



Centre universitaire de santé McGill  
McGill University Health Centre

*Les meilleurs soins pour la vie  
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# Active surveillance for low-risk Prostate Cancer Compared with Immediate Treatment: A Canadian cost evaluation

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# Introduction

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## Clinical and economic burden of prostate cancer

- 122 per 100,000 persons-years (twice the lung and colorectal cancer incidence rate);
- The five-year survival rate is estimated at 96%;
- The lifetime direct medical costs of the 1998 Canadian cohort of newly diagnosed - \$9.8 billion (Grover, 2000);
- In 1998, the hospitalization and drug costs - \$100 million (Health Canada);
- Similar cost estimates in US or other countries.

# **Introduction**

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**Active surveillance (AS)** *“involves actively monitoring the course of the disease with the expectation to intervene with curative intent if the cancer progresses”*;

## **Immediate Treatment (IT):**

- surgery (radical prostatectomy);
- radiation therapy (external beam radiation and brachytherapy);
- androgen deprivation therapy (ADT).

## **Advantages of AS over IT:**

- especially for older men and/or those with a low life expectancy;
- in those with good life expectancy AS may allow the preservation of quality of life since active treatment carries significant morbidity (urinary, sexual, and bowel dysfunction);

# Introduction

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**Hayes et al.** Active surveillance compared with initial treatment for men with low-risk prostate cancer: a decision analysis. (JAMA, 2010)

When quality of life associated with the clinical discomfort of initial treatment and psychological discomfort of living under AS were taken into consideration:

- AS 11.07 QALE;
- Brachytherapy 10.57 QALE
- Intensity-modulated radiation therapy 10.51 QALE
- Radical prostatectomy 10.23 QALE.

# Introduction

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**US study:** AS versus IT (Keegan et al., Cancer 2012)

- Objective: To evaluate costs associated with the AS strategy integrating delayed treatment compared to the IT by the US health system perspective;
- Over a 6-year period, the AS strategy is estimated to save 16,042 \$ per patient (95%CI: \$16,039-\$16,046) when compared to IT; The average cost per patient within the IT strategy was estimated at \$40,066.
- Not accounted for disease recurrence and mortality.

# Objectives

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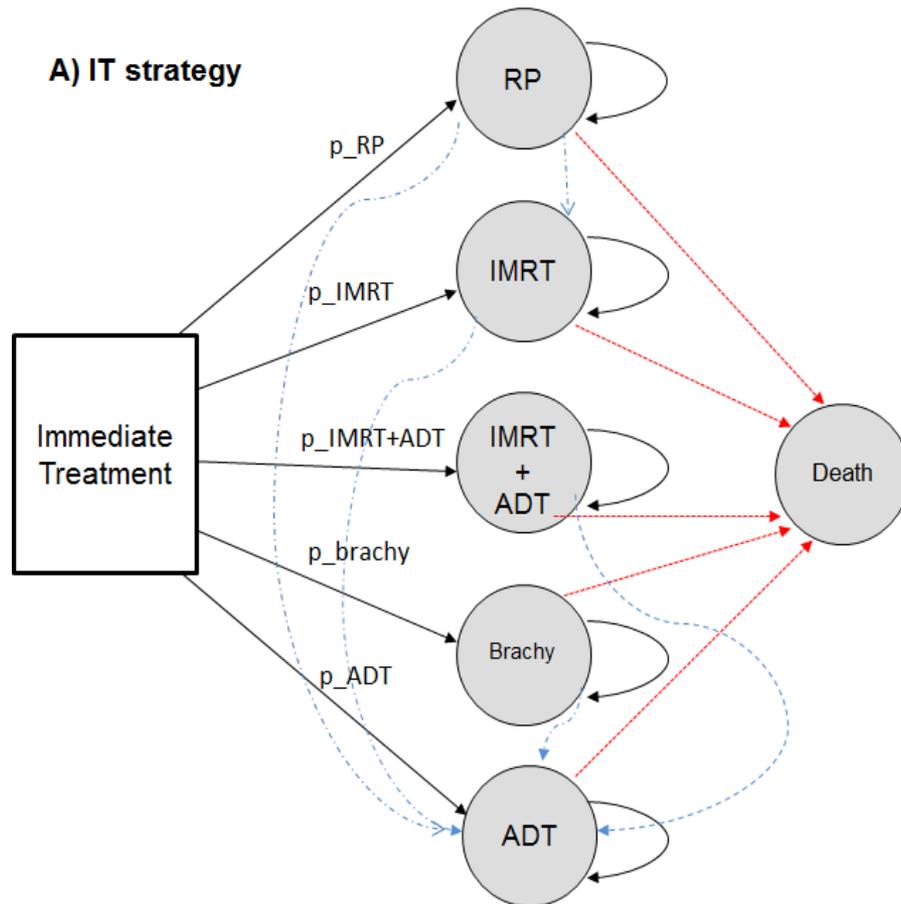
Clinical practice of prostate cancer is similar between US and Canada, but cost of healthcare services is likely quite different;

Study objectives:

1. To evaluate the costs associated with AS and IT strategies in Canada (Quebec's public health system);
2. To estimate costs including disease recurrence and mortality rate;
3. To compare the US and Canadian cost estimates.

# Methods

**Modeling approach** : Markov model with microsimulations (1-year cycles); Model accounting for mortality and recurrence requiring treatment



Model's assumptions: Canadian active surveillance cohort (Klotz et al., J Clin Oncol. 2010)

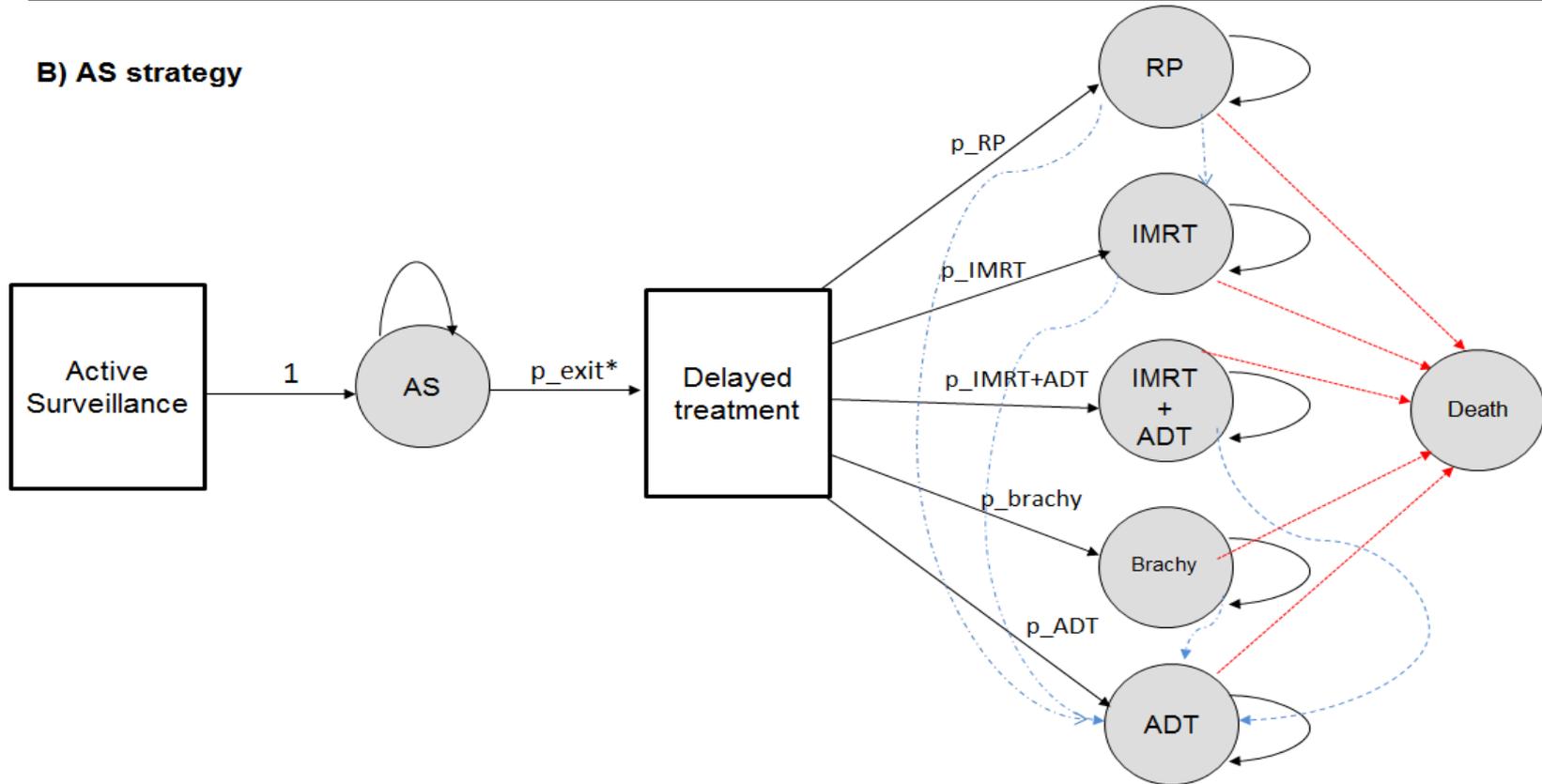
- 10-year overall survival of 68%;
- 5-year recurrence-free survival of 47% (AS) and 87% (IT);

*Corresponding to:*

- 1-year probability of death of 0.038 (similar to Statistics Canada estimates for the general population aged 65 to 89 years old);
- 1-year probability of recurrence receiving additional treatment of 0.139 (AS receiving AT) and 0.0257 (IT).

# Methods

## B) AS strategy



## Model's assumptions

Canadian active surveillance cohort (Klotz et al., J Clin Oncol. 2010)

- Probability of receiving delayed tx of: 0.08, 0.04 and 0.021;
- Tx distribution: 0.26 RP, 0.34 IMRT, 0.13 IMRT plus ADT, 0.20 brachytherapy and 0.074 ADT

# Methods

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## Cost assignments

- Canadian dollars (\$) and estimated from the 2012 Quebec's public health system perspective;
- The cost of AS and treatments were categorized into:
  - *initial cost* assigned in the first year; and
  - *follow-up cost* assigned over the following 5-year and 10-year period, respectively.

# Methods

## Cost components

Source

|   |                        |
|---|------------------------|
| Initial office consultation - urology                                     | RAMQ list (15)         |
| Initial office consultation - radiation oncology                          | RAMQ list (15)         |
| Urologist reimbursement for prostate biopsy                               | RAMQ list (15)         |
| Prostate biopsy   |                        |
| pathology   | MGH internal estimates |
| professional and technical fees   | MGH internal estimates |
| Prostate analysis after surgery   |                        |
| pathology   | MGH internal estimates |
| professional and technical fees   | MGH internal estimates |
| PSA test  | MGH internal estimates |
| office visits - urology   | RAMQ list (15)         |
| office visits - radiation oncology  | RAMQ list (15)         |
| Urologist reimbursement for radical prostatectomy                         | RAMQ list (15)         |
| Radio-oncologist reimbursement for radiation therapy                      |                        |
| computed tomography planning + IGRT plan                                  | RAMQ list (15)         |
| IMRT radiation session (includes office visit, image fusion and checking) | RAMQ list (15)         |
| dose planning +ultrasound guidance + interstitial seed implantation       | RAMQ list (15)         |
| medication costs (Zoladex implant each 3 months)                          | RAMQ list (16)         |
| nursing (average salary/month)  | MGH internal estimates |
| Surgical procedure  |                        |
| operating room  | CADTH 2011 (18)        |
| surgical supplies   | CADTH 2011 (18)        |
| Brachytherapy procedure (Pd-103)  | CETS 2000 (19)         |
| IMRT procedure  | Yong et al. 2012 (17)  |
| anesthesia for surgery  | MGH internal estimates |
| anesthesia for brachytherapy  | MGH internal estimates |
| hospitalisation ( mean cost per diem)*                                    | Med-Echo               |

# Methods

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## Cost analyses

Treatment course and associated cost of 12,750 incident subjects initially on AS and 12,750 incident subjects assigned to IT, was simulated over the 6-year and 11-year period by applying the corresponding Markov models.

The number of incidence prostate cancer candidates to AS was based on:

- 1) 50% of incident prostate cancer are candidates to AS;
- 2) 2012 Canadian incidence rate of prostate cancer;

# Results

## Cost of treatments and cost of active surveillance for prostate cancer; Initial and 5-year cost (2012 Canadian \$)

| Treatment type        | Initial  | 5-year period of follow-up |
|-----------------------|----------|----------------------------|
| Active surveillance   | \$1,224  | \$1,767                    |
| Radical prostatectomy | \$6,717  | \$929                      |
| IMRT                  | \$12,538 | \$618                      |
| IMRT + ADT            | \$14,721 | \$618                      |
| Brachytherapy         | \$6,390  | \$618                      |
| Primary ADT           | \$5,136  | \$23,202                   |

IMRT = intensity-modulated radiation therapy; ADT = androgen deprivation therapy

# Results

## Cost estimates under AS and IT strategies over the first year and 5 to 10 years of follow-up:

|   | Mortality rate* | Recurrence rate* | Discount rate* | Mean cost (95% CI) <sup>§</sup><br>(per patient) | Cost difference (IT versus AS) |          |
|---|-----------------|------------------|----------------|--|--------------------------------|----------|
|   |                 |                  |                |  | absolute                       | relative |
| <i>First year and 5 years of follow-up</i>  |                 |                  |                |  |                                |          |
| Active surveillance                         | 3.8%            | 13.9%            | -              | \$6,072 (\$5,957 to \$6,187)                     | \$7,250                        | 54.4%    |
|   | 3.8%            | 13.9%            | 5%             | \$5,442 (\$5,341 to \$5,544)                     | \$7,166                        | 56.8%    |
| Immediate Treatment                         | 3.8%            | 2.57%            | -              | \$13,322 (\$13,195 to \$13,449)                  |                                |          |
|   | 3.8%            | 2.57%            | 5%             | \$12,608 (\$12,501 to \$12,714)                  |                                |          |
| <i>First year and 10 years of follow-up</i> |                 |                  |                |  |                                |          |
| Active surveillance                         | 3.8%            | 13.9%            | -              | \$10,267 (\$10,052 to \$10,482)                  | \$7,700                        | 42.9%    |
|   | 3.8%            | 13.9%            | 5%             | \$8,493 (\$8,323 to \$8,664)                     | \$7,428                        | 46.7%    |
| Immediate Treatment                         | 3.8%            | 2.57%            | -              | \$17,967 (\$17,717 to \$18,217)                  |                                |          |
|   | 3.8%            | 2.57%            | 5%             | \$15,921 (\$15,735 to \$16,106)                  |                                |          |

# Results

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## Simulated PCa management and death:

### 6-year period:

- 2,767 (21%) have received delayed treatment,
- 374 (2.9%) have received delayed treatment and died;
- 2,306 (18.1%) died on AS;
- 7,303 (57.3%) still on AS.

### 11-year period:

- 2,833 (22.2%) have received delayed treatment;
- 924 (7.2%) have received delayed treatment and died;
- 3,527 (27.7%) died on AS;
- 5,366 (42.9 %) still on AS.

# Results

**Total cost and possible cost savings corresponding to an annual cohort of 12,750 patients with prostate cancer:**

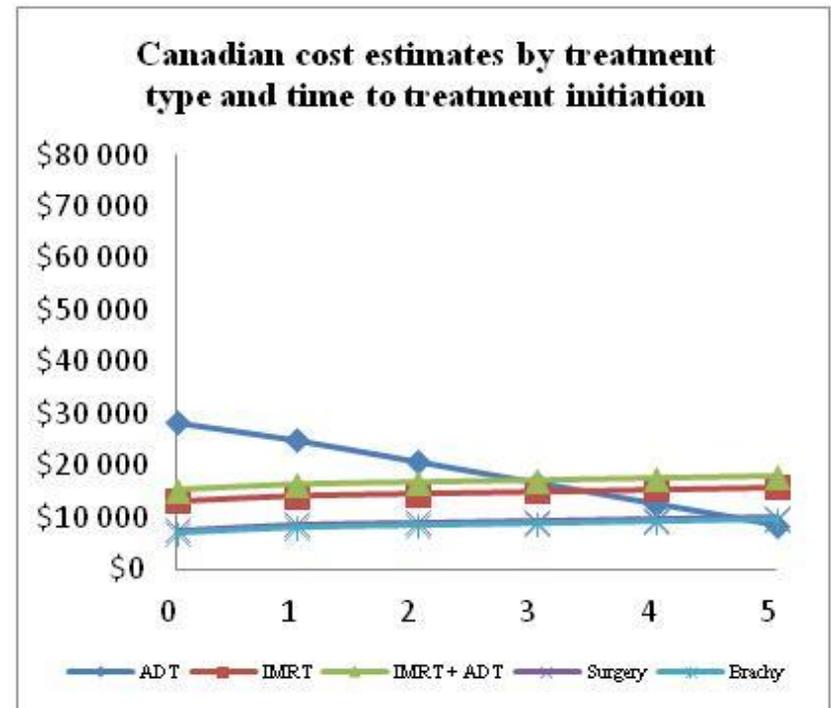
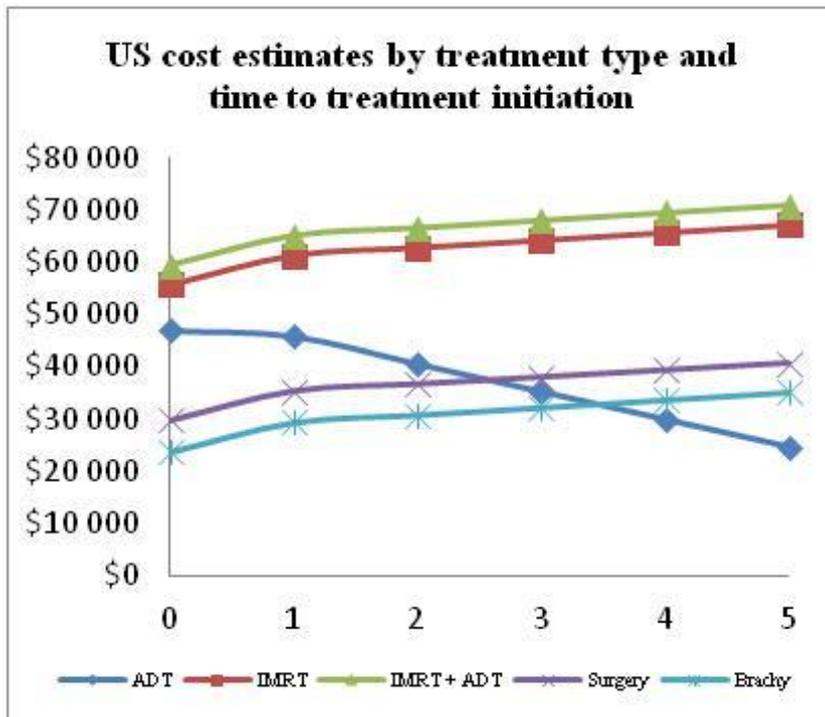
| Treatment status                                   | %           | N             | Mean cost per patient |                 | Total cost           |                      | Cost difference per patient AS versus IT | Total cost difference            |
|--|-------------|---------------|-----------------------|-----------------|----------------------|----------------------|--|----------------------------------|
|  |             |               | AS strategy           | IT strategy     | AS strategy          | IT Strategy          |  |                                  |
| <b><i>First year and 5 years of follow-up</i></b>  |             |               |                       |                 |                      |                      |  |                                  |
| Patients requiring treatment                       | 24.6%       | 3,141         | \$15,869              | \$13,322        | \$49,844,529         | \$41,844,402         | \$2,547                                  | \$8,000,127*                     |
| Patients not requiring treatment                   | 75.4%       | 9,609         | \$2,753               | \$13,322        | \$26,453,577         | \$128,011,098        | -\$10,569                                | -\$101,557,521**                 |
| <b>Total</b>                                       | <b>100%</b> | <b>12,750</b> | <b>\$6,072</b>        | <b>\$13,322</b> | <b>\$77,418,000</b>  | <b>\$169,855,500</b> | <b>-\$7,250</b>                          | <b>-\$92,437,500<sup>§</sup></b> |
| <b><i>First year and 10 years of follow-up</i></b> |             |               |                       |                 |                      |                      |  |                                  |
| Patients requiring treatment                       | 30.5%       | 3,895         | \$24,607              | \$17,967        | \$95,844,265         | \$69,981,465         | \$6,640                                  | \$25,862,800*                    |
| Patients not requiring treatment                   | 69.5%       | 8,855         | \$3,959               | \$17,967        | \$35,056,945         | \$159,097,785        | -\$14,008                                | -\$124,040,840**                 |
| <b>Total</b>                                       | <b>100%</b> | <b>12,750</b> | <b>\$10,267</b>       | <b>\$17,967</b> | <b>\$130,904,250</b> | <b>\$229,079,250</b> | <b>-\$7,700</b>                          | <b>-\$98,175,00<sup>§</sup></b>  |

\* Additional cost attributable to delayed treatment; \*\* Cost savings attributable to AS strategy;

<sup>§</sup> Total cost savings obtained with the AS strategy.

# Results

Cost estimates in US and Canadian systems by specific treatment and time to treatment initiation



# Limitations

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- 1) Costs derived from RAMQ lists. The costs for medications, professional fees and laboratory costs are generally similar over Canadian provinces, the medical fees and honoraria may be sometimes lower in Quebec;
- 2) Although our model expands on the previous published to account for additional treatment and risk of death, this model does not account for costs associated with side effects or complications related to treatments. Nevertheless, these will have mainly impact on active treatments costs, and thus further favor the economics of AS.
- 3) Principal limitation of our study, as well as others employing modeling, is the reliance on estimates as opposed to prospective cohort evaluations.

# Conclusion

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- Our study demonstrates that AS allows significant economic benefits. The AS strategy applied on **each annual cohort** of approximately 12,750 new cases, allows to the Canadian system an overall cost savings of **\$92 million** over a 6-year period (average cost reduction of **\$7,250** per patient, and a relative reduction of **54%**).
- These AS benefits are still maintained at the end of 11-year period.
- Similar trends are observed between Canadian and US systems, but the relative reduction attributable to AS was only of **36%** in the US;
- This figure is explained by the low cost of AS in Quebec, by avoiding the high-cost of overtreatment, and minimal additional cost related to delayed treatment, estimated at **500\$** per patient per year;
- Finally, **delaying ADT** will allow important savings over IT, estimated at **4 000\$** per patient per year.



Thank you

**Côté Sharp Family Foundation**

Program in Prostate Cancer Health  
Economics