

Incremental Cost Effectiveness of Proton Therapy

American Association of Physicists in Medicine
May 9, 2009

Justin Bekelman, MD
Department of Radiation Oncology
Leonard Davis Institute for Health Economics
University of Pennsylvania

No financial conflicts of interest

Proton therapy is expensive

- “A huge investment.”
 - WSJ
- “The price tag is mind boggling.”
 - Cancer Network
- “A price tag as intimidating as its size.”
 - National Association for Proton Therapy

Evidence

VOLUME 25 · NUMBER 24 · AUGUST 20 2007

JOURNAL OF CLINICAL ONCOLOGY

ORIGINAL REPORT

Is Proton Beam Therapy Cost Effective in the Treatment of Adenocarcinoma of the Prostate?

Andre Konski, William Speier, Alexandra Hanlon, J. Robert Beck, and Alan Pollack

- “Proton beam therapy is not cost effective for most patients with prostate cancer using the commonly accepted standard of \$50,000/QALY”

Evidence



December 22, 2008

- “Proton beam therapy is both less effective and more costly than either brachytherapy or IMRT.”

Limitations to current evidence

- Cost-effectiveness modeled not observed
- Assumption-based
 - Assumed substantial differences in cost
 - Assumed no or nominal differences in effect
 - Answer pre-determined by these assumptions
- Important and high quality efforts, but limited by lack of evidence for the models

Incremental Cost Effectiveness

$$\frac{\text{Cost}_{\text{PROTON}} - \text{Cost}_{\text{IMRT}}}{\text{Effect}_{\text{PROTON}} - \text{Effect}_{\text{IMRT}}}$$

Incremental Cost Effectiveness

$$\frac{\text{Cost}_{\text{PROTON}} - \text{Cost}_{\text{IMRT}}}{\text{QALY}_{\text{PROTON}} - \text{QALY}_{\text{IMRT}}}$$

Direct Costs

- Proton therapy 2x – 3x IMRT

Diffusion

- Costs decline with adoption and diffusion
- New proton technology a 10 fold discount to current facilities
- May lower costs by 50% over ten years

Fractionation

- Hypofractionation may be a wash, but could favor proton therapy
- Needs to be clinically evaluated first, though

Indirect Costs: Productivity Loss

- Absenteeism
- Presenteeism
- Productivity loss may be substantial
 - During therapy
 - Following therapy
- Example: Irritable Bowel Syndrome
 - 8.4 to 13.8 hours lost productivity per 40-hour workweek, attributable to presenteeism
- Has not been examined in cancer

Incremental Cost Effectiveness

Costs = only direct costs

QALY

Costs

- Favor IMRT
- Economic analyses of proton therapy have not accounted for long term cost estimates
 - Long term costs of proton therapy will fall
- Economic evaluations within clinical trials can *measure* costs and productivity

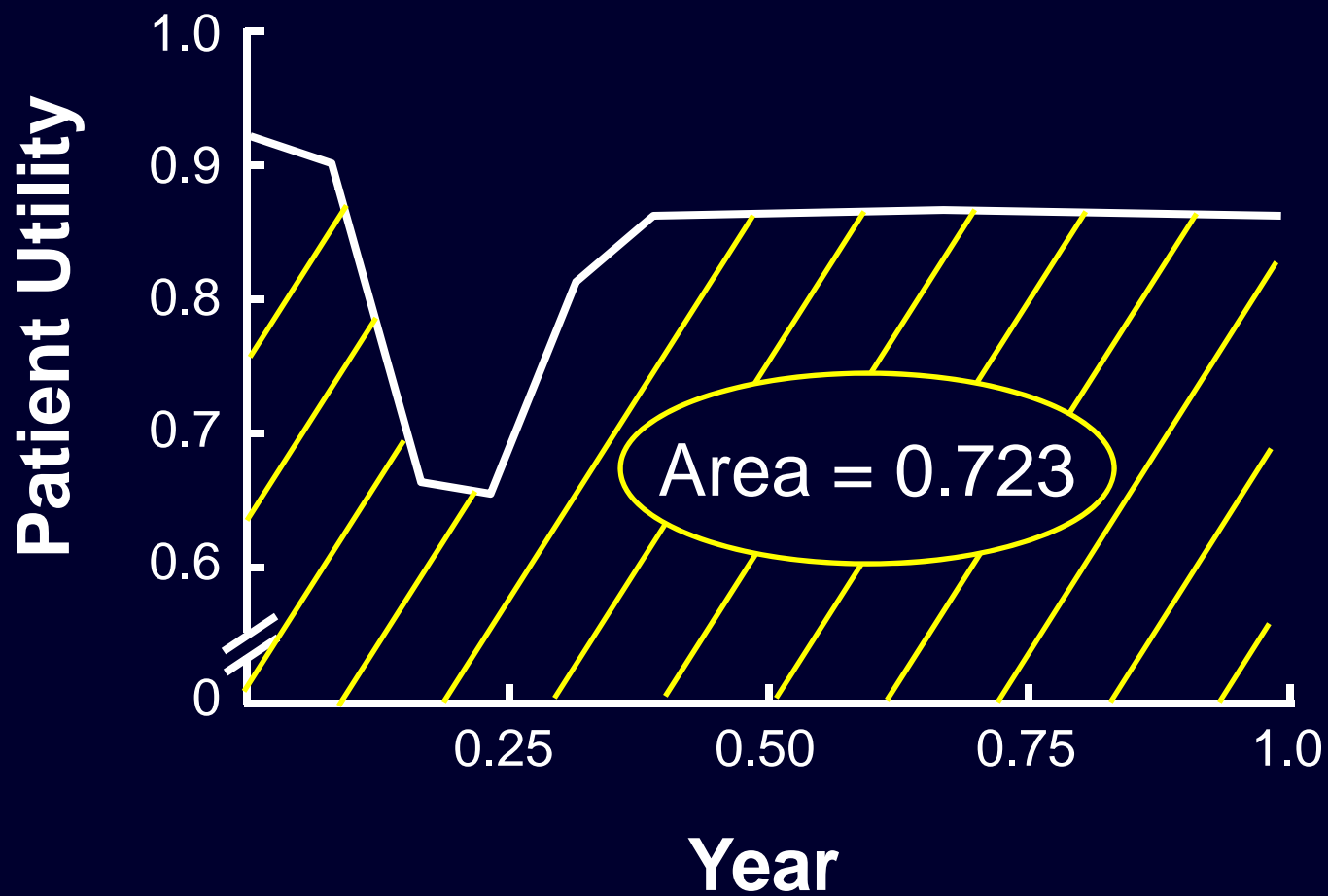
Effect - QALYs

- Treatment benefits offset by complications
- Affect patient preferences about QOL
- Health state utilities measure preferences
 - Range from 0 (death) to 1 (perfect health)
- Utilities can be transformed to QALYs
 - Combine preferences for both the *length* of survival and its *quality* into a single measure
- Prostate cancer . . . long survival
 - The *quality* of that survival is measurable

Utilities and Radiotherapy

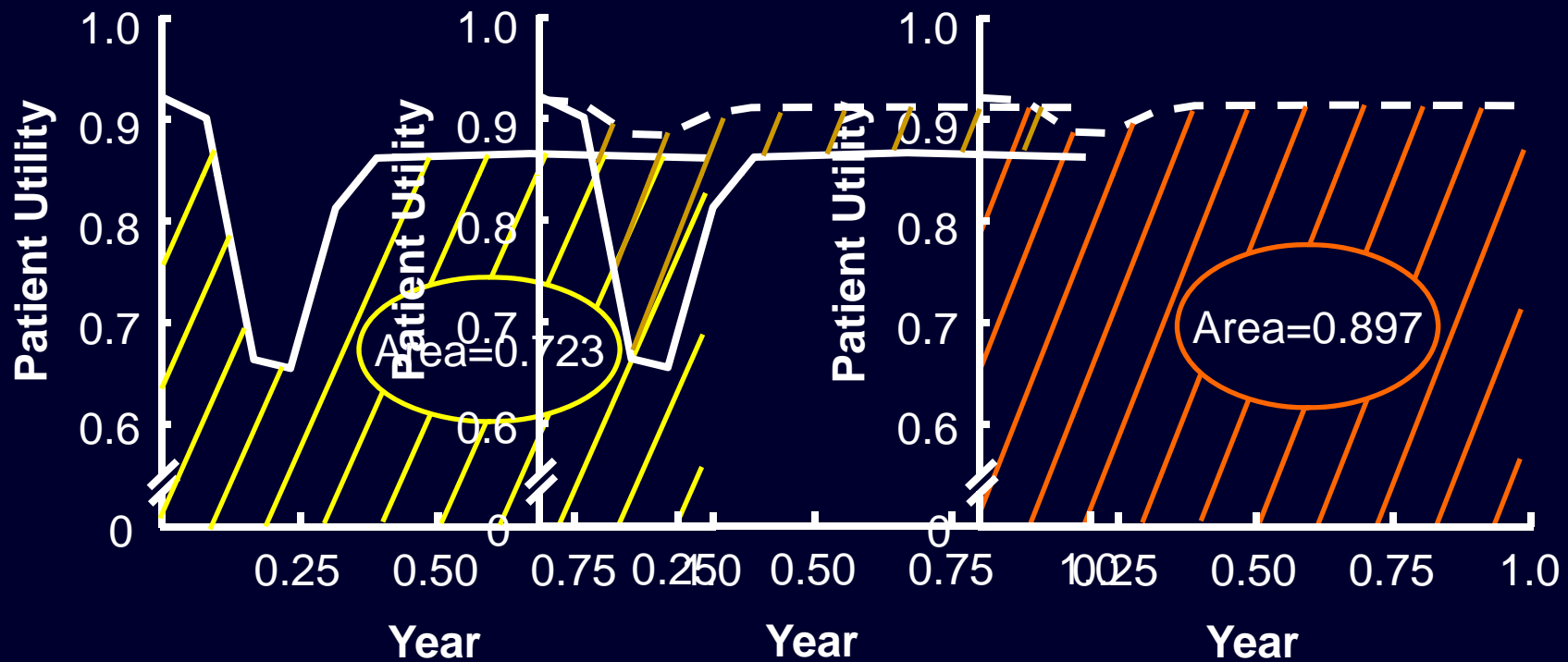
- Bowel problems worse than impotence, urinary difficulty or urinary incontinence.
- Radiotherapy-induced bowel dysfunction
 - General public: 0.40 to 0.55 utility decrement
 - Patients: 0.02 to 0.13 utility decrement
 - ✓ Non-healing leg ulcer: 0.03 decrement
- Has not been measured for IMRT or proton therapy

Measurement of QALYs in Trials



Measurement of QALYs in Trials

Treatment A - Treatment B = QALYs gained (lost)



Summary

- Are protons expensive? You bet.
- Are protons worth it (for prostate cancer)?
- Depends
 - Are costs and productivity measured?
 - Are long-term costs projected?
 - Does RT toxicity translate into QALY decrements?
- Only way to answer the question?
 - Formal clinical and economic evaluation within a trial (randomized or registry)

Next Step

- A randomized trial to compare the clinical and cost-effectiveness of IMRT and proton therapy for low-risk prostate cancer
 - University of Pennsylvania
 - Massachusetts General Hospital
 - Midwest Proton Radiotherapy Institute
 - American College of Radiology
- Feasibility study submitted to NIH
- Coordination with already proposed registry study