Quality and Sustainability in Cancer Control

A System Performance Spotlight Report

March 2016

Technical Appendix

1. Self-reported breast cancer screening mammograms performed on average risk women aged 40–49

Definition: Percentage of all screening mammograms performed in the past year that were reported by women aged 40–49. Results are reported by province/territory for the 2008–12 reporting years combined.
Numerator: Of the denominator, the number of women aged 40-49 who reported having a screening mammogram in the past year.
Denominator: The number of women aged 40 and older who reported having a screening mammogram in the past year due to the following reasons: family history of breast cancer, regular check-up/routine screening, age, or current use of hormone replacement therapy.
Data Source: Statistics Canada, Canadian Community Health Survey
Measurement timeframe: 2008 to 2012 combined
CCHS variables: 1. Have you ever had a mammogram that is, a breast x-ray? 2. Why did you have it? (mark all that apply): family history; part of regular check-up/routine screening; age; HRT; lump; follow-up to breast cancer treatment; breast problem; other; 3. When was the last time?
Stratification variables: Province/territory
Provinces/territories with data available: 2008: All provinces/territories; 2009: AB, NB, NS, NL, NT; 2010: AB, NB, NS, NL, NT; 2011: AB, ON, NL, NU; 2012: All provinces/territories
Province-specific notes: N/A
General notes:

1. This indicator is based on five combined years of data from the CCHS (2008–12) to reduce the variability of the estimate.
2. CCHS data are based on a representative sample which is then extrapolated to the overall population.
3. The analysis was also conducted for other age groups (50-59, 60-69, 70-74 and 75+) to show the variation across age groups.

Impact calculations:

1. **Number of mammograms** – see numerator above

    - Estimated from the Canadian Community Health Survey 2012.

2. **Number of mammograms avoided**

    - Two different scenarios for the percent reduction in the number of mammograms performed in women aged 40-49 are assumed: 15% and 50%

3. **Number of false positive results** = Number of mammograms x false positive rate

    - FP rate is assumed to be 11.1% based on reported studies[1-4]

4. **Number of false positives avoided** = Number of false positive results x % reduction / 100

    - Two different scenarios for the percent reduction in the number of false positives in women aged 40-49: 15% and 50%

5. **Cost of screening women 40-49** = Number of mammograms x cost of a mammogram

    - Cost of a mammogram is a weighted average of costs outlined in most current provincial fee schedules at the time of publication for BC ($137.40),[5] AB ($122.61),[6] MB ($117.35),[7] ON ($64.15),[8] NL ($96; G. Doyle, personal communication, 16 Dec 2015). Selected provinces are those that specified screening mammography and that included both a technical and professional (reading) fee in their costs.

6. **Cost reduction** = cost of screening women 40-49 x % reduction / 100

    - Two different scenarios for the percent reduction in the cost of screening women aged 40-49: 15% and 50%

2. Self-reported cervical cancer screening outside the recommended age range of 21–69 years

Definition: Percentage of all Pap tests that were reported by women under 21 or over 69 years of age. Results are reported by province/territory for the 2008–12 reporting years combined.
Numerator: Of the denominator, the number of women outside the recommended age group (ages 21-69) who reported receiving a Pap test in the past three years.
Denominator: The number of women aged 18 and older who reported receiving a Pap test in the past three years
Data Source: Statistics Canada, Canadian Community Health Survey
Measurement timeframe: 2008 to 2012 combined
CCHS variables: 1. Have you ever had a Pap smear test? 2. When was the last time? 3. Have you had a hysterectomy?
Stratification variables: Province/territory
Provinces/territories with data available: 2008: All provinces/territories; 2009: NS, PE, YT, NU; 2010: NS, PE, YT, NU; 2011: ON, NU; 2012: All provinces/territories
Province-specific notes: N/A
General notes:

1. This indicator is based on five combined years of data from the CCHS (2008–12) to reduce the variability of the estimate.
2. Only women aged 18 and older responded to CCHS questions about Pap tests.
3. Excludes women aged 18 and older who have had a hysterectomy.
4. CCHS data are based on a representative sample which is then extrapolated to the overall population.

Impact calculations:

1. **Number of Pap tests** – see numerator above

- Estimated from the Canadian Community Health Survey 2012.

2. **Number of Pap tests avoided**
   - Two different scenarios for the percent reduction in the number of Pap tests performed in women aged 18-20 or 70+ are assumed: 15% and 50%

3. **Number of false positive results** = Number of PAP smears x false positive rate

   - FP rate is assumed to be 3.3% (see reference 26)

4. **Number of false positives avoided** = Number of false positive results x % reduction / 100

   - Two different scenarios for the percent reduction in the number of false positives for Pap tests performed in women aged 18-20 or 70+: 15% and 50%

5. **Cost of screening women aged 18-20 and 70+** = Number of PAP smears x cost of a PAP smear

   - Cost of a PAP smear is taken from the Partnership's Cancer Risk Management Model which uses an estimate of $59.49[9]

6. **Cost reduction** = Cost of screening women aged 18-20 or 70+ x % reduction / 100

   - Two different scenarios for the percent reduction in the cost of screening women aged 18-20 and 70+: 15% and 50%

3. Locoregional treatment for patients with Stage IV cancer

Definition:

a) Percentage of patients with Stage IV colorectal cancer (CRC) undergoing colorectal resection
b) Percentage of patients with Stage IV rectal cancer receiving radiation therapy to the primary site
c) Percentage of patients with Stage IV breast cancer receiving a mastectomy or lumpectomy

Numerator: of the denominator,

a) The number of colorectal cancer patients undergoing colorectal resection within 1 year of diagnosis
b) The number of rectal cancer patients receiving radiation therapy to the primary site within 1 year of diagnosis
c) The number of breast cancer patients receiving a mastectomy or lumpectomy within 1 year of diagnosis

Denominator: The number of patients aged ≥ 18 with Stage IV a) colorectal b) rectal c) breast cancer

Data Source: Provincial cancer agencies
Measurement timeframe: 2013 treatment year
Stratification variables: Province, age (18-59, 60-69, 70+), disease site (colorectal, rectal, breast)
Provinces submitting data: AB, MB, NB, NS, PE, NL (rectal only)

Province specific notes: AB: Initial treatment was used to identify surgery and radiotherapy (Alberta Cancer Registry data). Radiotherapy to the primary site for stage IV patients might contain both curative and palliative treatments. All types of surgery were included for complete colon and rectal resection, and breast mastectomy and lumpectomy. If more than one surgical procedure was performed in the initial treatment plan, the most definitive procedures was documented. The definition of definitive is the surgical procedure with the intent to cure. There were also a few cases captured in the Alberta Cancer Registry but not in Discharge Abstract Database, which were outpatient procedures, inconsistent surgical coding, or out of province treatments. These cases were included in the result. **NL:** Surgery data were not available for fiscal year 2014-2015. As such, information would be incomplete for breast and colorectal disease sites.

General notes:

1. Stage defined according to AJCC Cancer Staging manual, 7th edition.
2. Colorectal cases identified as ICD-O-3 codes: C18.0, C18.2 to C18.9, C19.9, C20.9, C26.0. Excludes appendix C18.1, lymphoma codes M-95 to M-98, sarcoma codes – 8800/3.
3. Rectal cases identified as ICDO3 codes: C19.9 or C20.9.
4. Breast cases identified as ICDO3 codes: C50.0 to C50.9.

Impact calculations:

- Impact measures based on reductions in the amount of surgery in stage IV CRC were calculated using the Partnership's Cancer Risk Management Model (CRMM) version 2.2)[10]
- A base case scenario was constructed with the total percentage of stage IV CRC patients receiving surgery equal to 43% (the estimate obtained from combining the data submitted by provinces for this indicator).
- A scenario assuming a 15% reduction in the amount of surgery was also constructed.
    - In CRMM, Stage IV CRC patients are divided into curable (10%) and incurable (90%). The reduction in surgery was only applied to the incurable patients.
    - The patients who were spared surgery were assumed to receive chemotherapy instead.
    - CRMM models colon and rectum cancers separately, hence the reduction in surgeries was applied to colon and rectum stage IV cancers separately.
- The number of stage IV CRC patients estimated to receive surgery in 2013 and cumulated to 2030 are taken from outputs of the base case scenario

1. **The numbers of surgeries saved** in 2013 and by 2030 are calculated by subtracting the corresponding estimated number of stage IV CRC patient receiving surgery in the reduction scenario from the base case scenario

2. **The costs savings** are calculated in a similar manner using the cost estimates output from the base case and reduction scenario

3. **Number of hospital bed-days saved** = Number of surgeries saved x Average Length of Stay,

    - Average length of stay is estimated to be 8.4 days. It is calculated as the weighted length of stay for open large intestine/rectum resection without colostomy, unplanned; open large

intestine/rectum resection without colostomy, planned; endoscopic large intestine/rectum resection without colostomy.[11]

4. **Number of hours of surgery saved** = Number of surgeries saved x Average Length of Surgery,

    - Average length of surgery is estimated to be 2.25 hrs. It is calculated as the median of the range 1.5-3 hours.[12]

4. Patterns of care for patients with low-risk prostate cancer

Definition: Percentage of men with non-metastatic low-risk prostate cancer (i.e., PSA ≤ 10 ng/ml, Gleason score ≤ 6 and T1–T2a) aged 35 years or older who received different types of primary treatment.
Numerator: Of the denominator, the number of low-risk prostate cancer patients receiving primary treatment within one year of diagnosis by treatment modality.
Denominator: The number of low risk prostate cancer patients aged ≥ 35 newly diagnosed in 2011, 2012 and 2013.
Data source: Provincial cancer agencies
Measurement timeframe: 2011, 2012 and 2013 diagnosis years
Stratification variables: Province, treatment modality (Surgery only (radical prostatectomy), Radiation therapy only (external beam radiation therapy and/or brachytherapy), Surgery with adjuvant radiation therapy (adjuvant radiation therapy within one-year post surgery)).
Provinces submitting data: AB, SK, MB, NB, NS, PE
Province specific notes: AB: Only radical prostatectomy was coded as surgery. Radical prostatectomy surgeries that patients underwent outside of the province were not captured. Radiotherapy and adjuvant radiotherapy information was extracted from the Alberta Cancer Registry and compared with the electronic medical record (EMR) in Cancer Control Alberta. They were fairly consistent except a few discrepancies. Case review was conducted to check the discrepancies and identify radiation therapies that were not captured in the initial treatment in the Alberta Cancer Registry but within one year of diagnosis in EMR. These were patients under observation in the initial plan and then received radiation therapy post-initial treatment. **SK:** Both radiation therapy and surgery (radical prostatectomy) included initial procedure and surgery at review. Only radical prostatectomy surgery was included for surgery only and surgery with adjuvant radiation therapy post-surgery. **NB:** Radiation therapy data was available starting January 1, 2012. **NS:** The proportion of all prostate patients who could not be assigned a risk category was almost 20%, and many of these patients were, in fact, low risk. The exclusion of these patients from the denominator have a potential to overestimate the results since patients whose risk category could not be determined were also unlikely to have received surgery or RT. **NL:** Could not include cases diagnosed in 2013 due to treatment data issues.
General Notes:
1. Radical prostatectomy identified using CCI code: 1QT91.
2. Low risk must have ***ALL*** of the following:

- PSA ≤ 10ng/ml
- Biopsy Gleason Score ≤ 6
- Clinical Stage T1-T2a.

3. Exclude the cases which don't have valid PSA Value, or valid Biopsy Gleason Score, or valid Clinical Stage
   - Use CS Extension to extract data for Stage
   - Use CS Site-Specific Factor 8 (SSF8) to extract data for Biopsy Gleason Score
   - Use CS Site-Specific Factor 1 (SSF1) to extract data for PSA Value
   - Stage T2NOS is treated as T2c
   - Valid PSA Value: cases with known PSA value, exclude cases with SSF1=988 (not applicable), SSF1=997 (test ordered, results not in chart), SSF1=998 (test not done), SSF1=999 (unknown or no information)
   - Valid Clinical Stage: cases with clinical stage, exclude cases with error, T0, TX.
4. Exclude M1 cases.

Impact calculations:

1. **Number of low risk (LR) prostate cases (PCa) in Canada =** Number of PCa in Canada x %LR

   - **Number of PCa Canada** in 2013 is estimated as the average of the actual counts in 2010, 2011 and 2012.[13] This is done because 2013 data are not available and the 2012 actual count showed a dip that was not consistent with the trend over previous years and because of this dip Canadian Cancer Society estimates for 2013 are too high. Estimate of % LR PCa patients in Canada is calculated as the weighted average.

$$\%\ LR\ PCa = \frac{\sum_{Age\ Group}(Number\ of\ PCa\ \times\ \%\ LR)}{Total\ number\ of\ PCa}$$

   Where the number of PCa cases in each age group (35-49, 50-64, 65-79, 80+) is taken from CANSIM 201213 and the %LR in each of these age groups is taken from figure 2.3 of *Prostate Cancer Control in Canada: A System Performance Spotlight Report*.[14]

2. **Number of LR PCa patients receiving RT or surgery =**
   (Number of LR PCa x % receiving RT) + (Number of LR PCa x % undergoing surgery)

   - % receiving RT is estimated by pooling the data provided for RT use (primary and adjuvant) by the six provinces reporting this indicator
   - % undergoing surgery is estimated by pooling the data provided for surgery use (with or without RT) by the six provinces reporting this indicator

3. **Number LR PCa patients spared treatment** =
   Number of LR PCa patients receiving RT or surgery x % reduction / 100

   - Reductions of 15% and 50% are examined

4. **Cost of treating LR PCa patients with RT or surgery =**
   (Number of LR PCa receiving primary RT x cost of primary RT) +

Number of LR PCa receiving adjuvant RT x cost of adjuvant RT) +
(Number of LR PCa receiving surgery x cost of surgery)

- Cost of course of primary RT is assumed to be $9,598[15]
- Cost of course of adjuvant RT is assumed to be $2,758
- Cost of surgery is assumed to be $8149[15]

5. **Cost reduction** = Cost of treating LR PCa patients with RT or surgery x % reduction / 100

    - Reductions of 15% and 50% are examined

6. **Number of hours of surgery** = Number of LR PCa patients receiving surgery x time per surgery

    - Surgery time is assumed to be 3.5 hours (midpoint of 3-4 hours estimate)[16]

7. **Number of hours of surgery saved** = Number of hours of surgery x % reduction

    - Reductions scenarios of 15% and 50% are examined.

8. **LINAC hours** =
Number of LR PCa patients receiving primary RT x LINAC time for primary RT +
Number of LR PCa patients receiving adjuvant RT x LINAC time for adjuvant RT

    - LINAC time is assumed to be 22.5 minutes per fraction (midpoint of 15-30 minutes)[17]
    - Primary RT is assumed to be 43 fractions (midpoint of 42-44); adjuvant RT is assumed to be 34 fractions (midpoint of 32-36).[18]

9. **Number of LINAC hours saved** = Number of LINAC hours x % reduction

    - Reductions scenarios of 15% and 50% are examined.

5. Radiation fractions as part of breast conservation therapy for women with Stage I or II breast cancer

Definition: Percentage of women with Stage I or II breast cancer aged 50 or more receiving radiation therapy in 25 versus 16 fractions after breast-conserving surgery (BCS). This indicator excludes radiation boosts.
Numerator: Women aged ≥50 with Stage I and II breast cancer cases receiving 25 or 16 fractions of radiation therapy after breast conserving surgery
Denominator: Women aged ≥50 with Stage I or II breast cancer cases receiving radiation therapy after breast conserving surgery
Data source: Provincial cancer agencies

Measurement timeframe: 2013 diagnosis year
Stratification variables: Province, age (50-69, 70+), radiation fraction (16, 25)
Provinces submitting data: AB, SK, MB, NS, PE, NL
Province specific notes: AB: Initial treatment was used to identify surgery (Alberta Cancer Registry data). The CCI codes were not used by the Alberta Cancer Registry. The breast conserving surgery had been identified by a registry surgical modality variable with values 'lumpectomy' or 'Segmental resection'. If more than one surgical procedure was performed as a part of the initial treatment, the most definitive procedure was documented. The definition of definitive is the surgical procedure with the intent to cure. Radiotherapy was extracted from the electronic medical record (EMR). If a patient received multiple courses of radiotherapy, the first one after the surgery was reported. Radiotherapy is for the primary site only. **SK:** 48 patients who did receive RT were excluded since the number of fractions they received were not available. **MB:** Data reflected number of planned fractions rather than number of fractions actually delivered. **NS:** Radiation therapy must have started within 270 days of breast conserving surgery. **PE:** If patients had both surgery and radiation therapy, but radiation therapy was not within a year of diagnosis, then these patients were counted as having surgery only.
General Notes:
1. Stage defined according to AJCC Cancer Staging manual, 7th edition
2. Breast cases identified as ICD-O-3 codes: C50.0 to C50.9. Excludes male breast, lymphoma codes M-95 to M-98, sarcoma codes – 8800/3
3. Breast-conserving surgery cases are identified using CCI codes 1YM87 or 1YM88

Impact calculations:

1. **Number of Stage I/II Breast Cancer (BCa) Cases** = Number of BCa cases x % Stage I/II

    - Number of women aged 50 years or older with breast cancer is taken from CANSIM tables for 2012[13]
    - Estimate of % stage I/II (75.6%) is taken from calculations in the 2012 Cancer System Performance Report[19]

2. **Number of BCa patients receiving 25 or more fractions** =
   Number of stage I/II BCa cases x % of patients receiving 25 or more fractions

    - % of patients receiving 25 or more fractions is estimated by pooling the data provided by the six provinces reporting this indicator

3. **Number women spared extra fractions of RT** =
   Number of stage I/II BCa patients receiving 25 or more fractions x % reduction / 100

    - Reductions of 15% and 50% are examined

4. **LINAC hours saved** =
   Number of stage I/II BCa patients receiving 25 or more fractions x time per fraction of RT x Number of fractions saved x % reduction / 100

    - LINAC time saved per woman is assumed to be 22.5 minutes (.375 hours) per fraction (midpoint of 15-30 minutes)[17]

- 9 fractions are assumed to be saved (25 fractions-16 fractions); this is a slight underestimate as a small percentage of women receive more than 25 fractions
- Reductions of 15% and 50% are examined

5. **Skin and subcutaneous toxic effects avoided =**
   Number of stage I/II BCa patients receiving 25 or more fractions x % experiencing toxic effects / 100 x % reduction / 100

   - Assume that 3.8% and 5.4% of women receiving 25 fractions of RT experience skin and subcutaneous tissue toxicity respectively
   - Reductions of 15% and 50% are examined

6. **Cost reduction** = Cost of treating stage I/II BCa patients with 25 or more fractions x % reduction / 100

   - Cost of a fraction of RT is assumed to be $171.40 (CRMM version 2.2)[10]
   - 9 fractions are assumed to be saved (25 fractions-16 fractions); this is a slight underestimate as a small percentage of women receive more than 25 fractions
   - Reductions of 15% and 50% are examined

6. Fractionation of palliative radiation therapy for bone metastases in cancer patients

Definition: Percentage of all cancer patients receiving palliative radiation therapy to the bone who receive more than one fraction of radiation.
Numerator: The number of cancer patients receiving palliative radiation therapy to the bone by radiation fraction
Denominator: The number of all cancer patients aged ≥ 18 receiving palliative radiation therapy to the bone
Data source: Provincial cancer agencies
Measurement timeframe: 2013 treatment year
Stratification variables: Province, radiation fraction (1, 2-5, 6-10, 11-15, 16+)
Provinces submitting data: BC, SK, MB, NS, PE
Province specific notes: MB: The numbers reflected the treatment planned and not the actual treatment received. **NS:** A 'Palliative' intent code assigned by the treating oncologist was used to further restrict the treatment courses for analysis. **PE:** Unknown primaries were excluded. Patients diagnosed in another province but who received palliative radiation in PE were included. Potential spinal cord compression included as spine code was included.
General Notes:

1. Include invasive cancer cases with behavior code 3.
2. Exclude bone cancer, plasmacytomas and osteosarcoma.

Impact calculations:

1. **Total number of patients treated with RT to the bone =**
   Number of cancer cases in Canada x % patients receiving palliative RT

   Where % patients receiving palliative RT is the weighted average of % patients receiving RT in each reporting province and

   % patients that receive palliative RT in a province =

$$\frac{\#\ patients\ receiving\ palliative\ RT\ in\ province}{Number\ of\ cancer\ cases\ in\ province}$$

   - Numbers of cancer cases in Canada and by province are taken from CANSIM[13]

2. **Number of patients spared multiple fractions of RT=**
   Total number of patients treated with RT to the bone x proportion receiving >1 fraction x % reduction / 100

   - Reductions of 15% and 50% are examined

3. **Total number of fractions of RT saved =** Number of patients spared multiple fractions of RT x average number of fractions avoided

   - Average number of fractions avoided is estimated from data submitted by five provinces for this indicator

4. **Number of radiation-related adverse events avoided =**
   Number of patients spared multiple fractions of RT x decreased probability of a radiation related adverse event

   - Decreased probability of a radiation related adverse event from 1 fraction of RT compared to multiple fractions is estimated conservatively as 0.06 (Difference between 12% and 18%)[20]

5. **Hours of LINAC time saved =** Total number of fractions of RT saved x LINAC time for 1 fraction

   - Linear accelerator time required for 1 fraction of RT is estimated to be 22.5/60 minutes which is the midpoint of the range 15-30 minutes[17]

6. **Total cost savings** =
   Total number of fractions of RT saved x cost of one RT fraction

   - Cost of one fraction of RT is estimated as $171.40[10]

7. Chemotherapy use in the last 30 days of life

Definition: Percentage of all cancer patients who were started on a new chemotherapy regimen in their last 30 days of life.
Numerator: Of the denominator, the number of cancer patients aged ≥ 18 who were started on a new chemotherapy regimen in the last 30 days of life
Denominator: Adult patients (aged ≥ 18) who died of cancer in 2012, 2013
Data source: Provincial cancer agencies
Measurement timeframe: 2012, 2013 years of death
Stratification variables: Province, age (18-59, 60-69, 70-79, 80+)
Provinces submitting data: AB, SK, MB
Province specific notes: AB: Non-melanoma skin cancer diagnosis was excluded. The most recent diagnosis was kept if there were multiple diagnoses from one patient. The diagnosis with the highest stage was kept if there were multiple diagnoses on the same day. Chemotherapy information was extracted from the electronic medical record (EMR) online medical ordering system only. For oral chemotherapy, the chemotherapy order date was used as a proxy for treatment date. Chemotherapy delivered outside of Cancer Control Alberta was not available. Online chemotherapy order at the Associated Cancer Centres and Community Cancer Centres might not be 100% complete. Only the patients who started a new chemotherapy regimen within 30 days of death are included. **SK:** Chemotherapy included oral and intravenous (IV), since they were unable to be differentiated. Patients who started a new chemotherapy regimen within 30 days of death area included. The death data in 2013 only covers from January to July 2013, however there may still be some deaths not collected. Only behavior 3 cases have been included. **MB**: Cause of death data are not available for 2013. Chemotherapy information was only recorded once per year, so patients who started their treatment within 30 days of death were included. Oral chemotherapy was not complete in the cancer registry, but was included if it was collected. Non-melanoma skin cancer diagnosis was excluded. Only residents of Manitoba at time of death were included. Death certificate only cases were excluded.
General Notes:

1. Chemotherapy includes oral and IV chemotherapy.
2. Include all cancers (including metastatic cases).
3. Exclude non-solid tumors (except hematologic cancers).

Impact calculations:

1. **Number of patients in Canada receiving chemotherapy in last 30 days of life =**

$$\sum_{Age\ Grp} \#\ deaths\ in\ age\ grp \times \%receiving\ chemo\ in\ age\ grp\ /\ 100$$

   Number of deaths by age group (18-59, 60-69, 70-79, 80+) are taken from CANISM tables for 2011[21]

2. **Number of patients in Canada spared chemotherapy in the last 30 days of life =**
   Number of patients in Canada receiving chemotherapy in last 30 days of life x % reduction / 100

- Reductions of 15% and 50% are examined

3. **Number of patients spared fatigue as a side effect =**
   Number of patients in Canada spared chemotherapy in the last 30 days of life x probability of fatigue

   - Probability of having fatigue is estimated to be 0.89; the midpoint of 0.82-0.96[22]
   - Reductions of 15% and 50% are examined

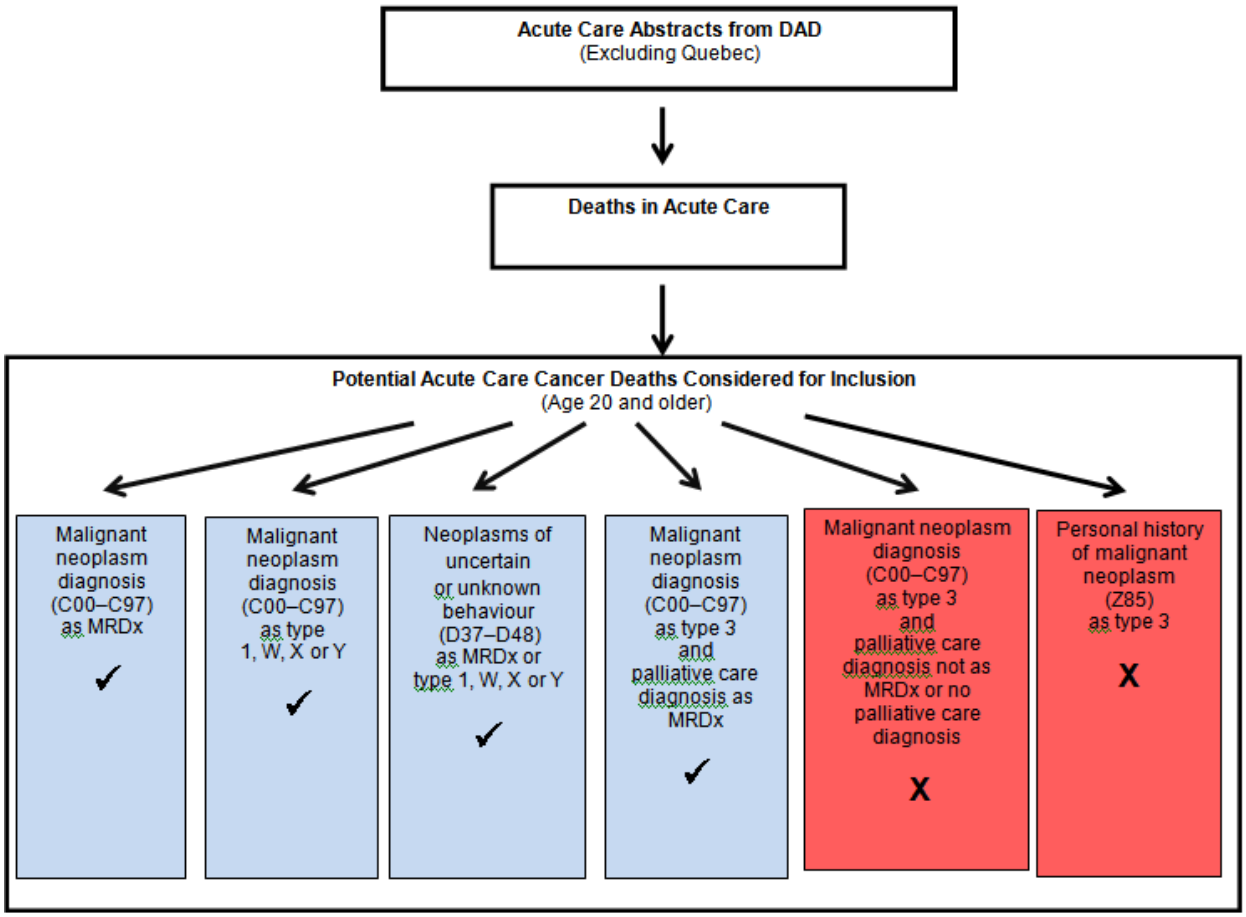
8. Intensive care use in the last two weeks of life

Definition: (1) Percentage of cancer patients admitted to an intensive care unit (ICU) in the last 14 days of life (2) percentage of cancer patients dying in an ICU.
The data are for cancer patients who were admitted to an ICU and who died in an ICU at acute-care hospitals from April 2011 to March 2014, and are reported by province.

Numerator: Of the denominator, (1) the number of cancer patients admitted to Intensive Care Unit (ICU) in their last 14 days of Life; (2) the number of cancer patients who died in an ICU**.**
Denominator: The total number of all cancer patients aged >=20 who died in hospital
Exclusions: Records submitted by Quebec facilities or records with Quebec-issued health cards
Data source: Canadian Institute for Health Information (CIHI), Discharge Abstract Database.
Measurement timeframe: 2011/12 – 2014/15 fiscal year combined
Stratification variables: Province/Territories
General Notes:

1. Territories include Nunavut, Northwest Territories and Yukon.
2. Based on patient's place of residence.
3. Cancer patients were identified using ICD-10-CA codes for either
   - A significant diagnosis of malignant neoplasm or neoplasms of uncertain or unknown behavior; or
   - A most responsible diagnosis of palliative care, with a secondary diagnosis of malignant neoplasm. (See Appendix A below on how cancer patients were selected)
4. To remove potential reporting bias, only facilities that submitted ICU data were used for the analysis.
5. Only records indicating at least one ICU visit within 14 days of death were included in the percentage of patients admitted to ICU in their last 14 days of life. All cancer patients who died in ICU, regardless of when they were admitted to an ICU, were included in the percentage of cancer patients who died in an ICU.

Appendix A



Legend

✓ Included in the study cohort.

X Excluded from the study cohort.

Notes
MRDx: most responsible diagnosis.
Type 1: significant pre-admit diagnosis.
Type W, X or Y (service transfers diagnosis): significant pre-admit diagnosis.
Type 3: secondary diagnosis.
Not shown in the diagram but also excluded were a few cases of C and D codes that had other diagnosis types.

Impact calculations:

1. **Total number of cancer patients admitted to ICU in last 2 weeks of life =**

$$\sum_{Province} (\%\ cancer\ patients\ admitted\ to\ ICU\ \times number\ of\ deaths\ due\ to\ cancer)$$

- Numbers of death due to cancer in each province in 2013 are taken from CANSIM tables for 2011[21] and scaled up proportionately to 2015 using the Canada estimate for 2015 from Canadian Cancer Statistics[23]

2. **Number of patients avoiding ICU in last 2 weeks of life =**
   Total number of patients admitted to ICU in the last 2 weeks of life x % reduction / 100

   - Reductions of 15% and 50% are examined. Reduction is applied equally across provinces.

3. **Number of ICU days saved=**
   Number of patients avoiding ICU in last 2 weeks of life x Average length of ICU visit

   - Average ICU visit is assumed to 1.6 days[24]

4. **Total cost savings** =

$$\sum_{province} \#\ pts\ avoiding\ ICU\ in\ the\ last\ 2\ weeks\ of\ life\ \times [(5{,}250\ \times proportion\ died\ in\ ICU) + (7{,}700\ \times proportion\ discharged\ from\ ICU)]$$

Cost saved by having palliative care consult rather than being admitted to ICU are $7,700 for those who are discharged and $5,250 for those who die in ICU[25]

9. Mastectomies performed as day surgeries

Definition: Percentage of mastectomies for breast cancer tumour resection that were done as day surgery. The data are for women with unilateral invasive breast cancer who had surgery between April 2009 and March 2014 and are reported by province.
Numerator: Of the denominator, the number of mastectomies performed as day surgery.
Denominator: Total number of mastectomies performed for women aged ≥ 18.
Exclusion**:**

1. Potential duplicate records are identified as discharges with identical values in some of the data elements. In the event that duplicate records are found, the most recent record is retained, the remaining duplicate records are removed.
2. Invalid Health Card Number.
3. Procedures coded as abandoned.
4. Newborns, stillbirths and cadaveric donors.
5. Invalid procedure date.
6. No discharge procedure laterality assigned.
7. Invalid postal codes.

Data source: Canadian Institute for Health Information; Hospital Morbidity Database (HMDB); National Ambulatory Care Reporting System; Alberta Ambulatory Care Reporting System.
Measurement timeframe: 2008/09 – 2010/11 fiscal year combined; 2011/12 – 2013/14 fiscal year combined.
Stratification variables: Province/Territories.
General Notes:

1. Patients receiving a mastectomy anywhere within the discharge record containing the surgical episode associated with the patient's first breast resection are considered mastectomy cases.
2. Territories include Nunavut, Northwest Territories and Yukon.
3. Based on patient's place of residence.
4. Data are collected annually for each individual fiscal year. Since estimates for multiple fiscal years combined require the addition of individual years of data, fiscal years with suppressed data owing to small numbers could not be included in the calculation.

Impact calculations:

1. **Number of inpatient mastectomies switched to day surgery =**
   Number of mastectomies performed in hospital 2013/14 x % reduction / 100

   - Reductions of 15% and 50% are examined.
   - This also gives number of overnight hospital stays avoided, as the average number of nights in hospital for mastectomy are assumed to be 1.

2. **Total cost savings** =
   Number of inpatient mastectomies switched to day surgery x difference in cost between inpatient and day-surgery mastectomy

   - Reductions of 15% and 50% are examined
   - Cost difference between inpatient and day-surgery mastectomy is assumed to be $1,777. This is calculated assuming an average cost of unilateral mastectomy of $4,627 regardless of location[11]; the percentage of mastectomies done in hospital is 70% (data provided by CIHI for this report) and that a day-surgery mastectomy is 0.65% the cost of an inpatient mastectomy.[26] Using this information, the cost of a unilateral mastectomy done in hospital is estimated to be $5,164 and one done as day surgery, $3,387.
   - Costs for unilateral surgery are used because this is the common type and because day surgery is more likely to be appropriate for unilateral mastectomies.

References

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