Prostate cancer screening strategies with re-screening interval determined by individual baseline prostate-specific antigen values are cost-effective
Kobayashi T, Goto R, Ito K, Mitsumori K

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.

CRD summary
This study evaluated the cost-effectiveness of personalised re-screening strategies for prostate cancer. Strategies were based on individual baseline levels of prostate-specific antigen (PSA). The authors concluded that personalised re-screening strategies using individual baseline PSA for the determination of screening intervals were cost-effective compared with conventional uniform re-screening strategies. Overall, the methodology of the study appears appropriate and was well reported. However, there were a few limitations to the study, so the authors’ conclusions should be considered with a degree of caution.

Type of economic evaluation
Cost-utility analysis

Study objective
The study evaluated the cost-effectiveness of personalised re-screening strategies for prostate cancer. Strategies were based on individual baseline levels of prostate-specific antigen (PSA).

Interventions
Five screening strategies were examined. Strategy A was annual PSA testing irrespective of baseline PSA levels. Strategies B to E were biennial screening for PSA baseline levels of ≤1.0 ng/mL (B), ≤2.0 ng/mL (C), ≤3.0 ng/mL (D) and ≤4.0 ng/mL (E).

Location/setting
Japan/outpatient.

Methods
Analytical approach:
A Markov model was used to facilitate the synthesis of costs and clinical data in the comparison of the five strategies under evaluation. Male cohorts of ages 50, 55, 60, 65 and 70 years were analysed up to 80 years of age. The cohort of 50-year-old men was regarded as the base-case. The authors stated that the perspective of the study was societal.

Effectiveness data:
Epidemiological and outcome data were based on published literature, which was stated to be the most appropriate evidence known to the authors. The authors did not report any search methods or any inclusion criteria for the selection of studies. One report informed the base-case probabilities of PSA elevation to >4.0 ng/mL (recommended biopsy) at a year after negative PSA results and also informed the initial distribution of men in the different PSA levels at baseline in the model (Ito et al. 2004, see ‘Other Publications of Related Interest’ for bibliographic details). Cancer detection rate was also an important clinical effectiveness estimate that was retrieved from a published study.

Monetary benefit and utility valuations:
Utilities for the calculation of quality-adjusted life-years (QALYs) were retrieved from the literature. No further information on the estimation of utilities was provided.

Measure of benefit:
The measure of benefit derived was the QALYs.
Cost data:
The cost categories included the costs of a PSA, biopsy, and treatment of cancer according to stage of disease. Resource use data were determined by the model while the unit costs were derived from the international literature. The price year was not stated. All prices were presented in US dollars ($). Discounting was performed at a rate of 3%.

Analysis of uncertainty:
Univariate sensitivity analysis was run to test all assumptions of the model. Extreme values were used for the input data in order to investigate the incremental cost-effectiveness ratio (ICER) in the extreme cases. The values of ranges used in the sensitivity analysis were derived from the reports informing the input parameters.

Results
Early cancer detection rates were similar among all strategies (92.6 to 93.2%).

The QALYs gained ranged from 17.14994 to 17.15121, while the total costs ranged from $1,086.80 to $1,171.70.

Strategy D, biennial screening for PSA baseline levels of ≤3.0 ng/mL, was the most cost-effective when all strategies were compared separately with a no screening strategy. Strategy E was more costly and less effective than strategy D and, therefore, was dominated by strategy D.

The base-case ICER of strategies A, B and C with respect to strategy D were $165,938/QALY, $46,505/QALY and $5,925/QALY, respectively.

Sensitivity analysis showed the results to be robust for all assumed parameters in the model. ICER changes were not linear with regard to sensitivity analysis for start age. The ICER of strategies A, B and C with respect to strategy D decreased with increasing age up to 60 years, and increased thereafter.

Authors’ conclusions
The authors concluded that personalised re-screening strategies using individual baseline PSA for the determination of screening intervals were cost-effective in comparison with conventional uniform re-screening strategies.

CRD commentary
Interventions:
The five screening strategies were reported clearly. The cut-off baseline PSA values for the four personalised re-screening strategies were well described. However, the authors acknowledged that these values were only based on one study report. It would appear that annual PSA was current practice in the authors’ setting.

Effectiveness/Benefits:
The effectiveness data were derived from various sources. The methods of the literature review were not reported, which makes it impossible to ascertain whether the best available evidence was used to inform the model. However, the authors justified only using one study for deriving PSA distributions and probabilities of PSA elevation on the basis of there being few published works in the field. There was no information about the derivation of the utilities used to compute the QALYs, and the authors highlighted the fact that the QALY results presented may not be robust. This leaves some uncertainty regarding the validity of the effectiveness estimates used.

Costs:
Although a societal perspective was stated, in fact, a health care perspective was undertaken given that wider societal costs were not taken into account. The authors justified this limitation by the lack of data. The cost categories and unit costs were well reported and discounting was appropriate, but the level of resource use and the price year were not stated. Therefore, the costs were poorly reported.

Results and Analysis:
An appropriate incremental analysis was conducted and the results were presented in full. The model structure was described in full detail, including a graphical depiction, which aids transparency. In addition, the methods used throughout the economic evaluation and the sensitivity analysis were well reported. The results were robust to changes...
in all input parameters in the one-way sensitivity analysis. However, a probabilistic sensitivity analysis would have been a more complete way to fully capture parameter uncertainty. The authors acknowledged that the cut-off baseline PSA levels for annual PSA testing can be changed according to age and gender of the population under analysis. They also noted the need for randomised controlled trials to show a mortality benefit from PSA screening. A number of other possible limitations and their potential impact on the results were outlined.

Concluding remarks:
Overall, the methodology of the study appears to have been appropriate and was well reported. However, there were a few limitations to the study, so the authors’ conclusions should be considered with a degree of caution.

Funding
Not externally funded.

Bibliographic details

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Aged; Cost-Benefit Analysis; Decision Support Techniques; Decision Trees; Early Diagnosis; Humans; Male; Markov Chains; Mass Screening /economics /statistics & numerical data; Middle Aged; Prostate-Specific Antigen /analysis; Prostatic Neoplasms /diagnosis /economics; Quality-Adjusted Life Years; Sensitivity and Specificity; Time Factors

AccessionNumber
22007001695

Date bibliographic record published
06/09/2007

Date abstract record published
09/08/2008