A systematic review and economic analysis of drug-eluting coronary stents available in Australia


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
The use of drug-eluting coronary stents (DES) available in Australia for the treatment of coronary artery stenosis. The study examined polymer-based sirolimus- or paclitaxel-eluting stents.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis and cost-utility analysis.

Study population
The study population comprised patients with single de-novo coronary lesions of 51 to 99% vessel diameter stenosis. One of the studies also included patients with restenotic lesions. Patients with acute myocardial infarction (MI) were excluded.

Setting
The setting was secondary care. The economic study was carried out in Australia.

Dates to which data relate
The effectiveness data were derived from studies published between 2003 and 2004. The resource use data were gathered from studies published in 2004. The price year appears to have been 2004.

Source of effectiveness data
The evidence was derived from a systematic review of published studies, as reported by the authors.

Outcomes assessed in the review
The following clinical and effectiveness data were obtained from the review of the literature:

- in-stent thrombosis rates at the latest reported time point,
- mortality,
- acute MI,
- coronary artery bypass grafting (CABG), and
- revascularisation of the stented lesion (referred to as "target-lesion revascularisation", TLR).
Study designs and other criteria for inclusion in the review

The authors reported that all randomised controlled trials or reviews that evaluated clinical outcomes for the types of DES available in Australia (polymer-based sirolimus- or paclitaxel-eluting stents) were included. In addition, the following criteria had to be satisfied for eligibility:

- patients with a de-novo atherosclerotic lesion of the coronary artery, with or without inclusion of sub-groups with diabetes mellitus single-vessel disease, stent restenosis, long lesions (> 18 mm) or small diameter vessels (≤ 2.5 mm);
- BMS as a comparator; and
- at least one of the specified outcomes at 12 months (mortality, MI, CABG, TLR, and in-stent thrombosis at the latest reported time point).

Sources searched to identify primary studies

MEDLINE, PreMedline, EMBASE, Current Contents, CINAHL and the Cochrane Library were searched for relevant studies published in English between 1966 and June 2004, using Medical Subject Heading terms and textwords for DES. Websites of health technology assessment agencies and bibliographies of relevant articles were also screened.

Criteria used to ensure the validity of primary studies

Two independent reviewers assessed the quality of the eligible studies according to the Australian National Health and Medical Research Council’s quality check list.

Methods used to judge relevance and validity, and for extracting data

Two independent reviewers appraised eligible studies and extracted the data.

Number of primary studies included

Seven studies were included in the review.

Methods of combining primary studies

Relative risks (RRs) and risk differences were calculated for all specified outcomes. Where possible, the data were pooled and fixed effects were calculated by the Mantel-Haenszel method, using RevMan (Review Manager) software (version 4.2.7; Cochrane Collaboration Oxford). Where the event rates for sub-groups were reported only as percentages, the number of events was calculated by referring to related sub-studies and conference presentations.

Investigation of differences between primary studies

Data around the baseline characteristics of the study population and co-therapy protocols were extracted to assess variation between the trials and to determine the applicability of the results to Australian practice.

Results of the review

Stent thrombosis was reported in 0.6% of all trial participants, with no statistically significant differences found between DES and BMS groups.

Among the 2,889 trial participants for whom clinical outcomes were reported at 12 months, 34 deaths, 105 MIs and 59 CABGs were reported.

The meta-analysis did not show a statistically significant difference in the RR of these events at 12 months between patients receiving paclitaxel- or sirolimus-eluting stents and those receiving BMS.
Patients receiving DES experienced significantly fewer TLRs at 12 months than those receiving BMS. The RR was 0.29 (95% confidence interval, CI: 0.20 to 0.43; p<0.00) for paclitaxel-eluting stents and 0.20 (95% CI: 0.13 to 0.29; p<0.00) for sirolimus-eluting stents.

**Measure of benefits used in the economic analysis**
The measures of benefits used were the quality-adjusted life-years (QALYs) and the absolute risk reduction in TLR rates. The utility weights for patients who experienced an event (defined as any repeat catheterisation) and for patients who experienced no events were obtained from published studies, while the TLR rates were obtained from the meta-analysis.

**Direct costs**
The cost/resource boundary appears to have been that of the hospital. The quantities and the costs were not reported separately. Resource consumption was determined from two of the studies included in the review. The unit costs were derived from the Department of Health and Ageing's Hospital Cost Data Collection database, the Medicare Benefits Schedule and the Pharmaceutical Benefits Schedule. The price year was not stated. Given the short time horizon of the study, discounting was not necessary.

**Statistical analysis of costs**
The costs were treated deterministically.

**Indirect Costs**
No indirect costs were included.

**Currency**
Australian dollars (AUD).

**Sensitivity analysis**
The area of uncertainty explored by the authors was variability in both the effectiveness and cost data. One-way sensitivity analyses were carried out to evaluate the effects on the results of varying the number of stents used per lesion, the rates of percutaneous interventions, the cost of a DES, and the utility weights for patients who required revascularisation.

**Estimated benefits used in the economic analysis**
The results of the study showed 0.847 QALYs for sirolimus-eluting stents and 0.834 QALYs for BMS at 12 months, a difference of 0.013 QALYs. The results also showed 0.847 QALYs for paclitaxel-eluting stents and 0.838 QALYs for BMS, a difference of 0.008 QALYs.

The study reported an estimated difference in the TLR at 12 months of 16.5% for sirolimus-eluting stents versus BMS and of 10.3% for paclitaxel-eluting stents versus BMS.

**Cost results**
The authors reported a cost per DES equal to AUD 2,400 and a cost per BMS equal to AUD 850 for the base-case analysis, with an estimated average number of stents per patient of 1.5.

**Synthesis of costs and benefits**
Estimates of the incremental cost per TLR avoided at 12 months ranged from AUD 3,746 (sirolimus trials) to AUD...
6,117 (paclitaxel trials).

Estimates of the incremental cost per additional QALY gained at 12 months ranged from AUD 46,829 (sirolimus trials) to AUD 76,467 (paclitaxel trials).

The results of the one-way sensitivity analysis indicated that, compared with BMS, the adoption of DES varied from being cost-saving to costing an extra AUD 25,150 per TLR avoided at 12 months and an extra AUD 314,385 per additional QALY gained at 12 months if trial-reported rates overestimated the "true" TLR rates and costs by 50%.

Varying the cost of DES over the range AUD 2,000 to AUD 3,700, the cost per TLR avoided ranged from AUD 120 to AUD 24,993 and the cost per QALY ranged from AUD 1,504 to AUD 312,418.

Authors' conclusions
Drug-eluting stents (DES) are cost-effective in comparison with bare metal stents (BMS). However, these estimates are very sensitive to changes in their true effects in clinical practice, market price, and the number of stents per patient.

CRD COMMENTARY - Selection of comparators
BMS was explicitly chosen as the comparator as it represented standard practice in Australia for the treatment of coronary artery stenosis. You must decide whether this is a widely used technology in your own setting.

Validity of estimate of measure of effectiveness
A systematic review of the literature was undertaken. The methods and conduct of the review were satisfactorily reported, and the authors explored differences between the primary studies. Another positive point of the study was that variation in effectiveness data was explored in the sensitivity analysis.

Validity of estimate of measure of benefit
QALYs and the absolute risk reduction in TLR rates were the measures of benefit used in the economic analysis; these appear to be valid measures of benefit. Moreover, the use of QALYs enables comparisons of the study results across different interventions. The authors stated that the 12-month horizon of the published trial data might have been insufficient to detect the true effects of the treatment.

Validity of estimate of costs
A hospital perspective was adopted for the study. However, it was unclear from the reporting of the study whether all the relevant cost categories were included. The resource quantities and the unit costs were not reported separately, thus hampering the reproducibility of the study in other settings. The price year was not stated. Sensitivity analyses of the costs were performed in order to assess uncertainty.

Other issues
This was the first study to compare the costs and benefits of DES in current use in Australia. Therefore, there were no previous studies with which to compare the findings. The authors acknowledged uncertainties surrounding the results of the study. In addition to the issue of time-horizon mentioned already, the applicability of the results to the Australian setting may be limited if a proportion of the TLRs reported in the trials resulted from angiographic findings that would otherwise have gone undetected in normal clinical practice. Also, quality of life data were obtained from patients undergoing repeat catheterisation and from a trial of acute MI patients receiving balloon angioplasty versus BMS. This evidence may not apply to patients receiving stents in Australia.

Implications of the study
The results of the study suggest that decisions to limit DES to patients at the highest risk of restenosis may improve
their cost-effectiveness, but will need to be reassessed when there is evidence available to permit comparisons of absolute benefits between patient groups.

**Source of funding**
None stated.

**Bibliographic details**

**PubMedID**
16274347

**Other publications of related interest**


**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Australia; Coronary Restenosis /prevention & control; Coronary Stenosis /therapy; Cost-Benefit Analysis; Equipment Design; Humans; Immunosuppressive Agents /administration & dosage /economics; Metals; Paclitaxel /administration & dosage /economics; Patient Selection; Polymers; Risk; Sirolimus /administration & dosage /economics; Stents /economics; Treatment Outcome

**AccessionNumber**
22005001799

**Date bibliographic record published**
31/08/2006

**Date abstract record published**
31/08/2006