Screening for prostate cancer: a decision analytic view
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Screening for prostate cancer with prostate-specific antigen (PSA), transrectal ultrasound (TRUS) and digital rectal examination (DRE).

Type of intervention
Screening/secondary prevention.

Economic study type
Cost-utility analysis.

Study population
Cohorts of men between the ages of 50 and 70.

Setting
Medical centre. The economic study was carried out in Ontario (Canada).

Dates to which data relate
Dates for effectiveness and resource data were not explicitly reported by the authors (effectiveness data were derived from studies available in 1994). Costs were expressed in 1992 values.

Source of effectiveness data
Literature

Modelling
A decision analysis model was used to assess final costs and outcomes.

Outcomes assessed in the review
Main outcomes were sensitivity and specificity of the tests, probabilities and rates for short term and long term treatment complications (e.g. pulmonary embolus, deep vein thrombosis, impotence, incontinence), and long term outcomes associated with disease progression, including cancer mortality.

Study designs and other criteria for inclusion in the review
Studies published within the American Cancer Society National Prostate Cancer Detection Project were used to derive estimates of test sensitivity and specificity. Published case series were used to estimate treatment complications. To estimate disease progression and mortality rates, studies of any design were included (RCT, case series and cohort...
Studies). For the calculation of mortality rates, only studies which reported death from cancer were included.

Sources searched to identify primary studies
These were specified for the disease progression and mortality rates, i.e. computerised database and bibliographies of retained articles.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Not specified.

Number of primary studies included
Two studies were used to estimate test sensitivity and specificity. Overall, twenty-six studies were used to estimate treatment complications. More than twenty studies were used to derive estimate of disease progression and mortality rates.

Methods of combining primary studies
Generally, this was not specified. Baseline values of disease progression and mortality rates for the natural history model were derived from the best study rather than the weighted mean event rate.

Investigation of differences between primary studies
Not investigated.

Results of the review
Sensitivity values were 0.67, 0.50 and 0.81 for PSA, DRE and TRUS respectively, while specificity values were 0.97, 0.94, and 0.84. Baseline values for main surgical complications were the following (in parenthesis the plausible range of values): perioperative death 0.011 (0-0.061); proportion of total, complete impotence 0.75 (0.66-0.75); complete incontinence 0.02 (0-0.10); partial incontinence 0.06 (0-0.32). For radiotherapy, the values of complications were: death 0.002 0-0.02; impotence 0.40 (0.27-0.60); incontinence 0.01 (0-0.01).

Measure of benefits used in the economic analysis
Life expectancy and quality-adjusted life expectancy (QALE), derived using a Markov cohort model. Utility weights were used to calculate quality-adjusted life expectancy: 1.0 identified full health, and 0.0 related to death. Utilities were estimated by a group of urologists, radiation oncologists and internists (10 physicians overall) using the time-trade-off method. Authors’ estimates were used for assessing quality of life following urethral obstruction.

Direct costs
Costs and quantities were not reported separately. Health service costs were considered. Variable costs for in-patient services and costs of out-patient and professional services were included. Inpatient cost data were provided by the Clinical Cost Manager and the New England Medical Centre. Other costs were derived through ‘ad hoc’ estimations based on actual data (charges). Final total costs were calculated using a decision model. Costs were discounted at 5%. 1992 prices were used.

Currency
US dollars ($).

**Sensitivity analysis**
Simple one-way sensitivity analysis was carried out for all the main variables, including prevalence of cancer, probability of treatment-related side-effects, treatment efficacy, utility of treatment-related impotence and incontinence, morbidity discount rate. Analysis of extremes was also performed for certain variables.

**Estimated benefits used in the economic analysis**
Screening with DRE alone yielded no reduction in mortality. All the other screening programmes produced a small gain (up to a maximum of 2 days, undiscounted) in life expectancy per men aged 50 to 70 years. PSA+TRUS+DRE yielded the greatest number of life-years gained at all ages. When quality of life in considered, all screening programmes produced a net loss of QALYs (2 to 13 days, undiscounted).

**Cost results**
Average undiscounted costs of no screening were $82, $184 and $396 for age groups of 50, 60 and 70 years respectively. The undiscounted incremental cost per person screened of DRE vs. no screening was $64, $149 and $371 for the three age groups respectively. Similarly, the results for PSA vs. no screening were $77, $4179 and $448; the results of PSA+DRE vs. no screening were $104, $233, $572; finally the results for PSA+DRE+TRUS vs. no screening were $253, $423, $874.

**Synthesis of costs and benefits**
With respect to the strategy of no screening, the incremental cost-effectiveness ratios (costs per life-years gained, with costs and benefits both discounted at 5% ) per a 50 year old person screened were $113,000 for PSA and $729,000 for PSA+DRE+TRUS. The incremental ratios per a 60 year old person screened were $127,000 for PSA and $475,000 for PSA+DRE+TRUS. For a 70 year old person screened, the incremental ratios were $189,000 for PSA, and $466,000 for PSA+DRE+TRUS. No incremental cost-effectiveness ratios were calculated for DRE and PSA+DRE vs. no screening, since these were dropped because they were less cost-effective with respect to the next most expensive strategy. Finally, since each screening programme yielded QALY loss, all programmes were dominated by no screening.

Results were sensitive only to assumptions about the efficacy of treatment. In the most optimistic scenario, the incremental cost per life-year gained of PSA vs. no screening was $16,000 (costs and years discounted at 5%) for a 60 year old man. Moreover, the incremental cost-utility ratio for PSA vs. no screening was $42,000/QALY gained for a 50 year old man (only costs discounted at 5%).

**Authors' conclusions**
The authors concluded that the screening programmes for men between the ages of 50 and 70 years may result in poorer health outcomes and will increase costs. Screening programmes only performed on high-prevalence populations will not improve the cost-effectiveness.

**CRD Commentary**
The decision analytical model presented by the authors appears constructed in an accurate and rigorous way. However, the reader should be aware of the fact that since the baseline probabilities were not derived from a comprehensive literature search, there could be publication bias regarding the results which were included. This problem is in part overcome in the study since an extensive sensitivity analysis was performed.

**Bibliographic details**