A Decision Analysis to Assess the Value of Prostate Cancer Screening:

A Shift in Focus from Prostate Cancer Specific Mortality to Distant Metastasis Free Survival

Arie Pablo Dosoretz, Nataniel H. Lester-Coll, Shiyi Wang, and James B. Yu
Yale Department of Therapeutic Radiology, New Haven, CT

Prostate Cancer Screening

- Prostate Cancer is the 2nd leading cause of cancer deaths among men in the United States, with over 28,000 deaths estimated for 2012

- The value of screening men for prostate cancer using prostate-specific antigen (PSA) testing has generated significant debate

- Criticisms of screening include:
  - False-positive rates associated with PSA testing
  - Harms associated with work-up and prostate biopsies
  - Over-diagnosis and over-treatment

- Randomized-Control Trial Evidence includes:
  - *PCLO Study*: Included 76,685 men in the United States, aged 55-74, and found no statistically significant overall survival or prostate-cancer specific mortality differences from annual PSA testing

  - *ERSPC study*: Included 162,388 European men, aged 55-69, and found a 20% reduction in prostate cancer mortality, but no overall mortality benefit from PSA testing every 4 years

- In May of 2012, the United States Preventive Services Task Force (USPSTF) concluded "…that there is moderate certainty that the benefits of PSA-based screening for prostate cancer do not outweigh the harms."

Purpose

To determine the quality-adjusted life expectancy (QALE) associated with screening men for prostate cancer with annual PSA testing

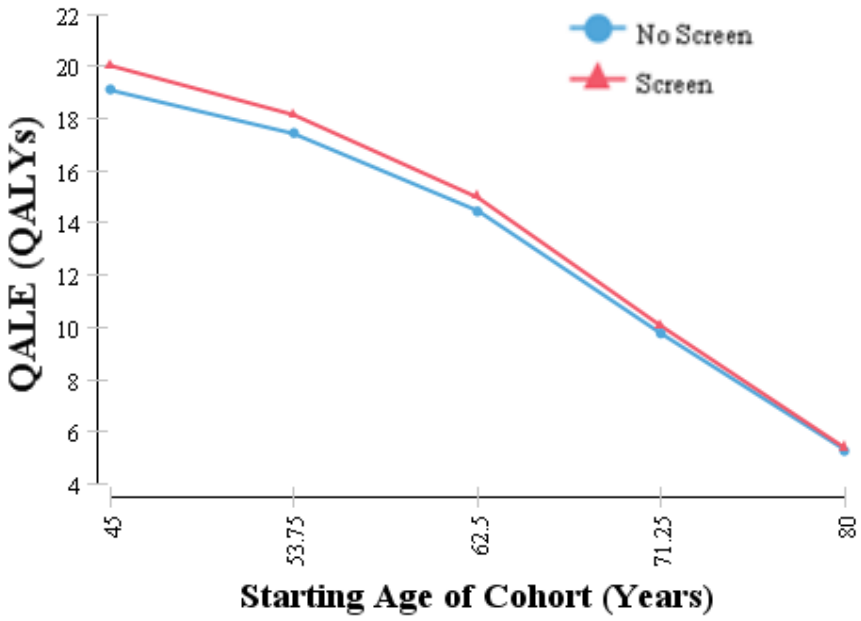
Methods

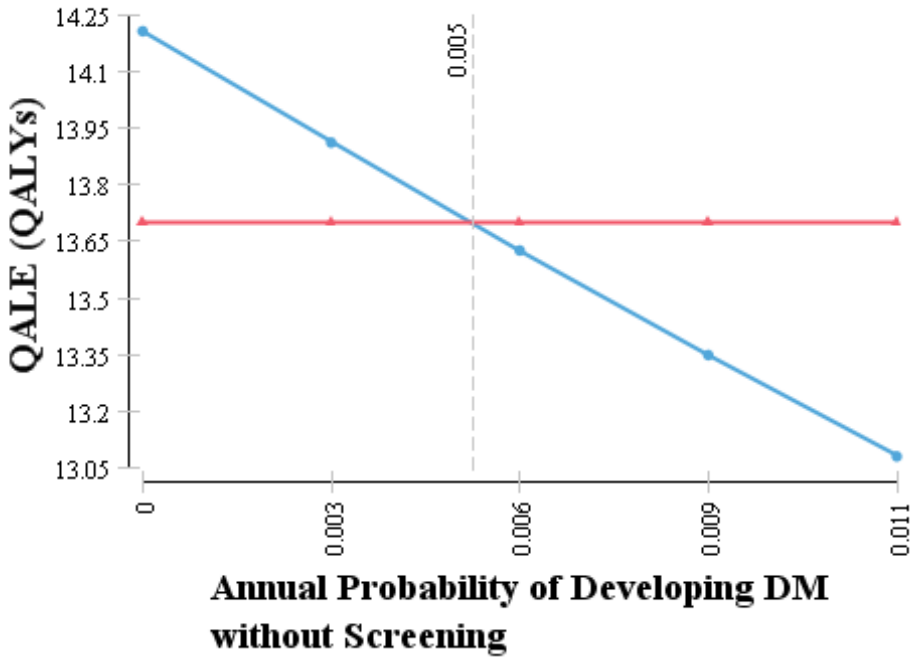
- A mathematical model (state transition Markov model) was constructed to compare QALE in men with and without annual PSA screening
- Men screened and found to be positive, after a confirmatory work-up, were assumed to have clinically localized, low-risk prostate cancer
- Unscreened men, who presented with prostate cancer, were also assumed to have low-risk prostate cancer, but could also present with metastatic disease
- All men with prostate cancer were assumed to undergo treatment with intensity-modulated radiation therapy (IMRT)
- Probabilities of transitioning between health states and quality of life values (utilities) for each state were entered into the model from a literature review
- Enhanced model constructed; included each risk group of prostate cancer and more detailed inclusion of possible toxicities from treatment

Results from Initial Model

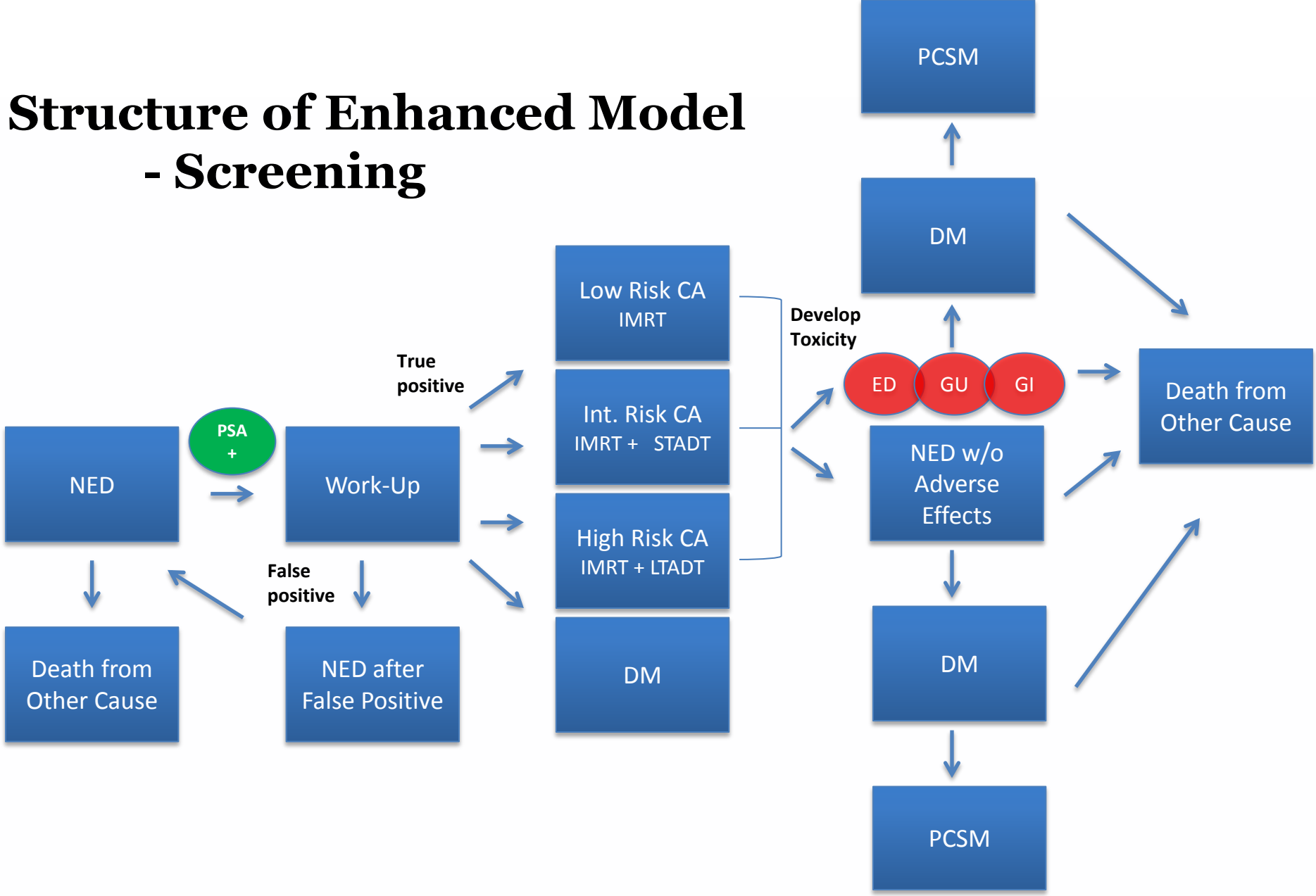
- QALE benefit found for all ages
- Benefit diminished with increasing age

- Model sensitive to probability of developing metastatic disease without screening
- If 10-year probability was less than 4.9%, no-screening became the preferred strategy



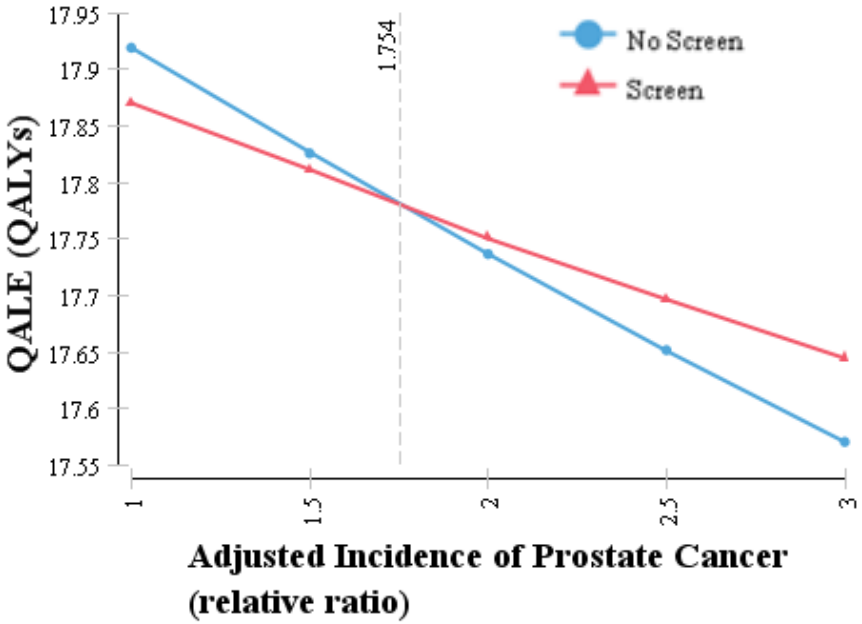


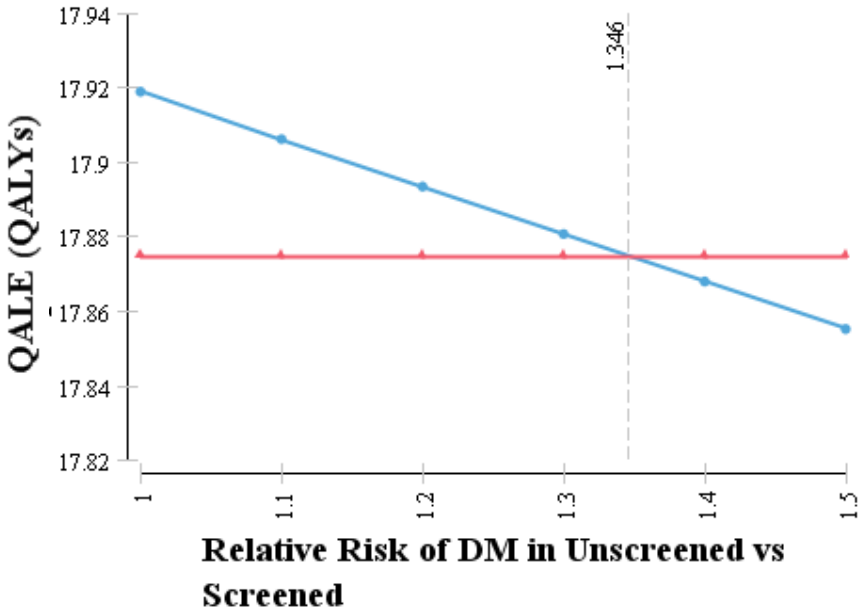
Structure of Enhanced Model - Screening



Results from Enhanced Model

- Other factors found to influence QALE and preferred strategy, including:
  - Incidence of prostate cancer
  - Proportion of men in the unscreened group presenting with distant metastatic disease
  - Probability of developing long-term adverse effects from treatment





Conclusions

- The decision to screen an individual or a population of men for prostate cancer is complex and nuanced
- Our model suggests that there may be a quality of life benefit associated with screening certain populations of men for prostate cancer with PSA testing
- Several factors were found to influence the quality of life effects of screening, including:
  - The proportion of unscreened men presenting with distant metastatic disease
  - The incidence of prostate cancer in the population
  - The probability of developing adverse effects from prostate cancer treatment
- Further research is needed in order to more thoroughly understand the impact of screening on quality of life and to optimize screening strategies