Economic Model of Multiple Radiation Therapy Treatments for Low-Risk Prostate Cancer: Overview

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ICER Model: Overview

- Markov cohort model
- One year cycle length
- Patient population
  - Low-risk disease (D’Amico criteria)
    - Gleason ≤6, PSA<10, stage ≤T2a
  - Base case: 65 year old man
    - Limited analyses will be conducted for 55 year old man, varying selected age-specific risks
ICER Model: Overview

- Multiple treatment strategies evaluated
  - Initial treatment at diagnosis
    - Brachytherapy
    - Proton beam therapy
    - IMRT (common referent standard)
  - Active surveillance
    - Treated upon clinical progression
    - Treated based on patient decision without progression
Prostate Cancer

Treatment

Proton Beam
IMRT
Brachytherapy

Recurrence
No Recurrence

Metastatic CaP
CaP Death
Non-CaP Death

Active Surveillance
ICER Model: Overview

- Health states will reflect presence or absence of treatment-related complications
  - Short- and long-term complications of all 3 treatments
  - Acute urinary retention with brachytherapy
- Utilities will be assigned to each health state
- Major cost categories will include:
  - Treatment-related (incl. management of complications)
  - Treatment-unrelated (e.g., annual medical costs, costs of terminal care)
ICER Model: Overview

- Primary Outcomes
  - Life Expectancy
    - Overall mortality, prostate cancer-specific mortality
  - Quality adjusted life expectancy
  - Cost-effectiveness ($/QALY)

- Secondary Outcomes
  - Biochemical freedom from failure
  - Cost per complication averted
Model Assumptions: Disease Course

- No men die of prostate cancer within 3 years of diagnosis
- All men who recur after definitive therapy will recur biochemically (BCR)
- Probability of progressing from BCR to metastatic disease same for all low-risk patients regardless of treatment
- Men die of prostate cancer only after the development of metastatic disease
- The probability of progressing from metastatic disease to death is the same regardless of treatment
Model Assumptions: Disease Course

- Active surveillance (AS)
  - Progression on AS is defined as
    - Increase in Gleason score or
    - Rapid PSA rise
  - No patients progress to metastatic disease while on AS
  - Patients who progress are treated with IMRT plus 6 months of androgen deprivation therapy (ADT)
  - 3 additional strategies for non-progressing patients who choose to be treated (1 each for brachytherapy, proton beam therapy, and IMRT respectively)
  - Patients who choose to be treated have same disease outcomes as those treated at diagnosis
Model Assumptions: Complications of Treatment/Disease

- All complications will be treated
- The occurrence of any complication is independent of the occurrence of a second complication
Model Assumptions: Complications of Treatment

- Long-term treatment complications
  - Erectile dysfunction (ED)
  - Genitourinary (e.g., incontinence)
  - Gastrointestinal (e.g., proctitis)
  - Occur at least 90 days after treatment
  - All long-term complications will have occurred by 24 months after treatment
  - All patients treated with 6 months ADT/IMRT will have ED during the year of treatment
Model Assumptions: Complications of Treatment

● Short-term complications
  ● Genitourinary
  ● Gastrointestinal
  ● Acute urinary retention (for brachytherapy only)
    ● All occur within 90 days of treatment

● Secondary malignancy after radiation (any tx):
  ● Patients will receive associated disutility
Model Assumptions: Complications of Disease

- Active surveillance (AS)
  - ED
  - Incontinence
  - Occur beginning two years after placement on AS
ICER Model: Utilities

- Utility for each health state remains constant for life, with 2 exceptions:
  - Short-term complication utilities will be applied to first year only and will be adjusted to be proportionate to 3-month duration
  - ED from ADT therapy assumed to persist for year in which treatment given only

- Disutility for secondary malignancy will differ between brachytherapy and other forms of radiation
  - Will be subject to sensitivity analyses as well
Categories of Cost

- Annual medical care costs (unrelated)
- Terminal care costs
  - Prostate cancer vs. other cause
- Direct medical costs
  - Outpatient surveillance
  - Outpatient treatments
  - Patient out of pocket costs
- Patient time costs (e.g., time-in-therapy)
Direct Medical Costs

- Outpatient surveillance
  - Active surveillance
  - Post-treatment surveillance
- Outpatient treatments
  - Initial treatments
  - Management of treatment-related complications
- Patient copayments, coinsurance, and deductibles
Base Case

- Perspective = “payer plus”
  - Costs from CMS, RedBook + patient time + out-of-pocket
  - Sensitivity analyses will focus on payer-only perspective
- Time horizon = lifetime
- Discounting = 3% annually
- Constant 2007 US $
  - CPI adjusted, +/-medical care component
- For each CPT:
  - RVU*annual units*national conversion factor
Omitted Costs

- Caregiver time
- Costs incurred by all patients prior to entering model
  - Diagnosis, staging of prostate cancer
- Non-health care resource use costs
  - Add a constant to each year of life; little variation in survival across treatments
- Amortization costs (e.g., for proton-beam facility)