stage III or IV (Figure 6.1), and 52% were histologically classified as serous carcinomas (Table 6.2).

Additional information about the epidemiology of ovarian cancer in Manitoba can be found in Table 6.2 at the end of this chapter.

Description of Surgical Procedures Used to Treat Ovarian Cancer

Ovarian cancer surgeries have two primary purposes: to remove all traces of cancer and to provide information about cancer stage. Depending on the extent of disease, one or more organs and/or various tissues may be removed. Examples of routinely performed procedures are described below.

Oophorectomy & Salpingo-oophorectomy
An oophorectomy is the surgical removal of an ovary. A unilateral salpingo-oophorectomy (USO) or bilateral salpingo-oophorectomy (BSO) is the removal of the fallopian tube and ovary. These procedures may be unilateral or bilateral and be performed in combination with a hysterectomy and/or omentectomy. When an oophorectomy is unilateral without the removal of any other reproductive organs, it is considered to be a fertility sparing surgery. A unilateral oophorectomy or unilateral salpingo-oophorectomy is typically conducted if the cancer is an ovarian germ cell (i.e. reproductive cell) or stromal (i.e. connective tissue cell) tumor that has not spread, and the patient is a young woman who would like to maintain fertility.

Omentectomy
An omentectomy is a procedure that removes all or part of the omentum (the thin layer of tissues that envelopes abdominal organs including the intestines and stomach). Removal may be indicated if the cancer has spread to the omentum or as a routine part of a staging procedure.

Hysterectomy
A hysterectomy removes the entire uterus. There are three main types of hysterectomy: (1) subtotal or supracervical, which removes the uterus but leaves the cervix, (2) total, which removes the uterus and cervix, and (3) radical, which removes the uterus, cervix, parametria (tissue around the cervix), and top part of the vagina. A hysterectomy may or may not be completed in conjunction with a salpingo-oophorectomy.

Debulking
Debulking is a procedure that removes all visible cancer in the abdomen. Optimal debulking is achieved when no visible tumour remains. Debulking may include the removal of one or more non-reproductive organs or tissues such as the colon, bowel, stomach, liver, pancreas, spleen, ureters, or bladder.

Descriptive Indicators

Ovarian cancer surgery

Indicator definition
Percentage of women diagnosed with ovarian cancer that had surgery within one year of diagnosis.

Why is this important to know?
Surgical resection, frequently combined with chemotherapy, is the only treatment modality that has the potential to cure ovarian cancer. Therefore, a high percentage of women with ovarian cancer receive surgery. This indicator, however, does not measure appropriateness of treatment. Personal preference and overall health also impact whether or not a woman receives surgery.

Take away message
- 91.7% of women diagnosed with ovarian cancer received surgery within one year of diagnosis (Figure 6.2).
- The percentage of women who had surgery for ovarian cancer decreased as age increased; from 100% of women 20-39 years of age, to 66.7% of women 80 years of age and older (Figure 6.3).

Figure 6.2 Percentage of women diagnosed with ovarian cancer treated with surgery, 2010-2014

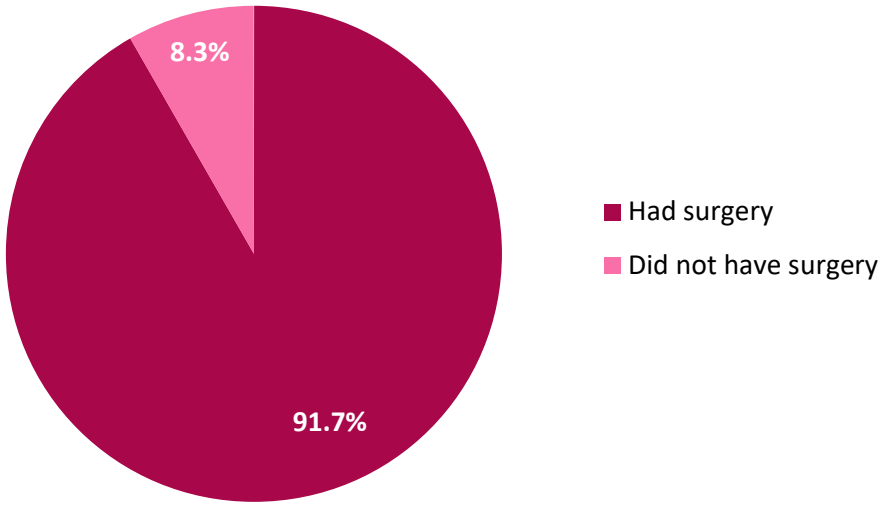
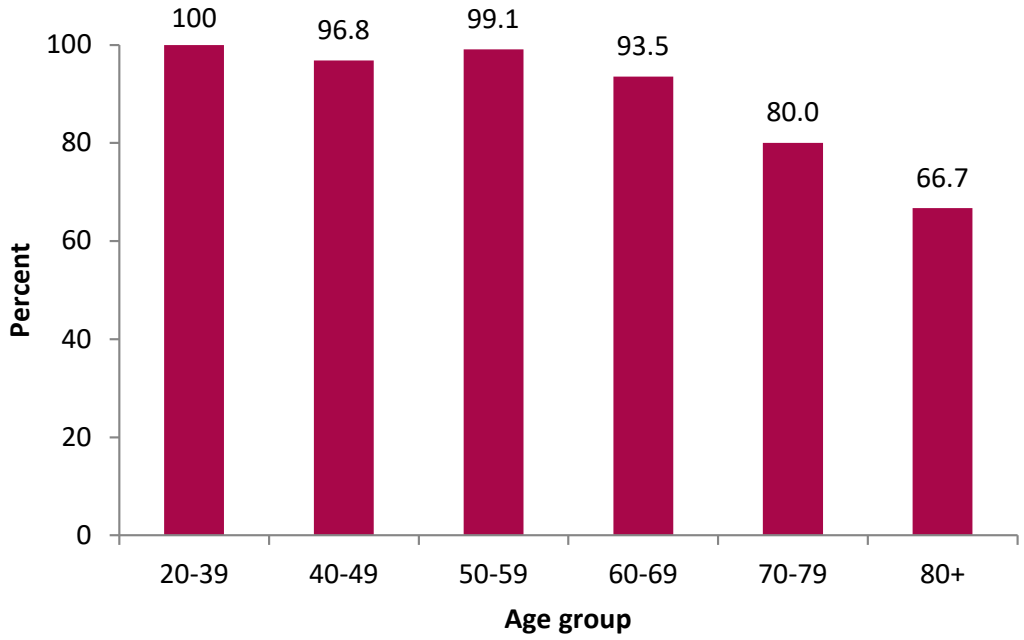


Figure 6.3 Percentage of women diagnosed with ovarian cancer who had surgery by age group, 2010-2014



What does the data tell us?

The majority of women diagnosed with ovarian cancer in Manitoba during the study period received surgery, although the percentage decreased with increasing age (Figure 6.3). This is similar to the results of other studies whose authors suggest that older women may be at increased risk of receiving inadequate surgical treatment.[7] Compared to other provinces between 2010 and 2012, Manitoba had the highest rate of surgery (91.7%), though inter-provincial differences were small.[8] In England between 2013 and 2014, 64.1% of all women with ovarian cancer received surgery within 9 months of their diagnosis.[9] The percentage of women who received surgery in England also differed by their stage at diagnosis (England: stage I - 95.4% vs stage IV - 32.2% / Manitoba: stage I – 100% vs stage IV - 81.8%).[9]

Additional information about this indicator, including stratification by stage, grade, morphology, and regional health authority can be found in Tables 6.3 and 6.4 at the end of this chapter.

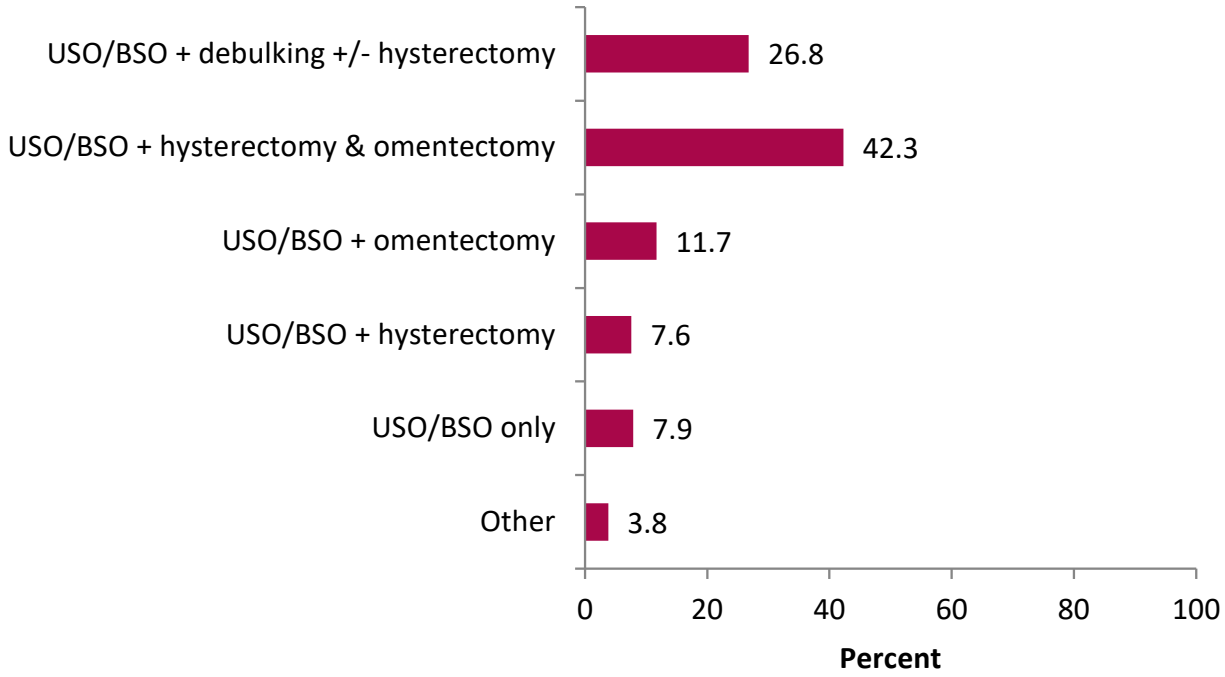
Surgical procedure

Indicator definition
Type of surgical procedure used to treat ovarian cancer cases within one year of diagnosis.

Why is this important to know?
This indicator provides information about the types of surgical procedures used to treat ovarian cancer in Manitoba. Procedures ranged from a simple USO to a complex procedure involving the removal of multiple organs (e.g. ovary, uterus, fallopian tubes, a portion of the intestines, etc.) and debulking.

Take away message
- The most common surgical procedure in Manitoba for ovarian cancer was a salpingo-oophorectomy with hysterectomy and omentectomy (42.3%) (Figure 6.4).
- 26.8% of women had an additional debulking procedure conducted during their surgery that varied by stage (Table 6.6).

Figure 6.4 Percentage of women treated with surgery for ovarian cancer by type of surgical procedures received



What does the data tell us?
The majority of ovarian cancer surgeries performed in Manitoba were not fertility conserving (i.e., more than one ovary and fallopian tube were removed). A salpingo-oophorectomy without any other procedure accounted for less than 8% of cases during the study period (Figure 6.4). Most women who received surgery in Manitoba had extensive surgery to remove ovarian cancer. The most common surgical procedure combination was a salpingo-oophorectomy with hysterectomy and omentectomy (42.3%), followed by a salpingo-oophorectomy with hysterectomy and debulking (26.8%) (Figure 6.4).

Additional information about the type of procedures performed can be found in Table 6.6 at the end of this chapter.

Length of post-operative hospital-stay (LOS)

Indicator definition

Median number of days and 90th percentile between surgery date and hospital discharge date for women diagnosed with ovarian cancer that underwent surgery within one year of diagnosis.

Why is this important to know?

LOS is related to many factors including type of procedure, pre-existing co-morbidities, and number and severity of post-operative complications. Shorter hospital stays - when appropriate - may have a positive impact on patient well-being and also have the potential to reduce costs to the healthcare system.

Take away message

- The median LOS was 4 days and ranged from 3 to 6 days depending on the type of procedure(s) performed (Table 6.1).
- The longest median LOS (6 days) occurred for procedures that included debulking (Table 6.1).
- 90% of women were discharged from hospital within 12 days.

Table 6.1 Post-operative length of stay for women who had surgery for ovarian cancer, 2010 to 2014 by surgical procedure

Procedure	Median LOS (days)	90th Percentile (days)
USO/BSO only	4	13
USO/BSO with hysterectomy	3	10
USO/BSO with omentectomy	5	14
USO/BSO with omentectomy and hysterectomy	4	11
USO/BSO +/- hysterectomy with debulking	6	13

What does the data tell us?

The median LOS for women diagnosed with ovarian cancer between 2010 and 2014 was similar to other provinces who have reported hospital stays ranging between 3 and 5 days.[8] Given that there is almost no variation between provinces, it is likely that the LOS in Manitoba during the study period was appropriate.

Additional information about the LOS can be found at the end of this chapter in Table 6.7.

Diagnosis and surgery in the same regional health authority in which they lived

Indicator definition

Percentage of Manitoba women diagnosed with ovarian cancer that had their surgery within one year of diagnosis in the same RHA in which they lived at diagnosis. This indicator only looks at the location of a woman's first surgery.

Why is this important to know?

This indicator provides information about where women had surgery. The primary factor influencing where women with ovarian cancer receive their surgery is where gynecological oncologists practice. However, patient preference may also influence where a patient receives her surgical cancer treatment.

Take away message

- 100% of women with stage IV cancers (Figure 6.5) and 100% of women ages 20-39 (Table 6.5) received their first surgery in the WRHA. Among all other women, a high percentage received surgery in the WRHA (stage I – 95.6%, stage II – 96.3%, stage III – 97.6%) (Figure 6.5).
- Between 63.7% (stage I) and 71.4% (stage IV) of women received their first surgical treatment in the same RHA in which they lived (Figure 6.6).

Figure 6.5 Percentage of women diagnosed with ovarian cancer who received surgery, by stage, 2010-2014

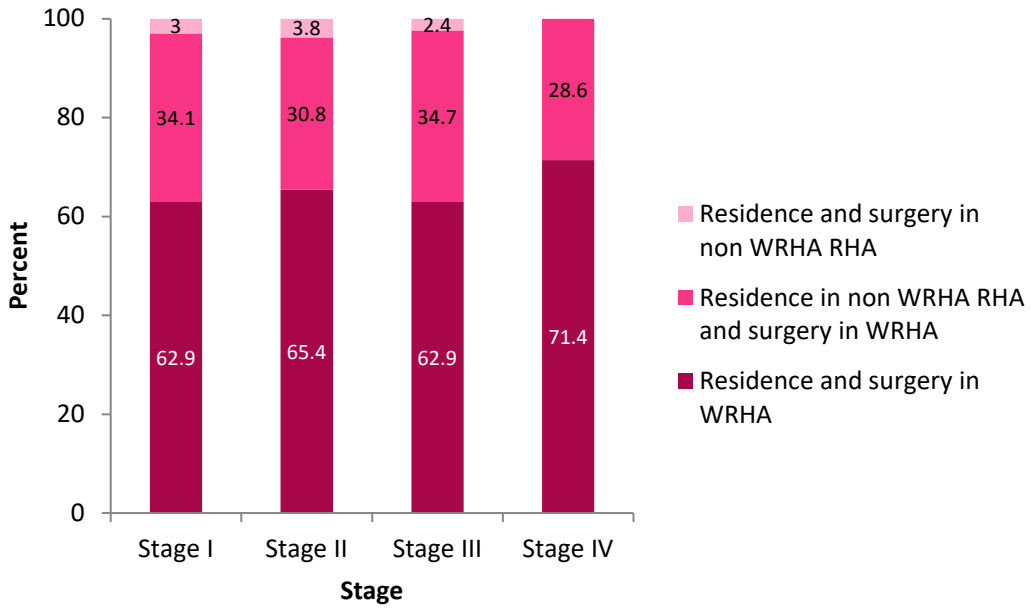
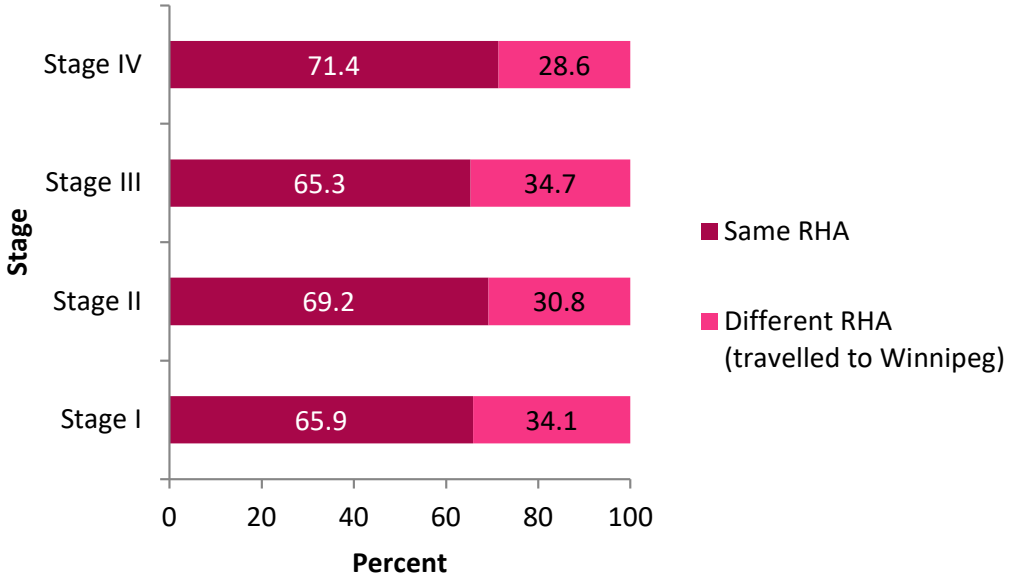


Figure 6.6 Percentage of women diagnosed with ovarian cancer who received surgery in the same RHA of residence, by stage, 2010-2014



What does the data tell us?

One-third to one-quarter of women who did not live in Winnipeg travelled to the WRHA for their first surgery (Figure 6.5). Although traveling to a different RHA can be costly and less convenient for the woman and those who provide support, the way that services are regionalized in Manitoba often necessitate it. Current guidelines recommend that women receive ovarian cancer surgery from gynecological oncology surgeons who are located in Winnipeg, Manitoba. Therefore, the 2.4-4.4% (Figure 6.5) of women who received surgical treatment in an RHA other than the WRHA may not have received care according to recommended guidelines.

Additional information about this indicator can be found in Table 6.5 at the end of this chapter.

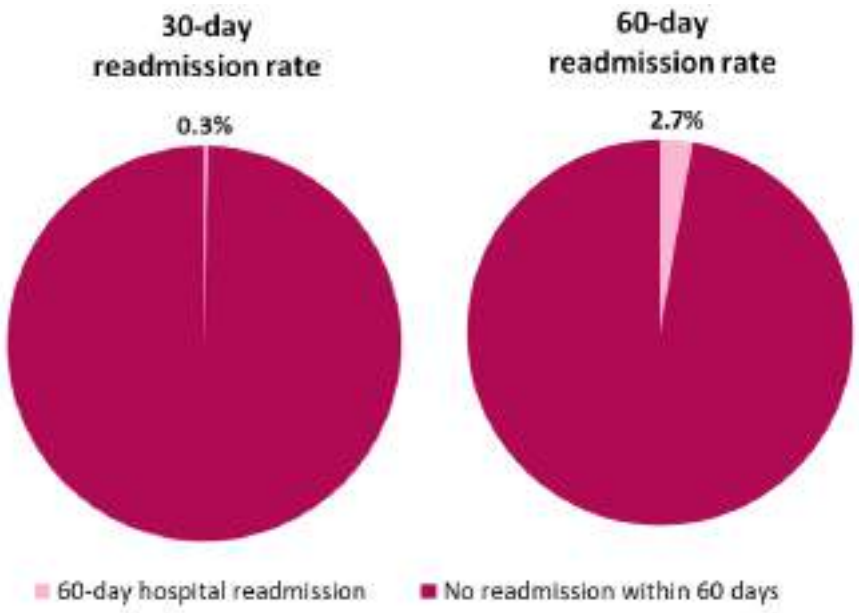
Hospital readmissions

Indicator definition
Percentage of women diagnosed with ovarian cancer that had a surgical resection within one year of diagnosis and were readmitted to the hospital within 30 or 60 days after surgery.

Why is this important to know?
Hospital readmissions are related to post-operative complications. Reducing readmissions is better for patients and may also reduce costs to the healthcare system. Hospital readmissions are a widely used, yet controversial, indicator of quality. This measure is sometimes considered controversial because factors that affect readmission, such as pre-existing conditions, are not easily controlled for during analysis. This measure is unadjusted for readmission due to complications from adjuvant chemotherapy or pre-existing conditions. Note that this indicator does not assess the appropriateness of readmission.

Take away message
- 30- and 60-day readmission rates were very low in Manitoba during the study period (Table 6.7).

Figure 6.7 Percentage of women readmitted to the hospital 30 or 60 days after first surgery, 2010-2014



What does the data tell us?
Readmission rates among women diagnosed with ovarian cancer between 2010 and 2014 who had a surgery within one year of diagnosis were low (Figure 6.7). Research has shown that readmissions are lowest amongst high-volumes of gynecologic oncologists and in high-volume surgical centers. [10, 11] In Manitoba, approximately 88% of ovarian cancer surgeries were performed by a small group of gynecologic oncologists at two high-volume surgical centres. This may partially explain the low readmission rates.

Quality Performance Indicators

Hospital readmissions

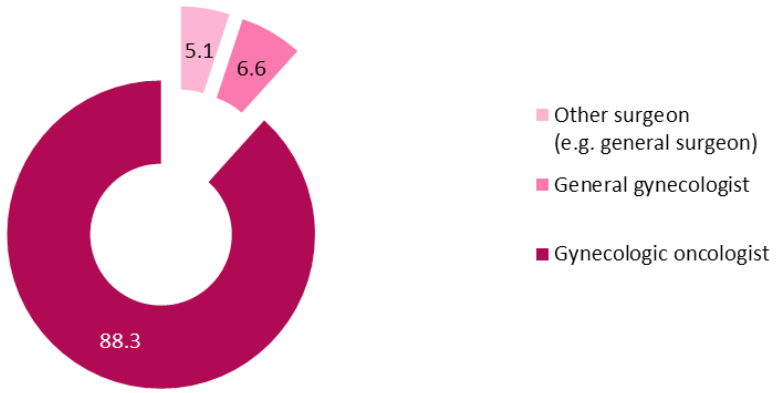
Indicator definition
Percentage of ovarian cancer cases treated with surgery within one year of diagnosis whose surgeries were conducted by a gynecologic oncologist.

Why is this important to know?
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.[12, 13] Several guidelines recommend that definitive surgical procedures should be conducted by a gynecological oncologist,[1, 2] and that ovarian cancer surgical procedures are "not within the domain of general surgery".[2]

Interpretation of results
A high value for this indicator can be interpreted as a favorable result. 100% of surgeries for ovarian cancer should be performed by a gynecological-oncologist.

Take away message
- 88.3% of women with ovarian cancer who had surgery within one year of diagnosis received their first ovarian cancer surgery from a gynecologic oncologist (Figure 6.8). Therefore, 11.7% of women may not have received optimal ovarian cancer surgery care.

Figure 6.8 Percent of first ovarian cancer surgeries by specialty, 2010-2014



What does the data tell us?
88.3% of cases diagnosed with ovarian cancer between 2010 and 2014 who received surgery had their first surgical procedure(s) conducted by a gynecological oncologist (Figure 6.8). In addition, 6.6% (43 women) and 5.1% (n = 19) of women had their first surgery conducted by a general surgeon or general gynecologist, respectively (Figure 6.8). 55.8% of women who did not have their first surgery conducted by a gynecologic oncologist lived outside of the WRHA. Twenty-two of the 43 women (48.8%) whose surgeon was not a gynecologic oncologist were diagnosed at stage I and IV cancer and 32.6% were diagnosed at stage III. These women may have opted to have surgery closer to home or a diagnosis of cancer was not suspected at the time of surgery. Of the 43 women who received their first surgical procedure by a non-gynecologic oncologist surgeon, 7 (16.4%) received a second, more extensive procedure by a gynecologic oncologist (Table 6.10).

In-hospital post-operative complications

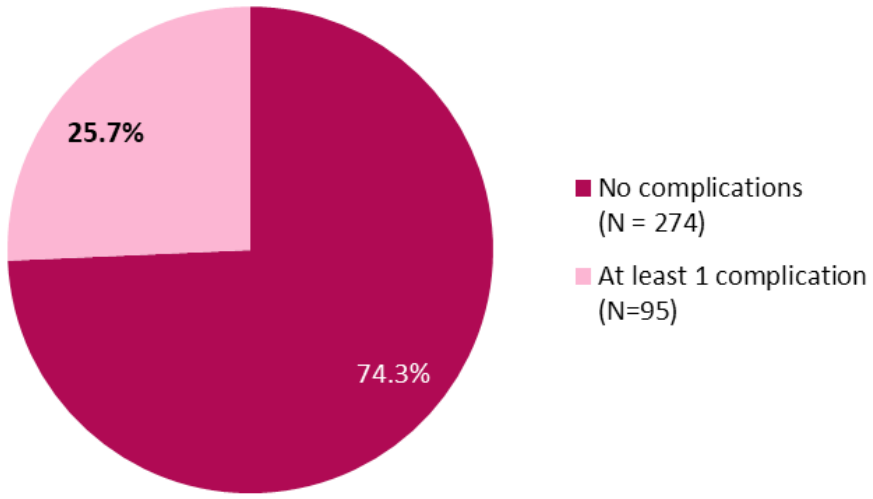
Indicator definition
Percentage of ovarian cancer cases that had surgery within one year of diagnosis and had at least one documented in-hospital post-operative complication.

Why is this important to know?
Post-operative complications such as abdominal organ injury, venous thromboembolism, and infection may impact patient recovery, quality of life, and length of hospital stay.[14]

Interpretation of results
A low value for this indicator can be interpreted as a favorable result.

Take away message
- 25.7% of women had at least one documented post-operative complication after ovarian cancer surgery (Figure 6.9).

Figure 6.9 Percentage of women who had at least one documented in-hospital complication, 2010-2014



What does the data tell us?
25.7% of women experienced at least one complication during ovarian cancer surgery or their hospital stay (Figure 6.9). Since information about the severity of the complication was not available, the impact of the complication on quality of life and cost to the health care system cannot be determined. In the United States, data from the National Surgical Quality Improvement Program (NSQIP) database reported that 14.6% of women diagnosed with ovarian cancer between 2005 and 2012 had a post-operative complication.[15] NSQIP hospitals often have very favorable results because they actively participate in performance measurement which is known to improve the quality of care.

Additional indicator calculation information
This indicator comprises complications that were documented in the hospital record which includes those that resolved without further treatment. Therefore, these results may underestimate the total number of complications that occurred after surgery. We were also unable to assess the severity of complications or the effect of pre-existing co-morbidities on the development of post-operative complications.

Table 6.2 Percentage and age-standardized incidence rates of ovarian cancer cases, by cohort characteristics, 2010-2014

Characteristic	Ovarian Cancer Cohort		Age-Standardized Incidence Rate per 100,000 (95% CI)
	N	% Manitoba (95% CI)	
Manitoba	404	100.0	16.8 (15.2,18.5)
Age group			
20-39	19	4.7 (2.6,6.8)	0.8 (0.5,1.2)
40-49	63	15.6 (12.0,19.1)	2.7 (2.1,3.5)
50-59	114	28.2 (23.8,32.6)	4.8 (3.9,5.6)
60-69	107	26.5 (22.2,30.8)	4.4 (3.5,5.2)
70-79	65	16.1 (12.5,19.7)	2.7 (2.1,3.4)
80+	36	8.9 (6.1,11.7)	1.5 (1.1,2.1)
Income quintile (urban)			
U1 (lowest)	46	11.7 (8.5,14.9)	16.6 (12.1,22.3)
U2	43	11.0 (7.9,14.1)	15.2 (11.0,20.4)
U3	49	12.5 (9.2,15.8)	16.6 (12.2,21.9)
U4	66	16.8 (13.1,20.6)	22.2 (17.1,28.3)
U5 (highest)	57	14.5 (11.0,18.0)	18.4 (13.9,24.0)
Income quintile (rural)			
R1 (lowest)	21	5.4 (3.1,7.6)	14.5 (9.0,22.2)
R2	17	4.3 (2.3,6.4)	9.6 (5.6,15.3)
R3	27	6.9 (4.4,9.4)	14.7 (9.7,21.4)
R4	30	7.7 (5.0,10.3)	16.6 (11.2,23.8)
R5 (highest)	36	9.2 (6.3,12.1)	20.1 (13.8,28.3)
RHA of residence at diagnosis			
WRHA	253	62.6 (57.9,67.4)	18.0 (15.8,20.2)
PMH	51	12.6 (9.4,15.9)	15.0 (11.1,19.8)
SH-SS	40	9.9 (7.0,12.8)	13.1 (9.3,17.8)
IERHA	51	12.6 (9.4,15.9)	20.0 (14.8,26.3)
NHA	9	2.2 (0.8,3.7)	9.1 (4.0,17.5)
Stage			
Stage I	113	29.1 (24.6,33.7)	4.7 (3.9,5.6)
Stage II	55	14.2 (10.7,17.7)	2.3 (1.7,3.0)
Stage III	182	46.9 (41.9,51.9)	7.6 (6.5,8.7)
Stage IV	38	9.8 (6.8,12.8)	1.6 (1.1,2.2)
Grade			
Low	319	79.0 (75.0,83.0)	13.3 (11.8,14.8)
High	85	21.0 (17.0,25.0)	3.5 (2.8,4.4)
Histology			
Serous carcinoma	210	52.0 (47.1,56.9)	8.7 (7.6,9.9)
Muscinous carcinoma	25	6.2 (3.8,8.5)	1.1 (0.7,1.5)
Endometriosis associated	69	17.1 (13.4,20.8)	2.9 (2.2,3.7)
Malignant mixed mullerian	15	3.7 (1.9,5.6)	0.6 (0.4,1.0)
Other/unspecified	85	21.0 (17.0,25.0)	3.5 (2.8,4.4)

Table 6.3 Percent of ovarian cancer cases that had surgery within one year of diagnosis, by cohort characteristics, 2010-2014

Characteristic	Had Surgery	
	N	% Total (95% CI)
Manitoba	369	91.7 (86.6,96.8)
Age group		
20-39	19	100.0 (82.4,100.0)
40-49	61	96.8 (92.5,100.0)
50-59	113	99.1 (97.4,100.0)
60-69	100	93.5 (88.8,98.2)
70-79	52	80.0 (70.2,89.8)
80+	24	66.7 (51.2,82.1)
Income quintile (urban)		
U1 (Lowest)	40	86.1 (72.5,99.8)
U2	39	94.8 (88.5,100.0)
U3	47	98.6 (96.6,100.0)
U4	62	93.7 (87.3,100.0)
U5 (Highest)	55	98.7 (96.9,100.0)
Income quintile (rural)		
R1 (Lowest)	19	95.8 (90.0,100.0)
R2	13	79.8 (59.6,100.0)
R3	24	69.1 (32.0,100.0)
R4	27	96.0 (91.3,100.0)
R5 (Highest)	33	96.9 (93.4,100.0)
RHA of residence at diagnosis		
WRHA	233	93.8 (90.1,97.5)
PMH	45	89.9 (81.2,98.5)
SH-SS	37	77.8 (45.1,100.0)
IERHA	46	96.1 (92.5,99.7)
NHA	8	94.5 (83.7,100.0)
Stage		
Stage I	113	100.0 (96.7,100.0)
Stage II	52	98.3 (96.3,100.0)
Stage III	167	93.5 (88.4,98.7)
Stage IV	28	81.8 (69.4,94.3)
Grade		
Low	287	90.2 (83.9,96.5)
High	82	97.7 (94.5,100.0)
Histology		
Serous carcinoma	202	92.0 (83.4,100.0)
Muscinous carcinoma	25	100.0 (86.1,100.0)
Endometriosis associated	69	100.0 (94.5,100.0)
Malignant mixed mullerian	15	100.0 (77.2,100.0)
Other/unspecified	58	79.2 (69.6,88.8)

**row percent*

Table 6.4 Percentage of women diagnosed with ovarian cancer that received a surgery within one year of diagnosis, by histology and grade, 2010-2014

Characteristic	High Grade	Low Grade	Total
Manitoba	287 (77.8)	82 (22.2)	369 (100)
Histology			
Serous carcinoma	171 (84.7)	31 (15.3)	202 (100)
Mucinous carcinoma	12 (48.0)	13 (52.0)	25 (100)
Endometriosis associated	46 (66.7)	23 (33.3)	69 (100)
Malignant mixed mullerian* and other/unspecified	58 (79.5)	15 (20.5)	73 (100)

**Due to a small number of cases when stratified by grade, malignant mixed mullerian tumours were combined with the other/unspecified group for this table.*

Table 6.5 Percentage of women diagnosed with ovarian cancer who received surgery within one year of diagnosis, by residence and location of surgery, 2010-2014

Characteristic	Residence and Surgery in WRHA (%)	Residence in Rural RHA, Surgery in WRHA (%)	Residence and Surgery in Rural RHA (%)
Manitoba	62.9	34.1	3.0
Age group			
20-39	63.2	36.8	0.0
40-49	68.9	27.9	3.3
50-59	54.9	40.7	4.4
60-69	64.0	35.0	1.0
70-79	71.2	26.9	1.9
80+	62.5	29.2	8.3
Stage			
Stage I	59.3	36.3	4.4
Stage II	65.4	30.8	3.8
Stage III	62.9	34.7	2.4
Stage IV	71.4	28.6	0.0

Table 6.6 Type of surgical procedures conducted to treat women diagnosed with ovarian cancer within one year of their diagnosis, 2010-2014

Characteristic	Proportion of Procedures (%; n = 369)					
	USO/BSO only	USO/BSO + Hysterectomy	USO/BSO + Omentectomy	USO/BSO + Hysterectomy & Omentectomy	USO/BSO + Debulking +/- Hysterectomy	Other*
Manitoba	7.9	7.6	11.7	42.3	26.8	3.8
Age group						
20-49	11.3	15.0	11.3	36.3	26.3	0.0
50-59	7.1	7.1	8.8	42.5	33.6	0.9
60-69	6.0	4.0	10.0	46.0	27.0	7.0
70+	7.9	5.3	18.4	43.4	17.1	7.9
Stage						
Stage I	13.3	19.5	4.4	31.9	30.1	0.9
Stage II	9.6	7.7	17.3	46.2	17.3	1.9
Stage III	4.8	1.2	14.4	44.3	28.7	6.6
Stage IV	0.0	0.0	14.3	60.7	21.4	3.6

**Other includes various combinations of surgical procedures not listed above.*
USO = Unilateral salpingo-oophorectomy, BSO = Bilateral salpingo-oophorectomy

Table 6.7 Length of stay for women diagnosed with ovarian cancer who had surgery within one year of diagnosis, 2010-2014

	Median (days)	90th Percentile (days)
Manitoba	4	12
Procedure		
USO/BSO only	4	13
USO/BSO with hysterectomy	3	10
USO/BSO with omentectomy	5	14
USO/BSO with omentectomy and hysterectomy	4	11
USO/BSO +/- hysterectomy with debulking	6	13
Other	5	12

Table 6.8 Number of in-hospital post-operative complications experienced by women diagnosed with ovarian cancer who had surgery within one year of diagnosis, 2010-2014

Complication status	N	%
No complications	274	74.3
At least 1 complication	95	25.7

Table 6.9 Percentage of hospital readmissions amongst women diagnosed with ovarian cancer that were treated with a surgery within one year of diagnosis, 2010-2014

Number of Days	Percent
30-day hospital readmission	0.3
60-day hospital readmission	2.7

Table 6.10 Percentage of women who were diagnosed with ovarian cancer by type of surgeon who performed their surgery, 2010-2014

Type of surgeon who conducted the first surgery	Total	Percent
Other type of surgeon (includes general surgeon)	19	5.1
General gynecologist	24	6.6
Gynecologic oncologist	323	88.3
Women who have a second surgery (among women who had their first surgery conducted by a non-gynecological oncologist)		
Gynecologic-oncologist	7	16.3

Note: Women who did not have a corresponding surgery recorded in the medical claims file were excluded because we were unable to obtain information about the type of surgeon who conducted the surgery.

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CHAPTER 7. PROSTATE CANCER

Key Findings

- One-quarter of men (24.6%) had a radical prostatectomy within one year of diagnosis. The percentage of men who received surgery varied by stage from 2.3% for stage I to 84.5% for stage III.
- Some men opt not to have immediate surgery but choose watchful waiting or surveillance. Some, however, will have surgery at a later point in time. Of all men diagnosed with prostate cancer, 3.2% had a radical prostatectomy more than one year after diagnosis.
- The median number of lymph nodes removed and examined during radical prostatectomy was 5. Although there is no nationally accepted benchmark, this number is similar to studies from the United States.[1, 2]
- The median length of stay in hospital for radical prostatectomy was 5 days. This is higher than the recently reported Canadian average of 3 days[3], which may be related to higher rates of laparoscopic surgery in other provinces.

Recommendations

A community of practice (CoP) model was used to engage in knowledge mobilization efforts. A CoP is defined as a group of individuals that share a common goal of gaining knowledge related to a specific field. Collective learning is achieved through the sharing of information and experiences.[4] Results from this report were shared with a prostate community of practice which consisted of surgeons and senior administration. The community of practice developed a recommendation to further understand and address the results in this report. The recommendation is listed below.

Prostate Cancer Surgery

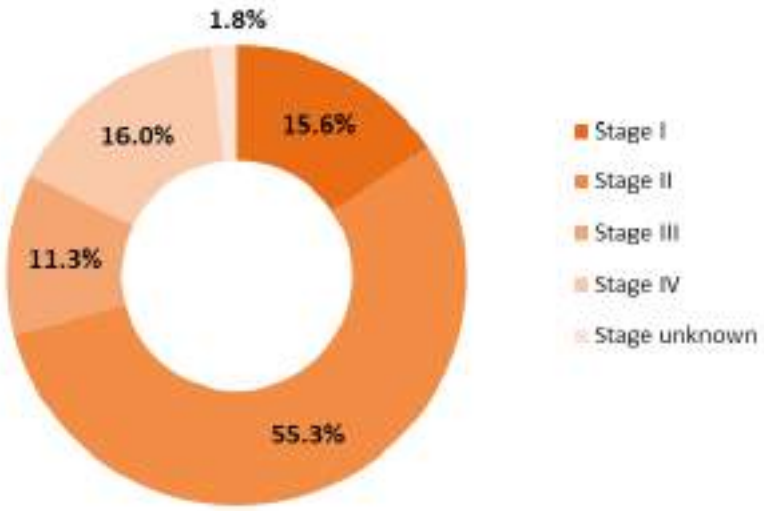
- Pelvic Lymphadenectomy is used in staging prostate cancer. However, there is a lack of consensus in the medical community on the ideal number of lymph nodes that should be removed. A very low number of nodes may result in inadequate staging and a very high number may result in unnecessary morbidity.

  Recommendation (1): Facilitate a discussion among Manitoba Urologists to determine the optimum number of nodes that should be removed for adequate staging purposes.

Prostate Cancer in Manitoba

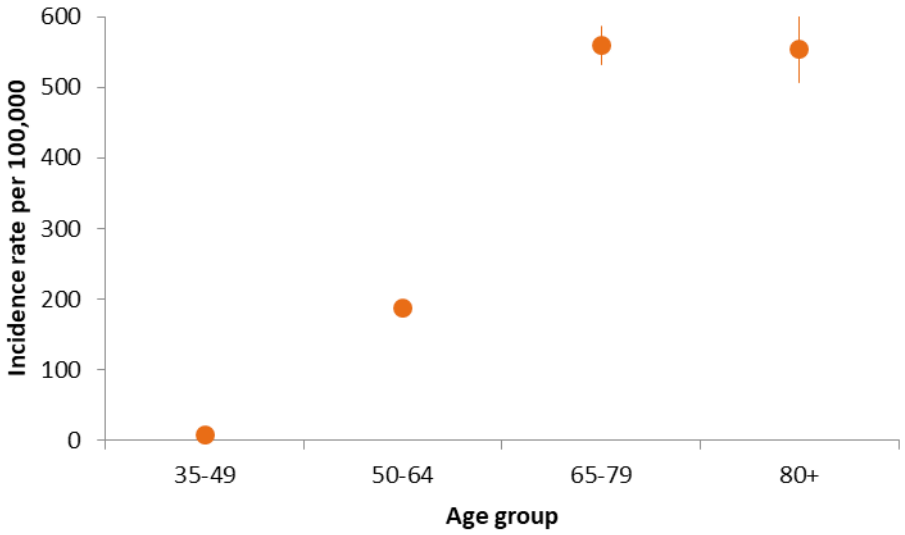
There were 3,399 cases of prostate cancer diagnosed in Manitoba men between January 1, 2010 and December 31, 2014. The age-standardized incidence rate was 203.6 per 100,000 men (Table 7.2).

Figure 7.1 Stage distribution of prostate cancer in Manitoba, 2010-2014



About half of men diagnosed with prostate cancer were between 65 and 79 years of age (49.1%) (Table 7.2); incidence rates among each of four age groups are depicted in Figure 7.2.
A majority of men had a Gleason score between 7 and 10 at diagnosis (70.5%) (Table 7.2). During the study period, 55.3% of prostate cancers were diagnosed at stage II (Figure 7.1).

Figure 7.2 Age-specific incidence rate of prostate cancer, 2010-2014



Additional information about the epidemiology of prostate cancer in Manitoba can be found in Table 7.2 at the end of this chapter.

Description of Surgical Procedures Used to Treat Prostate Cancer

Radical prostatectomy

A radical prostatectomy removes the tumour along with the entire prostate gland. This procedure can be conducted laparoscopically or using an open approach where an incision is made in the lower abdomen. Robotic-assisted laparoscopic radical prostatectomy is not currently available in Manitoba but is performed in some provinces. Radical prostatectomy has a curative intent and is the most common prostate cancer surgery procedure.

Transurethral resection of the prostate (TURP)

TURP removes a portion of the prostate gland and is typically conducted to reduce or alleviate symptoms of prostate cancer. This surgery is not considered curative and is not frequently conducted.

Pelvic lymph node dissection (PLND)

PLND is usually conducted at the same time as a radical prostatectomy. PLND is generally conducted for moderate or high risk individuals who are at greater risk of the cancer spreading to the lymph nodes.

Descriptive Indicators

Prostate cancer surgery

Indicator definition

(a) Number and percentage of prostate cancer cases that underwent radical prostatectomy within one year of diagnosis
(b) Number and percentage of prostate cancer cases that underwent radical prostatectomy after one year of diagnosis

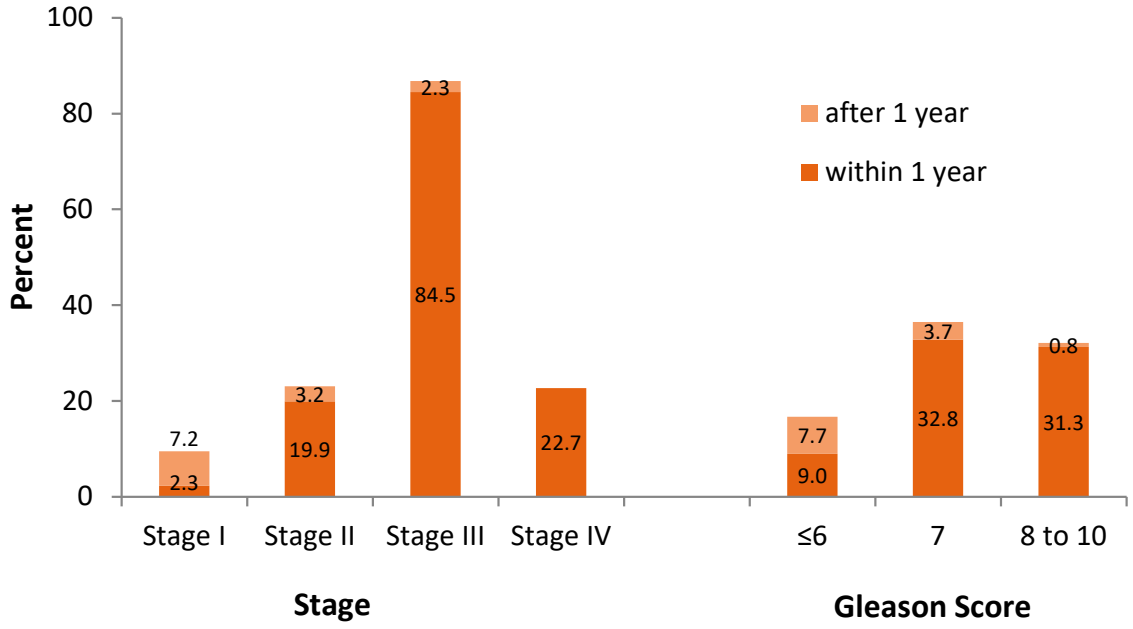
Why is this important to know?

The surgical removal of the prostate gland and tumour has the potential to cure prostate cancer but may also include substantial side-effects such as urinary incontinence and impotence. Therefore, several factors are included in the decision to surgically remove the prostate including age at diagnosis, prostate-specific antigen (PSA) and Gleason score, stage, overall health, presence of pre-existing co-morbidities, potential impact on quality of life, and patient preference.[5] Active surveillance or watchful waiting is commonly used in the treatment of prostate cancer; therefore, it is also important to determine the percentage of men who have surgery more than one year after being diagnosed.

Take away message

- 24.6% of men diagnosed with prostate cancer received a radical prostatectomy within one year of diagnosis (Table 7.3).
- The percentage of individuals with prostate cancer treated with radical prostatectomy differed by stage at diagnosis (ranging from 2.3% for stage I to 84.5% for stage III) and Gleason score (ranging from 9.0% for Gleason score ≤6 to 32.8% for Gleason score 7) (Figure 7.3).
- This pattern of surgical treatment is common and within recommended guidelines.

Figure 7.3 Percentage of prostate cancer cases that received a radical prostatectomy within one year of diagnosis and after one-year of diagnosis, 2010-2014



What does the data tell us?

This pattern of surgical treatment suggests that watchful waiting or active surveillance was frequently used taking into account patient preference, age, extent of disease, and risk status.[6, 7] Radical prostatectomy differed by stage at diagnosis and was commonly performed for men diagnosed with stage III cancer (84.5%) within one year of diagnosis (Figure 7.3). The percentage of men who had a radical prostatectomy was lowest for those diagnosed with stage I prostate cancer, likely because those men opted for active surveillance or watchful waiting. Men diagnosed with stage I cancer that had a radical prostatectomy after one year of diagnosis (7.2%) likely had disease progression which impacted the decision to proceed with surgery. A higher percentage of men in Manitoba with a Gleason score of 8-10 (31.3%) had a radical prostatectomy (Figure 7.3) compared to men during a similar time period in Ontario (approximately 10%).[8]

Additional information about this indicator, including stratifications by regional health authority and age are included in Tables 7.3 and 7.4 at the end of this chapter.

Surgical approach

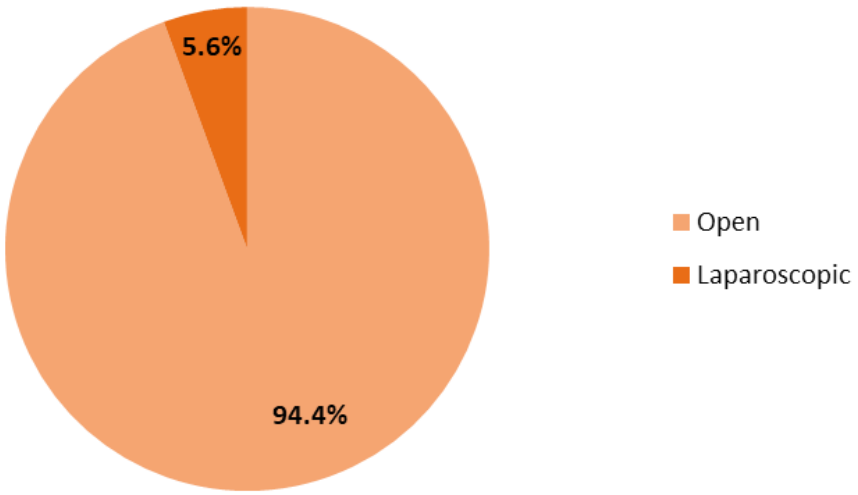
Indicator definition
Number and percentage of prostate cancer cases that had surgery within one year of diagnosis by surgical approach.

Why is this important to know?
The prostate may be surgically removed via an open approach or laparoscopically which is minimally invasive. It is important to understand patterns of practice, as the percentage of open, laparoscopic, and laparoscopic robot-assisted surgery differs greatly across Canada. There is no evidence that outcomes such as post-operative mortality, surgical complications, or disease recurrence differ by approach. 9 However, a laparoscopic approach may have a reduced length-of-hospital stay (LOS) and/or fewer required blood transfusions, but increased costs compared to an open approach.[9,10]

Take away message

- Most radical prostatectomies (94.4%) were completed using an open approach (Figure 7.4)

Figure 7.4 Percentage of radical prostatectomy surgery, by surgical approach completed within one year of diagnosis, 2010-2014.



What does the data tell us?
Almost 95% of radical prostatectomy surgeries on Manitoban men who had radical prostatectomy within one year of diagnosis used an open approach (Figure 7.4). Of the men who did have laparoscopic surgery, most (82.9%) had surgery outside of Manitoba. Manitoba has the lowest rate of laparoscopic surgery for prostate cancer in Canada except for Prince Edward Island, Nova Scotia, and Newfoundland and Labrador.[10]

Additional information about this indicator can be found in Table 7.5 at the end of this chapter.

Diagnosis and surgery in the RHA of residence

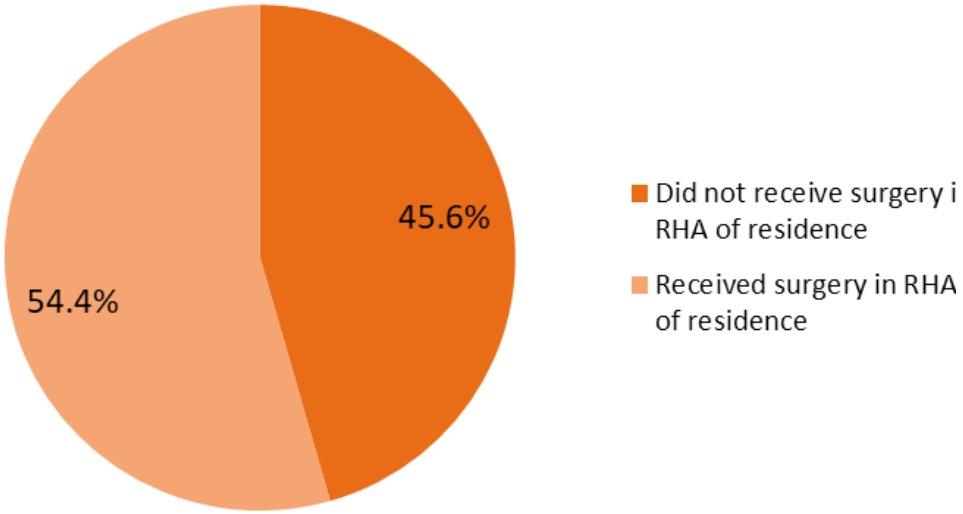
Indicator definition
Percentage of men diagnosed with prostate cancer that had a radical prostatectomy within one year of diagnosis in the same RHA in which they lived at diagnosis.

Why is this important to know?
This indicator provides information about whether or not Manitoba men travelled outside their RHA of residence for prostate cancer surgery. Factors that influence where a patient receives surgical cancer treatment include patient preference, type of procedure performed, and availability of specialists (urologists).

Take away message

- 54.4% of men received their surgery in the RHA in which they lived at diagnosis (Figure 7.5).
- The majority of men (89.1%) had surgery in the Winnipeg Regional Health Authority (WRHA) (Table 7.6).

Figure 7.5 Percentage of surgeries completed in the same RHA as a patient's area of residence at time of diagnosis, 2010-2014



What does the data tell us?
54.4% of men who had prostate surgery received their surgery in the same RHA in which they lived (Figure 7.5). A majority of surgeries were conducted in Winnipeg, due to it being the location of surgeons who specialize in radical prostatectomies.

Hospital readmissions

Indicator definition

Number and percentage of men with prostate cancer who had a radical prostatectomy within one year of diagnosis who were readmitted to hospital within 30 and 60 days of surgery.

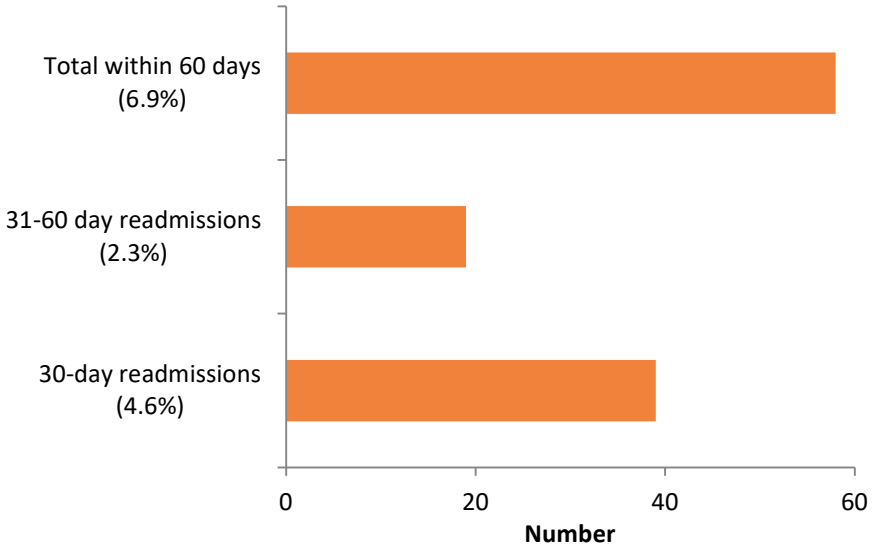
Why is this important to know?

Hospital readmissions are related to many factors including post-operative complications. Reducing readmissions will reduce costs on the healthcare system. Hospital readmissions are a widely used, yet controversial, indicator of quality without adjusting for other factors. Because we are unable to account for additional factors that impact the readmission rate, this indicator does not assess the appropriateness of the readmission.

Take away message

- The 30-day readmission rate was 4.6%, which was similar to the national average of 3.9% (Figure 7.6).

Figure 7.6 Number and percent of men who had a radical prostatectomy within one year of diagnosis and were readmitted to the hospital within 30 and 60 days, 2010-2014



What does the data tell us?

The percentage of men who had a radical prostatectomy and were readmitted to the hospital within 30 days of surgery in Manitoba (4.6%) (Figure 7.6) was higher than the Canadian age-adjusted 30-day average (2009/10 – 2011/12) of 3.9% but lower than 5.5% found[3] in a United States study using the National Surgical Quality Improvement Program (NSQIP) database (2011).[11]

Key Performance Indicators

Hospital readmissions

Indicator definition
Number and median number of lymph nodes removed and examined during a radical prostatectomy that occurred within one year of diagnosis among men diagnosed with prostate cancer.

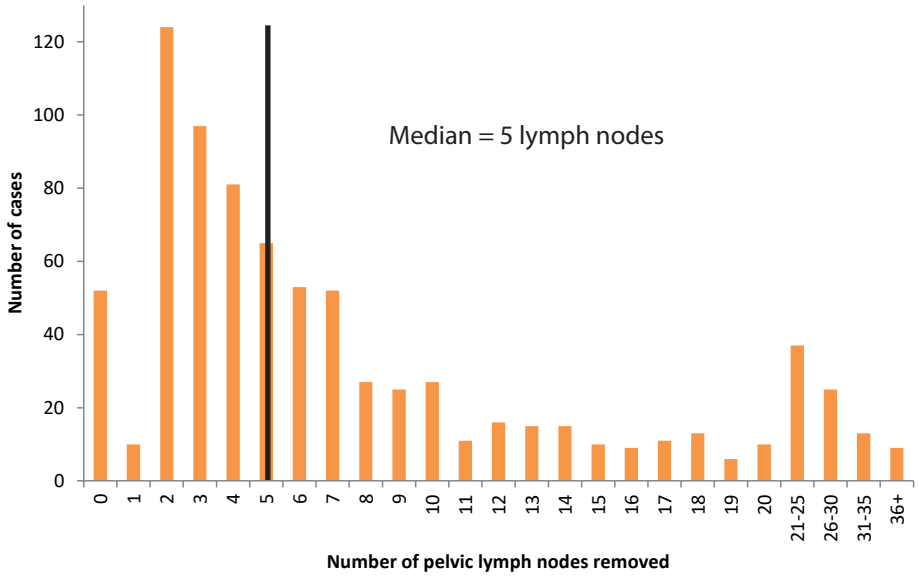
Why is this important to know?
Lymph node resections are important for staging, treatment decision making, and prognosis. The number of pelvic lymph nodes removed may also be correlated with cancer-specific mortality in men with clinically localized prostate cancer.[1]

Interpretation of results
Pelvic lymph node removal and examination should be routinely performed during radical prostatectomy for medium and high-risk patients.[12] If the risk of positive nodes is greater than 5%, the extent of lymphadenectomy is debated.[12] The European Association of Urology (EAU) recommends that extended pelvic lymph node dissection be completed in men with high risk of lymph node invasion.[13] Although there is currently no guideline or consensus statement that describes the number of lymph nodes that should be removed and examined, very high or low numbers may indicate issues with surgical quality of care.

Take away message

- Among men with prostate cancer who had a radical prostatectomy within one year of diagnosis, the median number of lymph nodes removed and examined was five (Figure 7.7).
- 6.2% (n = 52) of men with prostate cancer who had a radical prostatectomy within one year of diagnosis did not have any lymph nodes removed, and 33.4% had at least eight lymph nodes removed during their surgery (Table 7.9).

Figure 7.7 Distribution of the number of lymph nodes removed and examined among men who had a radical prostatectomy within one year of diagnosis, 2010-2014



What does the data tell us?

The median number of lymph nodes removed for examination during radical prostatectomies in Manitoba was five (Figure 7.7). The median number of nodes removed was lowest among men with low-stage disease (median = 4) and those who received treatment in the Prairie Mountain Health (PMH) RHA (median = 3) (Table 7.9). Thirty-seven percent of men with prostate cancer who had a radical prostatectomy within one year of diagnosis most frequently had between two and four lymph nodes removed. According to data from the National Cancer Database (United States), between 2004 and 2013, the mean number of pelvic lymph nodes removed was between 6.1 and 7.2.[2] In another United States study, the median number of lymph nodes removed was six.[1]

Additional information regarding the number of lymph nodes removed and examined can be found in Table 7.9 at the end of this chapter.

Length of post-operative hospital stay (LOS)

Indicator definition

Median number of days between surgery and discharge date from hospital for men diagnosed with prostate cancer who had a radical prostatectomy within one year of diagnosis.

Why is this important to know?

LOS is related to quality of care, quality of life for patients, and healthcare costs. A LOS that is too short has the potential to lead to readmissions and complications. Conversely, a LOS that is too long impacts the patient's quality of life, may increase the wait time for surgery for other patients, and unnecessarily increases costs to the health care system. LOS is affected by type of procedure, practice patterns, pre-existing co-morbidities, number and severity of post-operative complications, and surgical approach. Shorter hospital stays, when appropriate, have the potential to reduce healthcare system costs.

Interpretation of results

A low median number of days is considered to be a favorable result.

Take away message

- Median LOS for men diagnosed with prostate cancer who had an open radical prostatectomy was five days (Figure 7.1). The Canadian median LOS was three days during a similar time period.

Table 7.1 Median number of days between hospital admission and discharge and 90th percentile for men diagnosed with prostate cancer that had an open radical prostatectomy within one year of diagnosis, 2010-2014.

	Median (days)	90th percentile (days)
Manitoba	5	7

What does the data tell us?

During the study period, men who received an open radical prostatectomy in Manitoba had a median LOS of five days (Table 7.1). The median LOS reported by Canadian Institute of Health Information (CIHI) for open prostatectomies between 2009/10-2012/13 was three days.[3] The lower national LOS may be related to higher rates of laparoscopic or robotic-assisted laparoscopic surgery in other provinces which have shorter hospital stays compared to open procedures. A recent meta-analysis showed that men who had an open radical prostatectomy stayed in hospital an average of 1.74 days longer than those who had their surgery laparoscopically.[14]

Post-operative complications

Indicator definition

Percentage of prostate cancer cases that had a radical prostatectomy within one year of diagnosis with at least one recorded in-hospital post-operative complication.

Why is this important to know?

Post-operative complications (e.g. bleeding, damage to adjacent organs, infections, blood clots, and incontinence) can impact patient recovery, quality of life, and LOS. Research has shown that men treated by high-volume specialist surgeons generally have lower rates of complications compared to men treated by surgeons who complete few surgeries each year.[15]

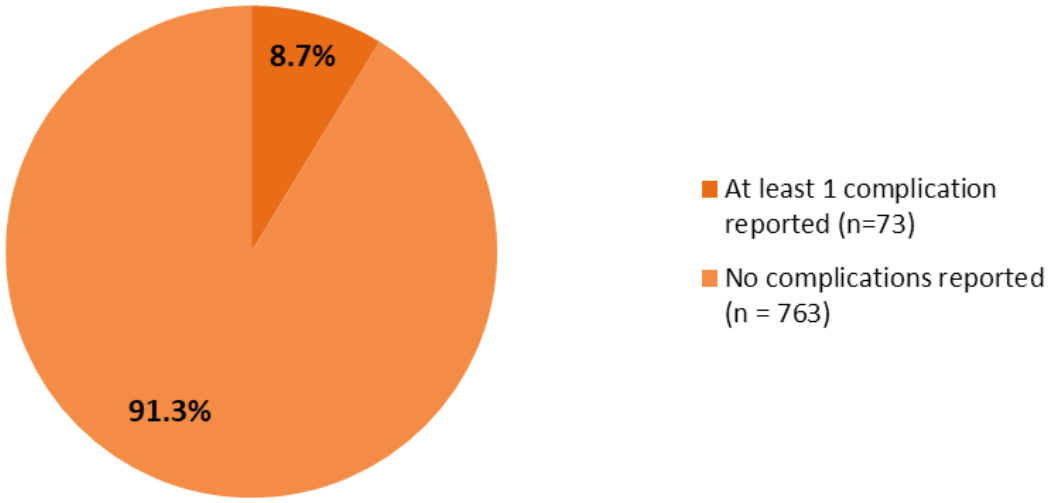
Interpretation of results

A low value for this indicator can be interpreted as a favorable result.

Take away message

- 8.7% of men who had a radical prostatectomy within one year of diagnosis had at least one post-operative complication recorded during their post-operative hospital stay (Figure 7.8).

Figure 7.8 Percentage of men who had at least one in-hospital complication recorded, 2010-2014



What does the data tell us?

Seventy-three men (8.7%) who had a radical prostatectomy had at least one post-operative complication recorded during their hospital stay (Figure 7.8). In Manitoba, the most common types of complications recorded were ileus or post-operative intestinal obstruction (3.2%), accidental puncture or laceration during the procedure (2.2%), and haemorrhage/haematoma (1.7%). A United States study that included surgeries between 2008 and 2009 using the Nationwide Inpatient Sample reported an in-hospital post-operative complication rate of 11.1%.[16]

Additional Indicator Calculation Information

This indicator only includes complications that were recorded in the hospital record during the same hospital stay that the resection occurred. This may underestimate the number of complications that actually occurred. We are unable to assess the severity of complications or the effect of pre-existing co-morbidities on the development of post-operative complications. Death was not included as a complication in this indicator.

Additional information about length of hospital stay, including stratifications, is included in Table 7.7 at the end of this chapter.

Table 7.2 Percentage and age-standardized incidence rates of prostate cancer cases, by cohort characteristics, 2010-2014

Characteristic	Prostate Cancer Cohort		Age-Standardized Incidence Rate per 100,000 (95% CI)
	N	% Total (95% CI)	
Manitoba	3399	100	203.6 (196.8,210.5)
Age group			
35-49	49	1.4 (1.0,1.8)	7.7 (5.7,10.2)
50-64	1143	33.6 (32.0,35.2)	186.8 (176.1,197.9)
65-79	1668	49.1 (47.4,50.8)	559.0 (532.5,586.5)
80+	539	15.9 (14.6,17.1)	553.3 (507.5,602.0)
Income quintile (urban)			
U1 (lowest)	291	8.8 (7.8,9.7)	170.1 (150.4,189.7)
U2	323	9.7 (8.7,10.7)	183.1 (163.1,203.1)
U3	384	11.6 (10.5,12.7)	192.9 (173.6,212.2)
U4	419	12.6 (11.5,13.7)	208.7 (188.7,228.8)
U5 (highest)	492	14.8 (13.6,16.0)	232.5 (211.9,253.2)
Income quintile (rural)			
R1 (lowest)	224	6.7 (5.9,7.6)	208.0 (180.7,235.3)
R2	310	9.3 (8.3,10.3)	221.8 (197.0,246.6)
R3	281	8.5 (7.5,9.4)	195.0 (172.1,217.9)
R4	282	8.5 (7.5,9.4)	206.4 (182.3,230.6)
R5 (highest)	315	9.5 (8.5,10.5)	242.3 (214.9,269.7)
RHA of residence at diagnosis			
WRHA	1837	54.0 (52.4,55.7)	197.6 (188.6,206.6)
PMH	519	15.3 (14.1,16.5)	202.3 (184.8,219.8)
SH-SS	489	14.4 (13.2,15.6)	220.2 (200.7,239.7)
IERHA	447	13.2 (12.0,14.3)	226.5 (205.3,247.6)
NHA	107	3.1 (2.6,3.7)	180.4 (144.5,216.3)
Stage			
Stage I	530	15.6 (14.4,16.8)	31.8 (29.1,34.5)
Stage II	1880	55.3 (53.6,57.0)	112.4 (107.3,117.5)
Stage III	385	11.3 (10.3,12.4)	23.1 (20.8,25.4)
Stage IV	544	16.0 (14.8,17.2)	32.6 (29.9,35.4)
Unknown	60	1.8 (1.3,2.2)	3.6 (2.8,4.7)
Gleason score			
≤ 6	662	19.5 (18.1,20.8)	39.7 (36.7,42.7)
7	1248	36.7 (35.1,38.3)	74.7 (70.6,78.9)
8 – 10	1148	33.8 (32.2,35.4)	68.6 (64.7,72.6)
No needle core biopsy/TRP	268	7.9 (7.0,8.8)	16.1 (14.2,18.1)
Unknown	73	2.1 (1.7,2.6)	4.4 (3.5,5.5)

** Includes cases diagnosed between January 1, 2010 and December 31, 2014. All characteristics are calculated at date of diagnosis. Incidence rates have been age and sex standardized to the Manitoba population from 2010 to 2014. Age-specific rates have not been standardized. Table shows column %.*

Table 7.3 Percentage of prostate cancer cases that had a radical prostatectomy within one year of diagnosis, by cohort characteristics, 2010-2014

Characteristic	Had a radical prostatectomy within one year of diagnosis		Did not have a radical prostatectomy within one year of diagnosis	
	N	% Total (95% CI)	N	% Total (95% CI)
Manitoba	836	24.6	2563	75.4
Age group				
35-49	25	51.0 (37.0,65.0)	24	49.0 (35.0,63.0)
50-64	522	45.7 (42.8,48.6)	621	54.3 (51.4,57.2)
65-79	289	17.3 (15.5,19.1)	1379	82.7 (80.9,84.5)
80+	0	0.0 (0.0,0.01)	539	100.0 (99.3,100)
Income quintile (urban)				
U1 (lowest)	47	15.3 (10.9,19.8)	244	84.7 (80.2,89.1)
U2	65	19.3 (14.7,24.0)	258	80.7 (76.0,85.3)
U3	88	23.5 (18.8,28.1)	296	76.5 (71.9,81.2)
U4	108	25.0 (20.5,29.5)	311	75.0 (70.5,79.5)
U5 (highest)	135	27.8 (23.4,32.1)	357	72.2 (67.9,76.6)
Income quintile (rural)				
R1 (lowest)	49	20.3 (14.7,26.0)	175	79.7 (74.0,85.3)
R2	73	25.5 (20.1,30.9)	237	74.5 (69.1,79.9)
R3	67	25.0 (19.4,30.6)	214	75.0 (69.4,80.6)
R4	90	32.0 (26.0,37.9)	192	68.0 (62.1,74.0)
R5 (highest)	93	28.1 (22.8,33.5)	222	71.9 (66.5,77.2)
RHA of residence at diagnosis				
WRHA	425	23.1 (21.0,25.2)	1412	76.9 (74.8,79.0)
PMH	133	27.3 (23.1,31.6)	386	72.7 (68.4,76.9)
SH-SS	129	25.9 (21.7,30.1)	360	74.1 (69.9,78.3)
IERHA	123	27.2 (22.7,31.7)	324	72.8 (68.3,77.3)
NHA	26	21.3 (13.2,29.4)	81	78.7 (70.6,86.8)
Stage				
Stage I	15	2.3 (1.0,3.6)	515	97.7 (96.4,99.0)
Stage II	383	19.9 (18.0,21.9)	1497	80.1 (78.1,82.0)
Stage III	324	84.5 (80.7,88.2)	61	15.5 (11.8,19.3)
Stage IV	111	22.7 (18.7,26.7)	433	77.3 (73.3,81.3)
Gleason score				
≤ 6	70	9.0 (6.7,11.2)	592	91.0 (88.8,93.3)
7	433	32.8 (30.0,35.6)	815	67.2 (64.4,70.0)
8 – 10	326	31.3 (28.3,34.3)	822	68.7 (65.7,71.7)

**row percent*

Table 7.4 Percentage of prostate cancer cases that had a radical prostatectomy more than one year after diagnosis, by cohort characteristics, 2010-2014

Characteristic	Had a radical prostatectomy more than 1 year after diagnosis	
	N	% Total (95% CI)
Manitoba	108	3.2
RHA of residence at diagnosis		
WRHA	55	3.0 (2.2,3.8)
PMH	17	3.3 (1.7,4.8)
SH-SS	12	2.5 (1.1,3.8)
IERHA	18	4.0 (2.2,5.9)
NHA	6	5.6 (1.2,10.0)
Stage		
Stage I	38	7.2 (5.0,9.4)
Stage II	61	3.2 (2.4,4.0)
Stage III	9	2.3 (0.8,3.8)
Stage IV	0	n/a(0.0,0.0)
Gleason score		
≤ 6	51	7.7 (5.7,9.7)
7	46	3.7 (2.6,4.7)
8 – 10	9	0.8 (0.3,1.3)

**row percent*

Table 7.5 Percentage of prostate cancer cases treated with a radical prostatectomy within one year of diagnosis who received surgery laparoscopically or open approach, 2010-2014

Characteristic	Laparoscopic		Open	
	N	Percent	N	Percent
Manitoba	47	5.6	789	94.4
Age group				
35-64	39	7.1	508	92.9
65-79	8	2.8	281	97.2
80+	0	0	0	0
RHA of residence at diagnosis				
WRHA	18	4.2	407	95.8
PMH	9	6.8	124	93.2
SH-SS	6	4.7	123	95.3
IERHA	14	11.4	109	88.6
NHA	0	0	26	100
Location of treatment				
Manitoba	13	1.6	782	98.4
Out of Province	34	82.9	7	17.1
Stage				
Stage I	<6	-	11	-
Stage II	28	7.3	355	92.7
Stage III	9	2.8	315	97.2
Stage IV	<6	-	107	-
Gleason score				
≤ 6	7	10.0	63	90.0
7	28	6.5	405	93.5
8 – 10	12	3.7	314	96.3

Table 7.6 Percentage of prostate cancer cases treated with a radical prostatectomy within one year of diagnosis, by Regional Health authority (RHA) of residence and treatment, 2010-2014

	N	Percent
Diagnosis and surgery in WRHA	423	50.6
Diagnosis in non-WRHA and surgery in WRHA	322	38.5
Diagnosis and surgery in same non-WRHA RHA	32	3.8
Diagnosis in non-WRHA RHA and surgery in a different non-WRHA RHA	59*	7.1
Did not receive surgery in RHA of residence	381	45.6
Received surgery in RHA of residence	455	54.4

**41 (69.5%) of these cases were treated out of province*

Table 7.7 Length of stay for men diagnosed with prostate cancer that had an open radical prostatectomy within one year of diagnosis, 2010-2014

Characteristic	Median (days)	90th Percentile (days)
Manitoba	5	7
Age group		
35-49	5	6
50-64	5	7
65-79	5	7
RHA of residence at diagnosis		
WRHA	5	7
PMH	5	9
SH-SS	5	7
IERHA	5	7
NHA	5	8
RHA of first surgery		
WRHA	5	7
PMH	5	11
Stage		
Stage I	4	6
Stage II	5	7
Stage III	5	7
Stage IV	4	7

Table 7.8 Percentage of hospital readmissions for prostate cancer cases treated with a radical prostatectomy within one year of diagnosis, 2010-2014

Timing of readmission	N	Percent
Within 30 days	39	4.6
Between 31 and 60 days	19	2.3
Within 60 days	58	6.9
No readmission within 60 days	778	93.1

Table 7.9 Percentage of men with 8 or more lymph nodes removed and median number of lymph nodes removed for prostate cancer cases treated with a radical prostatectomy within one year of diagnosis, 2010-2014

Characteristic	Median	8 or more lymph nodes removed	
		N	Percent
Manitoba	5	279	33.4
Age group			
35-49	5	8	32.0
50-64	5	186	35.6
65-79	5	85	29.4
80+	0	0	0
Location of surgery			
WRHA	6	263	37.4
PMH	3	9	9.9
Stage			
Stage I/II	4	106	26.6
Stage III	5	101	31.2
Stage IV	11	72	64.9
Gleason score			
≤ 6	3	9	12.9
7	5	132	30.5
8 – 10	6	138	42.3

Table 7.10 Percentage of men diagnosed with prostate cancer that underwent a radical prostatectomy within 1 year of diagnosis and had at least one recorded in-hospital post-operative complication, 2010-2014

Number of complications	N	Percent of men who had a radical prostatectomy
One complication recorded	48	5.7
One or more	73	8.7
Two or more complications recorded	25	3.0
Total complications	118	n/a
Type of complication recorded (only complications that had at least 8 cases shown)		
Ileus or post-operative intestinal obstruction	27	3.2
Accidental puncture and laceration during procedure	18	2.2
Haemorrhage or haematoma	14	1.7
Infection following a procedure	10	1.2
Pulmonary embolism	8	1.0

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Technical Appendix

Cancer Surgery Quality in Manitoba

Cohort

Study Population
All Manitobans aged 20 or over diagnosed with an invasive colon, rectal, breast, ovarian, lung or prostate tumour between January 1, 2010 and December 31, 2014 were included in this study. 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 December 31, 2015) 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-10-CA codes that were used to identify each of these cancer sites.

Cancer Site	ICD-10-CA Code
Colon	C18* (colon), C19.9 (rectosigmoid)
Rectal	C20.9 (rectum)
Breast (female)	C50 (breast)
Ovarian	C56.9 (ovary), C48.2 (peritoneum), C57.0-C57.2 (fallopian tube, broad and round ligament), C57.4-C57.9 (uterine adnexa, other female genital organs)**
Lung	C34 (bronchus, lung)
Prostate	C61 (prostate)

**Excludes C18.1 (appendix)*
***Ovarian includes other female genital organs because research suggests that most cancers of the female genital organs originate in the ovary.*

Cancer Cohort

Colorectal	
Time frame	Tumour diagnosed between January 1, 2010 and December 31, 2014 inclusive
Tumour description	Invasive tumours only ("/3" histology code) Primary tumours only
Topography codes	Colon and rectosigmoid: C18.0, C18.2-C18.9 and C19.9 Rectum: C20.9
Resident status	Manitoba residents
Exclusions	The following atypical or rare morphologies were excluded: 8800, 8801, 8802, 8803, 8804, 8805, 8933, 8980, 89361, 8936, 9180, 9185, 8013, 8246, 8240, 8241, 8242, 8243, 8244, 8245, 8249, 8052, 8070, 8071, 8072, 8073, 8074, 8075, 8076, 8078, 8082, 8083, 8084, 8720, 8721, 8722, 8723, 8772, 8773, 8774, 8041, 8042, 8043, 8044, 8045, 8510, 8550, 9687, 90911, 9590 to 9999. The following topology was excluded: Appendix C18.1 Age: <20 years old at diagnosis Cancer Registry status: 'Pending' case

Breast cancer cohort	
Time frame	Tumour diagnosed between January 1, 2010 and December 31, 2014.
Tumour description	Invasive tumours only ("/3" histology code) – For invasive group DCIS tumours only ("/2" histology code) – For DCIS group Primary tumours only
Topography codes	C50.0-C50.9
Resident status	Manitoba residents
Exclusions	The following atypical or rare morphologies were excluded: 8012, 8032, 8070, 8401, 8550, 8980, 8982, 9020, 9180, 8013, 8014, 80702, 80713, 8083, 8720, 8530, 8004, 8983, 8851, 8543, 8541, 8542, 8543, 9590 to 9999. Age: <20 years old at diagnosis Sex: Male Cancer Registry status: 'Pending' case
Other methodological notes	If a woman had multiple tumours diagnosed during the study time period where: - A tumour was diagnosed in each breast, both tumours were kept. - An invasive tumour and a DCIS tumour were both diagnosed in one breast less than 60 days apart, only the invasive tumour was kept. - An invasive tumour and a DCIS tumour were both diagnosed in one breast more than 60 days apart, both tumours were kept. - Multiple invasive tumours were diagnosed in one breast less than 60 days apart; the invasive tumour with the highest stage was kept. - Multiple DCIS tumours were diagnosed in one breast less than 60 days apart, the tumour that was diagnosed first was kept. - Multiple invasive tumours were diagnosed in one breast more than 60 days apart, both tumours were kept. - Multiple DCIS were diagnosed in one breast more than 60 days apart, both tumours were kept.

Lung cancer cohort	
Time frame	Tumour diagnosed between January 1, 2010 and December 31, 2014.
Tumour description	Invasive tumours only ("/3" histology code) Primary tumours only
Topography codes	C34.0-C34.9
Resident status	Manitoba residents
Exclusions	8801, 8804, 8890, 8900, 9180, 9540, 9680, 9751, 9823, all lymphomas, leukemia's, and other ill-defined and unknown cancers Age: <20 years old at diagnosis Cancer Registry status: 'Pending' case Topography codes associated with: Trachea, pleura, and mediastinum
Stratification	
Non-small cell carcinoma	8000, 8001, 8010, 8012, 8013, 8014, 8020, 8022, 8031, 8032, 8033, 8046, 8052, 8070, 8071, 8072, 8073, 8074, 8082, 8083, 8084, 8123, 8140, 8200, 8240, 8244, 8246, 8249, 8250, 8251, 8230, 8252, 8253, 8254, 8255, 8260, 8310, 8430, 8550, 8574, 8460, 8480, 8481, 8490, 8560, 8562, 8800, 8972, 8973, 8980, 9040, 9041, 9043, 9080, 9120, 9133.
Small cell carcinoma	8002, 8041, 8042, 8043, 8044, 8045, 8141, 8244.

Ovarian cancer cohort

Time frame	Tumour diagnosed between January 1, 2010 and December 31, 2014.
Tumour description	Invasive tumours only (“/3” histology code) Primary tumours only
Topography codes	C56.9, C48.2, C57.0-C57.2,C57.4-C57.9
Resident status	Manitoba residents
Exclusions	The following sex-chord stromal, germ cell and other atypical or rare morphologies were excluded: 8240, 8241, 8242, 8243, 8244, 8245, 8330, 8331, 8332, 8333, 8335, 8340, 8574, 8600, 8620, 8630, 8631, 8634, 8640, 8650, 8670, 8810, 9052, , 9060, 9062, 9063, 9064, 9065, 9070, 9071, 9072, 9080, 9081, 9082, 9083, 9084, 9085, 9090, 9100, 9101, 9102, 9105, 9380, 9381, 9382, 9390, 9391, 9392, 9393, 9395, 9400, 9401, 9410, 9411, 9420, 9423, 9424, 9425, 9430, 9440, 9441, 9442, 9450, 9451, 9680. Age: <20 years old at diagnosis Cancer Registry status: ‘Pending’ case

Prostate cancer cohort	
Time frame	Tumour diagnosed between January 1, 2010 and December 31, 2014.
Tumour description	Invasive tumours only ("/3" histology code) Primary tumours only
Topography codes	C61
Resident status	Manitoba residents
Exclusions	The following morphologies were excluded: Lymphomas, leukemias and other ill-defined and unknown cancers. Age: <35 years old at diagnosis Cancer Registry status: 'Pending' case

Data Sources

Database	Source of database	Years
Manitoba Cancer Registry	CancerCare Manitoba	2010 - 2015
Medical Claims Database	Manitoba Health, Seniors and Active Living	2010 - 2015
Discharge (Hospital) Abstracts Database	Manitoba Health, Seniors and Active Living	2010 - 2015
Canadian Census	Statistics Canada	2006
Manitoba Health Coverage Data File	Manitoba Health, Seniors and Active Living	2010-2015

Data Linkage

A list of surgical procedures used in cancer treatment was developed for each cancer site (see "Procedure (CCI) Codes" section). To determine who in the cancer cohort received these surgical services, treatment information was extracted from two data sources: the Manitoba Cancer Registry (MCR) and the Discharge Abstract Database (DAD). The MCR treatment data was directly linked to the cancer cohort using a specific tumour identifier, while the DAD treatment data was linked using a person-specific identifier (Scrambled Personal Health Identification Number (SPHIN).

We then looked backward and forward in time from the diagnosis date to identify surgical procedures that had been performed on the tumours found within the cancer cohort. For each cancer site, we selected the first surgical procedure that occurred within the one-year time period after diagnosis; however, other procedures and dates were also used for a variety of adjustments and exclusions depending on the indicator being calculated (details can be found in the "Methodology" section).

Where information about physician specialty type or tariff code was needed for specific surgical procedures, Medical Claims data was linked to the selected procedures by SPHIN and date of procedure (+/- 1 day, if no matching procedure was found in Medical Claims data on the same date). In addition, the Manitoba Health Coverage Datafile was linked to the cancer cohort using SPHIN in order to allow for exclusions where health coverage was insufficient.

Definitions

Age Groups

Age groups used in this study were created as follows:

Site	Age Group*
Breast	20-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80+
Colorectal	20-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80+
Lung	20-54, 55-64, 65-69, 70-74, 75-79, 80-84, 85+
Ovarian	20-39, 40-49, 50-59, 60-69, 70-79, 80+
Prostate	35-49, 50-64, 65-79, 80+

Income Quintiles

Groupings for income quintiles followed the 2006 census, and are as described below:

Income Quintile Rural		
1	$22,449.24	$41,575.50
2	$41,615.00	$47,928.64
3	$47,966.57	$53,810.17
4	$53,829.00	$65,235.00
5	$65,339.00	$148,242.00
Income Quintile Urban		
1	$14,640.00	$42,407.00
2	$42,463.00	$54,663.00
3	$54,696.00	$68,132.00
4	$68,140.00	$87,201.00
5	$87,214.00	$406,531.00

Provider codes (MD Bloc)

Ovarian Cancer	
General surgical oncology	155
General surgery	041
Gynecologic oncology	151
Urogynaecology	152
Obstetrics and gynecology	09 /099

Prostate risk category

Risk Category*	Calculation
Low Risk (must have **ALL** of the following	PSA <= 10ng/ml Biopsy Gleason Score <=6 Clinical Stage T1-T2a
Intermediate Risk (must have all of the following if not low risk)	PSA<=20ng/ml Biopsy Gleason Score =7 Clinical Stage T1-T2
High Risk, must have **ANY** of the following	PSA >20ng/ml Biopsy Gleason Score 8-10 Clinical Stage T3a-T4

**Cases without valid PSA value, Biopsy Gleason Score, or valid Clinical Stage were excluded from risk category calculation. T0 and Tx clinical stage cases were also excluded.*

Complication (ICD-10 Code) List

ICD-10 Codes

Breast
A04, A40.0-A40.3, A40.8, A40.9, A41.0-A41.5, A41.51, A41.52, A41.58, A41.80, A41.88, A41.9, B95, B96, I21, I22, I23, I24.0, I24.8, I24.9, I26.0, I26.9, I28, I30.0, I30.1, I30.8, I30.9, I33.0, I33.9, I40.0, I40.1, I40.8, I40.9, I46.0, I46.1, I46.9, I48, I49.9, I80, J13, J15, J16, J18, J69.0, J69.8, J80, J85.0, J98.0, J98.1, J98.8-J98.10, J98.18, L89, N17, R06.0, R09.2, R50, R57.1, R57.2, R57.9, T81.0-T81.5, T81.81-T81.83, T81.88, T81.9, T88.2, T88.5, T88.7, Y84.6, Y65, Y69, T14.1, I97.2, I89.0
Colorectal
A04, A09.0, A09.9, A04.7, A41.8, A41.9, E86.0, E86.8, I21, I24.0, I24.9, I26, I46, I80, J69.0, J69.8, J95.2-J95.4, J95.8, J96, K43, K46, K56.0, K56.4, K56.6, K56.7, K60.1-K60.5, K61.1-K61.4, K62.5, K63.0, K63.2, K65.0, K65.8, K65.9, K91, K91.4, K92.2, L02.2, N17, N30.0, N30.9, N32.1, N73.0, R09.2, R15, R19.0, R22.2, R32, R33, R50, R57.1, R57.2, R57.9, R64, S31.8, S36.5, S36.6, S36.9, T81.1, T81.2, T81.3, T81.4, T81.5, T81.7, T81.8, T81.9, T83.0, T83.1, T83.5, T83.9, T88.2, T88.5, Y84.6
Ovarian
A04, A09.0, A09.9, A41.8, A41.9, E86.0, R86.8, I21, I24.0, I24.9, I26, I46, I74.0, I80, J69.0, J69.8, J95.8, J95.2, J95.3, J95.4, J96, K43, K46, K60.5, K61.2-K61.4, K62.5, K63.0, K63.2, K65.0, K65.8, K65.9, K91, K92.2, L02.2, N17, N30.0, N30.9, N32.1, N73.0, N93.8, N93.9, R09.2, R15, R19.0, R22.2, R32, R33, R50, R57.1, R57.2, R57.9, R64, S31.8, S36.5, S36.6, S36.9, T81, T83.0, T83.1, T83.5, T83.9, T88.2, T88.5
Prostate
A04, A09.0, A09.9, A41.8, A41.9, E86.0, E86.8, I21, I24.0, I24.9, I26, I46, I80, I82.2, I82.3, I82.8, I82.9, I89.0, J69.0, J69.8, J95.2-J95.4, J95.8, J96, K31.0, K31.6, K43, K46, K56.0, K56.4, K56.6, K56.7, K61.4, K63.0, K63.2, K65.0, K65.8, K65.9, K91, K92.2, L02.2, N17, N30.0, N30.9, N32.1, N73.0, R09.2, R15, R19.0, R22.2, R32, R33, R50, R57.2, R57.1, R57.9, R64, S31.8, S36.3, S36.5, S36.7, S36.8, S36.9, S37.1-S37.3, S37.8, S37.9, T81.0, T81.1, T81.2, T81.3, T81.4, T81.5, T81.7, T81.8, T81.9, T83.0, T83.1, T83.5, T83.9, T88.2, T88.5

Procedure (CCI) Codes

Surgery	CCI Codes
Breast	
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	1MD89, 1YM91, 1YM92

Surgery	CCI Codes
Colorectal - Procedure	
Bypass	1NK76DN, 1NK76DP, 1NK76DQ, 1NK76RE, 1NK76RF, 1NK76RJ, 1NM76DF, 1NM76DN, 1NM76RE, 1NM76RN
Potentially reversible stoma with no resection	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 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
Polypectomy	(1NM87BA or 1NM87LA or 1NM87DA or 1NQ87BA) AND recorded as day surgery in-hospital records AND has a colonoscopy or sigmoidoscopy billing code (TARIFF code = 3187 or 3188, 3189 or 3323, 3324)
Colorectal – Approach (Resections)	
Open	1NQ89AB, 1NQ89LH, 1NQ89LHXXG, 1NQ89RS, 1NQ89RSXXG, 1NK87TF, 1NK87TG, 1NM87TF, 1NM87TG, 1NM89TF, 1NM91TF, 1NM91TG, 1NQ87TF, 1NQ89KZXXG, 1NQ89SFXXG, 1NK87LA, 1NK87RE, 1NK87RF, 1NM87LA, 1NM87RD, 1NM87RE, 1NM87RN, 1NM87WJ, 1NM89KZXXG, 1NM89RN, 1NM89SFXXG, 1NM91RD, 1NM91RE, 1NM91RN, 1NQ87LA, 1NQ87RD, 1NQ89KZ, 1NQ89SF, 1NQ90LAXXG, 1NQ87PF (if billing data isn't identified as TEMS)
Laparoscopic	1NK87DX, 1NK87DY, 1NM87DX, 1NM87DY, 1NM89DX, 1NM91DE, 1NM91DX, 1NM91DY, 1NQ87DX, 1NK87DN, 1NK87DA, 1NK87DP, 1NM87DA, 1NM87DE, 1NM87DF, 1NM87DN, 1NM87GB, 1NM89DF, 1NM91DF, 1NM91DN, 1NQ87DA, 1NQ87DE, 1NQ87DF, 1NQ89GV
Orifice	1NG87CA, 1NQ87PB, 1NM82RE (if billing data identified as TEMS)

Surgery	CCI Codes
Lung - Procedure	
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
Lung - Approach	
Open	1GR87NW, 1GR87QB, 1GR91QB, 1GR91QBXXA, 1GR91QBXXG, 1GR91QBXXF, 1GR91QBXXN, 1GR91QBXXQ, 1GR91NW, 1GR91NWXXA, 1GR91NWXXG, 1GR91NWXXF, 1GR91NWXXN, 1GR91NWXXQ, 1GR91NWXXL, 1GR89NW, 1GR89QB, 1GT87NW, 1GT87QB, 1GT89NW, 1GT89QB, 1GT91QB, 1GT91QBXXN, 1GT91QBXXG, 1GT91QBXXF, 1GT91QBXXQ, 1GT91NW, 1GT91NWXXN, 1GT91NWXXG, 1GT91NWXXF, 1GT91NWXXQ,
VATS	1GR87DA, 1GR89DA, 1GT87DA, 1GT89DA

Surgery	CCI Codes
Ovarian - Procedure	
USO/BSO	1RB87DA, 1RB87LA, 1RB87RA, 1RB89DA, 1RB89LA, 1RB89RA, 1RD89DA, 1RD89LA, 1RD89RA, 1RF87DA, 1RF87LA, 1RF87RA, 1RF89DA, 1RF89LA, 1RF89RA
Hysterectomy	1RM87DAGX, 1RM87DAAK, 1RM87DAAG, 1RM87BAGX, 1RM87BAAK, 1RM87BAAG, 1RM87CAAF, 1RM87CAAE, 1RM87CAGX, 1RM87CAAK, 1RM87LAGX, 1RM87LAAK, 1RM89AA, 1RM89CA, 1RM89DA, 1RM89LA, 1RM91AA, 1RM91CA, 1RM91DA, 1RM91LA
Omentectomy	1OT87DA, 1OT87LA, 1OT91LA
Debulking	1NV89, 1OB87, 1OB89, 1OA87, 1GX87, 1NM77, 1RS87, 1RS89, 1PM87, 1PM89, 1PM91, 1NM87, 1NM89, 1NM91, 1NQ87, 1NQ89, 1NK87, 1NK58, 1PM77, 1PV80, 1RM59, 1RN59
Vulva and cervix resections	1RW87, 1RW88, 1RW91, 1RY87, 1RN87, 1RN89
Lymph node excision	1MH87DA, 1MH87LA, 1MG87DA, 1MG87LA, 1MG87QF, 1MJ87, 1MJ89, 1MJ91, 1MG89, 1MH89
Procedure Categories	
USO/BSO	(USO or BSO code) AND no other codes
USO/BSO with hysterectomy	(USO or BSO code) AND hysterectomy code AND no other codes
USO/BSO with omentectomy	(USO or BSO code) AND omentectomy code AND no other codes
USO/BSO with hysterectomy + omentectomy	(USO or BSO code) AND hysterectomy code AND omentectomy code AND no other codes
USO/BSO +/- hysterectomy with debulking	(USO OR BSO) AND any debulking codes AND any other combination of hysterectomy, omentectomy, or lymph node excision codes, or vulva or cervix resections
Other	Any debulking codes AND any other combination of hysterectomy, omentectomy, or lymph node excision codes, or vulva or cervix resections AND NO (USO or BSO)

Surgery	CCI Codes
Prostate - Procedure	
Radical prostatectomy	1QT91PB, 1QT91PK, 1QT91DA
Partial prostatectomy	1QT87BAGX, 1QT87PKGX, 1QT87QZGX, 1QT87PBGX, 1QT87DAGX, 1QT87BAAG, 1QT87QZAG, 1QT87BAAK
Pelvic lymph node excision	1MH87, 1MH89
Prostate – Approach (Radical only)	
Open	1QT91PB, 1QT91PK
Laparoscopic	1QT91DA

Methodology

Cancer Incidence

Definition	Age standardized incidence rate per 100,000 by cancer site
Numerator	Number of new cancer cases per site
Denominator	Manitoba standard populations
Exclusions	See "Cancer Cohorts" section for disease site specific exclusions
Stratifications	Age, sex, income quintile, regional health authority of residence at diagnosis, stage
Time period	Diagnosis between January 1, 2010 to December 31, 2014
Data source(s)	Manitoba Cancer Registry and Manitoba Health Population Registry

Cancer Surgery

Definition	Percentage of individuals diagnosed with cancer that had surgery within 12 months of diagnosis
Numerator	Number of cancer cases that have a surgical treatment coded in the Manitoba Discharge Abstract Database and/or Manitoba Cancer Registry
Denominator	Number of cancer cases
Exclusions	Non-Manitoba residents, individuals who have not reached one year post-diagnosis
Stratifications	Age, sex, income quintile, regional health authority of residence at diagnosis, regional health authority of first surgery, stage, type of surgical procedure, approach
Time period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data source(s)	Manitoba Cancer Registry, Discharge Abstracts Database
Methodological notes	Surgery codes included for each site are listed in "Procedure (CCI) Code" section above. All characteristics are calculated at date of earliest tumour diagnosis. Subgroup proportions (% Total) have been age standardized Colorectal surgeries where a stoma was created were included if they occurred 12 months prior to a pathological diagnosis. Breast: Only includes first surgery after diagnosis whose treatment intent in the Manitoba Cancer Registry is listed as curative or NULL (i.e. excludes prophylactic procedures).

Regional Health Authority of residence at diagnosis is the same as Regional Health Authority of first treatment.

Definition	Percentage of cases that had cancer surgery within one year of diagnosis in the same regional health authority in which they lived at diagnosis.
Numerator	Number of cases that undergo surgery within one year of diagnosis in the same RHA in which they live at diagnosis.
Denominator	Number of cases that undergo surgery within one year of diagnosis.
Exclusions	See exclusions per site; no additional exclusions
Stratifications	Age, income quintile, stage, type of surgery, approach
Time Period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data Source(s)	Discharge (Hospital) Abstract Database, Manitoba Cancer Registry

In-hospital post-operative complications

Definition	Percentage of cases that had at least one in-hospital post-operative complication recorded
Numerator	Number of cases that undergo surgery within one year of diagnosis and have one or more post-operative complications recorded in their hospital record.
Denominator	Number of cases that undergo surgery within one year of diagnosis.
Exclusions	See exclusions per site; no additional exclusions
Stratifications	Age, income quintile, stage, type of surgery, approach
Time Period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data Source(s)	Discharge (Hospital) Abstract Database, Manitoba Cancer Registry
Methodological notes	Includes only complications during admission for first procedure after diagnosis, whose treatment intent was curative or NULL. Excludes procedures where admission and separation dates were not available. Lists of complications included in the analysis are included in the “Complications CCI Codes” table above. Death was not included as a complication, but measured separately in post-operative mortality rate indicator

Length of post-operative hospital stay

Definition	Number of days between date of hospital admission and date of post-surgery discharge for cases that undergo surgery within one year of diagnosis.
Calculation	Number of days between date of hospital admission and date of post-surgery, calculated as minimum, maximum, mean, median and 90th percentile
Exclusions	Patients with multiple treatment dates within the admission Patients with a prior cancer diagnosis Patients who died prior to being discharged
Stratifications	Age, income quintile, regional health authority of residence at diagnosis, regional health authority of surgery, stage, type of surgery, approach
Time Period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data Source(s)	Discharge (Hospital) Abstract Database, Manitoba Cancer Registry
Methodological notes	Excludes procedures for which an admission and separation date were not available

Hospital readmissions

Definition	Percentage of cancer cases that underwent a surgery with curative intent within one year of diagnosis that were readmitted to hospital within 30 and 60 days of surgery.
Numerator	Number of cancer cases who had a resection within one year of diagnosis and were readmitted to a hospital within 30 or 60 days of being released from the hospital after their surgery.
Denominator	Number of cancer cases who had a resection within one year of diagnosis
Exclusions	Patients in in-hospital palliative care after surgery (i.e. never discharged in to the community)
Stratifications	Age, income quintile, regional health authority of residence at diagnosis, regional health authority of surgery, stage, type of surgery, approach
Time Period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data Source(s)	Discharge (Hospital) Abstract Database, Manitoba Cancer Registry
Methodological notes	Excludes procedures for which an admission and separation date were not available

Thirty and ninety day post-surgery mortality rate

Definition	Percentage of individuals diagnosed with cancer that undergo surgery within one year of diagnosis who die within 30, 60 or 90 days of surgery
Numerator	Number of individuals diagnosed with cancer that undergo surgery within one year of diagnosis who die within 30, 60 or 90 days of surgery
Denominator	Number of individuals diagnosed with cancer that undergo surgery within one year of diagnosis
Exclusions	See exclusions per site; no additional exclusions
Stratifications	Age, income quintile, stage, type of surgery,
Time Period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data Source(s)	Discharge (Hospital) Abstract Database, Manitoba Cancer Registry
Other Methodological Notes	Day "1" is day after surgery Death =< 30 days, =< 30 days & =<90 days (i.e. includes the 30^{th}, 60^{th}, and 90^{th} days)

Breast Quality Indicator Methodology

Re-excision rate

Definition	Percentage of cases with invasive breast cancer or DCIS that had a breast conserving surgery within one year of diagnosis, followed by another surgery within one year.
Numerator	Number of invasive breast cancer cases that had breast conserving surgery within one year of diagnosis followed by another breast conserving surgery or mastectomy within one year of the initial surgery.
Denominator	Number of invasive breast cancer cases that had breast conserving surgery within one year of diagnosis.
Exclusions	Re-excision excluded if an intervening cancer diagnosis occurs on the same breast as the first lumpectomy.
Stratifications	Age, income quintile, regional health authority of residence at diagnosis, stage
Time Period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data Source(s)	Discharge (Hospital) Abstract Database and Manitoba Cancer Registry

Negative axillary clearance rate

Definition	Percentage of invasive breast cancer cases that did not receive neoadjuvant therapy and underwent axillary clearance within one year of diagnosis with no pathological evidence of nodal metastatic disease.
Numerator	Number of invasive breast cancer cases undergoing surgical axillary clearance within one year of diagnosis found to have no nodal metastasis
Denominator	Number of invasive breast cancer cases undergoing surgical axillary clearance within one year of diagnosis
Exclusions	Tumours diagnosed at Stage IV or with unknown stage Tumours which received neoadjuvant treatment.
Stratifications	Age, income quintile, regional health authority of residence at diagnosis, and stage
Time Period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data Source(s)	Discharge (Hospital) Abstract Database and Manitoba Cancer Registry
Methodological Notes	Axillary clearance defined as any cci code that begins with 1.MD.89, 1.YM.91, or 1.YM.92. Axillary clearance must be within 1 year of diagnosis. Includes nodes taken at any previous sampling procedure.

Timeliness of breast cancer surgery

Definition	Percentage of women diagnosed with invasive breast that had a resection within 30 days of their last surgical consult
Numerator	Number of women diagnosed with invasive breast cancer that undergo definitive surgery within 30 days of surgical consult that did not receive neoadjuvant chemotherapy.
Denominator	Number of women diagnosed with invasive breast cancer that undergo definitive surgery and had a surgical consult that did not receive neoadjuvant chemotherapy.
Exclusions	Tumours diagnosed at Stage IV or with unknown stage Tumours which received neoadjuvant treatment.
Stratifications	Age, income quintile, regional health authority of residence at diagnosis, stage, type of first surgery (+/- immediate reconstruction)
Time Period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data Source(s)	Discharge (Hospital) Abstract Database, Manitoba Cancer Registry, Medical Claims Database
Methodological Notes	A surgery consult was defined as a medical claim where mdbloc is 041 or 155, tariff code 8550 and icdcm 174 Procedure must be coded as curative/NULL Neoadjuvant treatment is defined as cci code 1ZZ35CAM0, 1ZZ35HAM0, 1ZZ35YAM0, 1ZZ35CAM5, 1ZZ35HAM5, 1ZZ35YAM5, 1ZZ35CAM9, 1ZZ35HAM9, or 1ZZ35YAM9 occurring between diagnosis and first curative/NULL procedure.

Colorectal Quality Indicator Methodology

Timeliness of Surgery

Definition	Percentage of individuals diagnosed with invasive colorectal cancer that have a resection within 31 days of their colonoscopy
Numerator	Number of colorectal cancer cases that undergo surgery within 31 days of their first colonoscopy
Denominator	Total number of colorectal cancer cases that undergo surgery within one year of diagnosis and had a colonoscopy within 1 year prior to their resection
Exclusions	Individuals with multiple scopes Individuals who did not have Manitoba Health coverage for a full-year prior to resection
Stratifications	Age, Sex, income quintile, regional health authority, stage
Time period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data source(s)	Manitoba Cancer Registry, Discharge Abstracts Database

Lymph Node Removal and Examination

Definition	Percentage of colon cancer cases that have a resection within one year of diagnosis and have >=12 lymph nodes removed and pathologically examined
Numerator	Number of colon cancer cases that undergo a resection within one year of diagnosis and have >=12 lymph nodes removed and examined
Denominator	Number of colon cancer cases that undergo a resection within one year of diagnosis
Exclusions	Cases with an unknown number of nodes removed and examined
Stratifications	Age, Sex, income quintile, regional health authority, stage
Time period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data source(s)	Manitoba Cancer Registry, Discharge Abstracts Database

Circumferential Resection Margin

Definition	Percentage of rectal cancer cases that had a resection resulting in a positive circumferential resection margin
Numerator	Number of rectal cancer cases that undergo a resection within one year of diagnosis that have a positive circumferential resection margin
Denominator	Number of rectal cancer cases that undergo a resection within one year of diagnosis
Exclusions	Cases with data unknown, not applicable or not available for circumferential margin.
Stratifications	Age, Sex, income quintile, regional health authority, stage
Time period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data source(s)	Manitoba Cancer Registry, Discharge Abstracts Database
Other methodological notes	Approximately 23% of cases were excluded because the appropriate data was not entered in to the Manitoba Cancer Registry. There were no differences in age, sex, stage, income quintile, regional health authority at diagnosis, or regional health authority of first resection for cases who had and did not have circumferential resection margin data entered into the Manitoba Cancer Registry.

Ovarian Quality Indicator Methodology

Surgery conducted by gynecologic oncologists

Definition	Percentage of ovarian cancer cases treated with surgery within one year of diagnosis whose first surgery was conducted by a gynecologic oncologist.
Numerator	Number of women diagnosed with ovarian cancer that undergo surgery within one year of diagnosis whose surgery was conducted by a gynecologic oncologist.
Denominator	Total number of women diagnosed with ovarian cancer that undergo surgery within one year of diagnosis.
Exclusions	Surgeries that were unable to be linked with MD Bloc
Stratifications	Age, income quintile, regional health authority, stage, surgeon specialty
Time period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data source(s)	Manitoba Cancer Registry, Discharge Abstracts Database, Medical Claims Database
Other methodological notes	If multiple MD Blocs were assigned to the surgery, the surgery was assigned to the highest ranking specialty as follows: Gynecologic oncologist > General gynecologist > Surgical oncologist > General / other surgeons

Prostate Quality Indicator Methodology

Number of lymph nodes resected during radical prostatectomy

Definition	Number of lymph nodes removed and examined during a radical prostatectomy that occurred within one year of diagnosis among men diagnosed with prostate cancer
Numerator	Number of men with prostate cancer who undergo a radical prostatectomy within one year of diagnosis that have at least 8 (>=8) pelvic lymph nodes removed during surgery and examined.
Denominator	Number of men with prostate cancer who undergo radical prostatectomy within one year of diagnosis.
Exclusions	Cases where no lymph node data is blank, unknown (99), nodes surgically removed but number not recorded (98), number of nodes not stated (96 or 97)
Stratifications	Age, income quintile, regional health authority, stage
Time period	Diagnosis between January 1, 2010 to December 31, 2014; surgery between January 1, 2010 and December 31, 2015
Data source(s)	Manitoba Cancer Registry, Discharge Abstracts Database
Other methodological notes	Lymph node data from collaborative staging regional node examined; which is contained in the Manitoba Cancer Registry Pelvic lymph node CCI codes: 1MH87 and 1MH89