The Delivery of Radical Prostatectomy to Treat Men With Prostate Cancer

Technical Notes

Health System Performance

Canadian Institute for Health Information
Institut canadien d'information sur la santé

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The Delivery of Radical Prostatectomy to Treat Men With Prostate Cancer: Technical Notes

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b) National Ambulatory Care Reporting System (NACRS), 2006–2007 to 2012–2013

1.2) Alberta Health

a) Alberta Ambulatory Care Reporting System (AACRS), 2006–2007 to 2012–2013

2. Analytical Population: Inclusions and Exclusions

The analytical population includes all inpatient and day surgery records from the HMDB, NACRS and AACRS from 2006–2007 to 2012–2013 for male patients of all ages whose discharge record contains a treatment for prostate cancer (see Appendix A for case identification).

2.1) HMDB

a) Inclusion criteria

i) Discharged from acute care or day surgery

- ANALYTICAL_INST_TYPE_CODE in (“1” or “A”)

ii) Discharge must have a valid male gender recorded

- Gender in (“M”)

b) Exclusion criteria

i) Duplicate records

- Potential duplicate records were removed from the analysis. These were identified as discharges with identical values in the following data elements:

  INST_CODE, HEALTH_CARD_ENCRPT_NUM, ADMISSION_DATE, ADMISSION_TIME, DISCHARGE_DATE, DISCHARGE_TIME, HEALTH_CARD_PROV_CODE, BIRTHDATE, GENDER, POSTAL_CODE, MR_DIAG_ICD10_CODE, PRINC_INTERV_CCI_CODE

ii) Newborns, stillbirths and cadaveric donors

- If ENTRY_CODE not in (“S” or “N”)
- If ADMISSION_CATEGORY not in (“R”)

iii) Discharges with an invalid encrypted health card number

- HEALTH_CARD_ENCRYPT_NUM = “0000000000”

iv) All identified procedures with status attribute code “A” (abandoned)

- STATUS_ATTRIBUTE not in (“A”)

2.2) NACRS

a) Inclusion criteria

i) Discharge must have a valid male gender recorded

- Gender in (“M”)

b) Exclusion criteria

i) Duplicate records

- Potential duplicate records were removed from the analysis. These were identified as discharges with identical values in the following data elements:

  FACILITY_AM_CARE_NUM, HEALTH_CARD_ENCRPT_NUM, DATE_OF_REGISTRATION, REGISTRATION_TIME, DISPOSITION_DATE, DISPOSITION_TIME, HEALTH_CARD_PROV_CODE, BIRTHDATE, GENDER, POSTAL_CODE

ii) Discharges with an invalid encrypted health card number

- HEALTH_CARD_ENCRYPT_NUM = “000000000000”

iii) All identified procedures with status attribute code “A” (abandoned)

2.3) AACRS

a) Inclusion criteria

i) Discharge must have a valid male gender recorded

- Gender in (“M”)

b) Exclusion criteria

i) Duplicate records

- Potential duplicate records were removed from the analysis. These were identified as discharges with identical values in the following data elements:

  INST, HEALTH_CARD_ENCRYPT_NUM, STDATE, STHOUR, ENDDATE, ENDHOUR, DOB, SEX, POSTCODE, MDIAG, MINT

ii) Discharges with an invalid encrypted health card number

- HEALTH_CARD_ENCRYPT_NUM = “000000000000”

iii) All identified procedures with status attribute code “A” (abandoned)

- STATUS_ATTRIBUTE not in (“A”)

2.4) We used the Organization ID (OI) to identify the location of surgery. Using the data source and procedure date, we obtained the OI code from the SAS table OI_view.submission_activity. We then used the SAS table OI_view.organization to obtain the postal code. We used the OI postal code in Statistics Canada’s Postal Code Conversion File+ (PCCF+) to obtain the facility’s province.

3. Unit of Analysis: Hospitalizations Based on Episode of Care

Note: This section applies to only the hospitalization portion of the analyses (HMDB data).

A unique patient ID was created using

- HEALTH_CARD_ENCRPT_NUM + person_birthyear.

An episode of care refers to all contiguous acute care hospitalizations. To construct an episode of care, transfers within and between facilities were linked. A transfer was assumed to have occurred if either of the following conditions was met:

- An acute care hospitalization occurred within six hours of discharge from a previous acute care hospitalization, regardless of whether a transfer was coded
  - Readmit_date&time − Previous discharge_date&time ≤ 6

OR

- An acute care hospitalization occurred between 6 and 24 hours after discharge from a previous acute care hospitalization and at least one hospitalization was coded as a transfer
  - 6 < Readmit_date&time − Previous discharge_date&time ≤ 24

  AND
  - Transfer_to/from_institution_type in (“1” or “E” or “N”) for at least one of the hospitalizations

4. Predictors and Risk-Adjustment Model

Three surgical outcomes were examined in this study. The time period for all outcome analyses was 2009–2010 to 2012–2013.

Surgical Outcome Variables

1. Total length of stay (LOS) days
   - Total LOS for an episode of care (EP_TOTAL_LOS_DAYS) was calculated by summing up TOTAL_LOS_DAYS on each separation record within the episode.
   - If there was only one separation record in the episode of care, EP_TOTAL_LOS_DAYS = TOTAL_LOS_DAYS.
2. Surgery duration
   - Data was not available for Quebec.
   - Surgery duration = EPISODE_DURATION_MINS (intervention table).
   - Surgery duration is from the time a patient enters the operating room to the time he leaves the operating room.
3. Readmission
   - An acute care readmission occurred between 24 hours and 30 days of the discharge of the index discharge.
   - Includes only unscheduled readmissions (Admission Category = “U”).

Methodology

- Logistic regression models were used to measure the strength of association of readmission with selected risk factors.
- Linear regression models (with outcome variable transformed using the natural log) were used to measure the strength of association of surgery duration with selected risk factors.
- Linear regression models (with outcome variable log transformed using the natural log) were used to measure the strength of association between LOS with selected risk factors.

Note: The regression coefficients can be found in Appendix C.

- In this study, variation across jurisdictions was determined based on the location of the submitting facility, which may be different from the patient's place of residence.
- To compare readmission rates across jurisdictions, age-standardized readmission rates were calculated. Adjustment was accomplished by first multiplying the age-specific readmission rates by age-specific weights. The weights used were the proportion of the 1991 Canadian population within each age group. The weight rates were then summed by province to give the age-adjusted readmission rates for each jurisdiction.
- Risk factors included in the models were
  - Patient comorbidity based on Charlson group;
  - Age at the time of surgery;
  - Hospital volume at the time of surgery;
  - Fiscal year in which surgery took place; and
  - Type of surgery: open, robotic or non-robotic (see Appendix A for definitions).

Note: We did not risk-adjust for LOS and surgery duration.

Appendix A: Defining the Cohort of Patients With Prostate Cancer Who Underwent Treatment

Records were included if they had

- A most responsible diagnosis (MRDx) of prostate cancer (C61) with at least one of the intervention codes from the table below on the abstract. The procedure status for the intervention code could not be abandoned.

Diagnostic Code	Code Title
C61	Malignant neoplasm of prostate
Z85.4	Personal history of malignant neoplasm of genital organs (mandatory)

Intervention CCI Code	Intervention CCI Description
1.QT.91	Excision radical, prostate
1.QT.91.PB; 1.QT.91.PK	Excision radical, prostate—Open Surgery
1.QT.91.DA; 1.QT.91.BQ	Excision radical, prostate—Laparoscopic Surgery
1.QT.91.BQ	Excision radical, prostate—Robotic Assistance (2009 to 2011)
7.SF.14	Excision radical, prostate—Robotic Assistance (2012)
1.QT.59	Destruction, prostate
1.PM.91	Excision radical, bladder
1.PM.92	Excision radical with reconstruction, bladder

Note
CCI: Canadian Classification of Health Interventions.

Surgical Cohort

An individual with an index procedure

1) Has surgery (one of 1.QT.91) on the index procedure;
2) Has an MRDx = C61; and
3) Has no past history of prostate cancer (Z85.4).

Type of Surgery

1) Open surgery: Intervention code (1.QT.91.PB or 1.QT.91.PK)
2) Minimally invasive: Intervention code (1.QT.91.DA or 1.QT.91.BQ or 7.SF.14)
    a. Laparoscopic only: Intervention code (1.QT.91.DA)
    b. Robotic only:
        i. 2009–2010 to 2011–2012: Intervention code (QT.91.BQ)
        ii. 2012–2013: Must be minimally invasive and have intervention code (7.SF.14)

Appendix B: Charlson Index

The Charlson Index is an overall comorbidity score that has been shown to be highly associated with mortality and has been widely used in clinical research. Based on Quan's updated methodology,[1] the comorbid conditions below were used to calculate the Charlson Index score for each record. Conditions within each group were counted only once (e.g., if I43 and I50 appeared on the abstract, the score was 2). If conditions from different groups were present on the abstract, their weights were summed (e.g., if I50 and F00 were present on the abstract, the score was 4).

Comorbid Condition	ICD-10 Codes (First Three or Four Digits, as Specified)	Weight
Congestive heart failure	I099, I255, I420, I425, I426, I427, I428, I429, I43, I50	2
	P290	
Dementia	F00, F01, F02, F03, F051	2
	G30, G311	
Chronic pulmonary disease	I278, I279	1
	J40, J41, J42, J43, J44, J45, J47, J60, J61, J62, J63, J64, J65, J66, J67, J684, J701, J703	
Connective tissue disease/ rheumatic disease	M05, M06, M315, M32, M33, M34, M351, M353, M360	1
Mild liver disease	B18	2
	K700, K701, K702, K703, K709, K713, K714, K715, K717, K73, K74, K760, K762, K763, K764, K768, K769	
	Z944	
Diabetes with complications	E102, E103, E104, E105, E107, E112, E113, E114, E115, E117, E132, E133, E134, E135, E137, E142, E143, E144, E145, E147	1
Paraplegia and hemiplegia	G041, G114, G801, G802, G81, G82, G830, G831, G832, G833, G834, G839	2
Renal disease	N032, N033, N034, N035, N036, N037, N052, N053, N054, N055, N056, N057, N18, N19, N250	1
	Z490, Z491, Z492, Z940, Z992	
Cancer	C00, C01, C02, C03, C04, C05, C06, C07, C08, C09, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C30, C31, C32, C33, C34, C37, C38, C39, C40, C41, C43, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C60, C61, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C81, C82, C83, C84, C85, C88, C90, C91, C92, C93, C94, C95, C96, C97	2
Moderate or severe liver disease	I850, I859, I864, I982	4
	K704, K711, K721, K729, K765, K766, K767	
Metastatic carcinoma	C77, C78, C79, C80	6

Diagnosis types 1, W, X and Y were used to calculate the Charlson score. As of February 2012, type 3 codes for the following conditions are also included (to account for coding and classification standards):

- Asterisk codes (coded at the second position in the abstract): I43, F00, F02, M360, I982
- Diabetes codes in the "Diabetes with complications" group: E102, E103, E104, E105, E107, E112, E113, E114, E115, E117, E132, E133, E134, E135, E137, E142, E143, E144, E145, E147
- Cancer and metastatic carcinoma codes, when a patient's diagnosis group is not cancer (does not start with "C")

The following exclusions were applied:

- For cases without a type 6 diagnosis code:
  - If a patient had a qualifying Charlson diagnosis code as type 1, W, X, Y or 3 (for selected cases), and this same code also appeared as the MRDx or type 2, then this type 1, W, X, Y or 3 code was not included in the Charlson calculation.
- For cases with a type 6 diagnosis code:
  - The original type 6 code is not included in the Charlson calculation.
  - The original MRDx is included in the Charlson calculation if this diagnosis code is not also a type 2 code.
  - If a patient had a qualifying Charlson diagnosis code as type 1, W, X, Y or 3 (for selected cases), and this same code also appeared as type 6 or type 2, then this type 1, W, X, Y or 3 code was not included in the Charlson calculation.
- For all cases:
  - When the MRDx was not used to determine a diagnosis group, the diagnosis used to assign the diagnosis group was not counted in the Charlson calculation. For example, if a patient had an MRDx of care involving use of rehabilitation procedures (Z50) and also had a stroke (I61) as a preadmission diagnosis, the diagnosis group would be I61. Accordingly, the I61 diagnosis was not included in the Charlson Index score calculation.

The following illustrates how the Charlson score is assigned.

Outside Quebec, if the sum of all Charlson weights is equal to 0, the patient is in Charlson group 0. If the sum of all weights is 1 or 2, then the patient is in Charlson group 1. If the sum of all weights is 3 or more, then the patient is in Charlson group 2.

Due to differences in data collection, it is not possible to distinguish comorbidities from secondary diagnoses in Quebec. Therefore, Charlson score groups for Quebec patients are assigned differently in order to achieve comparability across the country: patients with a score of 0 or 1 are in group 0, patients with a score of 2, 3 or 4 are in group 1 and patients with a score of 5 or more are in group 2.

	Charlson Score	
Charlson Group	Outside Quebec	In Quebec
0	0	0 and 1
1	1 and 2	2, 3 and 4
2	3+	5+

Appendix C: Predictive Model Coefficients

1) Length of Stay

Coefficient	Estimate	Standard Error	Pr > |t|	95% Confidence Limits	
Intercept	1.072	0.0300	<0.0001	1.0132	1.1306
Age in Years	0.004	0.0005	<0.0001	0.0033	0.0051
Fiscal Year: 2012 vs. 2009	-0.133	0.0088	<0.0001	-0.1507	-0.1162
Fiscal Year: 2011 vs. 2009	-0.078	0.0083	<0.0001	-0.0939	-0.0612
Fiscal Year: 2010 vs. 2009	-0.035	0.0083	<0.0001	-0.0515	-0.0189
Hospital Volume	-0.001	0.0000	<0.0001	-0.0013	-0.0012
Charlson Group 2 vs. 0	0.027	0.0188	0.1542	-0.0101	0.0638
Charlson Group 1 vs. 0	0.115	0.0216	<0.0001	0.0724	0.1571
Approach: Robotic vs. Open	-0.532	0.0761	<0.0001	-0.6812	-0.3829
Approach: Laparoscopic vs. Open	-0.297	0.0836	0.0004	-0.4605	-0.1328
Age in Years × Approach: Robotic	-0.003	0.0012	0.0223	-0.0050	-0.0004
Age in Years × Approach: Laparoscopic	-0.003	0.0013	0.0327	-0.0053	-0.0002
Hospital Volume × Approach: Robotic	0.002	0.0001	<0.0001	0.0018	0.0021
Hospital Volume × Approach: Laparoscopic	0.001	0.0001	<0.0001	0.0008	0.0013
2012–2013 × Approach: Robotic	-0.014	0.0233	0.5403	-0.0598	0.0313
2012–2013 × Approach: Laparoscopic	0.051	0.0252	0.0437	0.0014	0.1003
2011–2012 × Approach: Robotic	0.010	0.0239	0.6791	-0.0369	0.0567
2011–2012 × Approach: Laparoscopic	0.042	0.0243	0.0864	-0.0060	0.0893
2010–2011 × Approach: Robotic	0.038	0.0250	0.1244	-0.0106	0.0873
2010–2011 × Approach: Laparoscopic	0.009	0.0242	0.7201	-0.0387	0.0560

Bonferroni Test (Compare Surgery Approach)

Approach	log_LOS LSMEAN	LSMEAN Number
Robotic	0.70937336	1
Laparoscopic	0.85205101	2
Open	1.17298247	3

Least Squares Means for Effect Approach Pr > |t| for H0: LSMean(i) = LSMean(j) Dependent Variable: log_LOS			
i/j	**1**	**2**	**3**
1		<0.0001	<0.0001
2	<0.0001		<0.0001
3	<0.0001	<0.0001	

2) Surgery Duration

Parameter	Estimate	Standard Error	Pr > |t|	95% Confidence Limits	
Intercept	5.184	0.0222	<0.0001	5.140	5.227
Age in Years	0.000	0.0004	0.2756	-0.001	0.000
Hospital Volume	0.000	0.0000	<0.0001	0.000	0.000
Charlson Group 2 vs. 0	0.102	0.0135	<0.0001	0.076	0.129
Charlson Group 1 vs. 0	0.068	0.0157	<0.0001	0.037	0.099
Approach: Robotic vs. Open	0.473	0.0552	<0.0001	0.365	0.581
Approach: Laparoscopic vs. Open	0.548	0.0641	<0.0001	0.422	0.673
Age in Years × Approach: Robotic	0.001	0.0009	0.3584	-0.001	0.002
Age in Years × Approach: Laparoscopic	-0.003	0.0010	0.0075	-0.005	-0.001
Charlson Group 2 × Approach: Robotic	-0.187	0.0434	<0.0001	-0.272	-0.102
Charlson Group 2 × Approach: Laparoscopic	-0.066	0.0468	0.1581	-0.158	0.026
Charlson Group 1 × Approach: Robotic	-0.149	0.0478	0.0019	-0.242	-0.055
Charlson Group 1 × Approach: Laparoscopic	-0.123	0.0480	0.0105	-0.217	-0.029
Hospital Volume × Approach: Robotic	-0.001	0.0001	<0.0001	-0.001	-0.001
Hospital Volume × Approach: Laparoscopic	-0.001	0.0001	<0.0001	-0.001	-0.0005

Bonferroni Test (Compare Surgery Approach)

Approach	log_DUR LSMEAN	LSMEAN Number
Robotic	5.48244977	1
Laparoscopic	5.43673332	2
Open	5.19663468	3

Least Squares Means for Effect Approach Pr > |t| for H0: LSMean(i) = LSMean(j) Dependent Variable: log_DUR			
i/j	**1**	**2**	**3**
1		0.3758	<0.0001
2	0.3758		<0.0001
3	<0.0001	<0.0001	

3) Readmissions

Parameter	Estimate	Standard Error	Pr > ChiSq
Intercept	-4.338	0.361	<0.0001
Age in Years	0.021	0.005	<0.0001
Hospital Volume	0.001	0.001	0.1036
Charlson Group 1 vs. 0	0.215	0.155	0.1666
Charlson Group 2 vs. 0	0.146	0.145	0.3128
Approach: Laparoscopic vs. Open	0.138	0.152	0.3645
Approach: Robotic vs. Open	-0.330	0.179	0.0643
Hospital Volume × Approach: Laparoscopic	-0.001	0.001	0.5065
Hospital Volume × Approach: Robotic	0.002	0.001	0.0324

Note
Approach (type of surgery) was not significant, so we did not do any further analyses.

Reference

1. Quan H, Li B, Couris CM, et al. Updating and validating the Charlson comorbidity index and score for risk adjustment in hospital discharge abstracts using data from 6 countries. *Am J Epidemiol*. 2011;173:676-682.

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