Cost-effectiveness of the Taxus paclitaxel-eluting stent in the Swedish healthcare system

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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
The study compared three percutaneous coronary interventions (PCIs) in patients with coronary artery disease. The interventions were Taxus (a drug-eluting stent, DES), bare-metal stents (BMS) and coronary artery bypass grafting (CABG). Taxus is a paclitaxel-eluting stent system (Taxus Express2, Boston Scientific). It consists of a BMS covered with a specific polymer that permits the gradual controlled release of the anti-inflammatory and anti-proliferative drug paclitaxel.

Type of intervention
Treatment (PCIs).

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

Study population
This was a modelling study and the target population comprised the general population. The characteristics of the general population were not described in detail, nor were any inclusion or exclusion criteria reported. The high-risk sub-population comprised patients with medically manageable diabetes, small vessels (<2.5 mm) and long lesions (>20 mm).

Setting
The setting was not explicitly reported. The economic analysis was carried out in Sweden.

Dates to which data relate
The effectiveness data were derived from studies published between 2001 and 2005. Resource use was partly derived from sources published in 2004. The costs were based on actual data for 2004 derived from the authors’ setting. The price year was 2004.

Source of effectiveness data
The effectiveness data were derived from a review and synthesis of published studies.

Modelling
To evaluate the cost-effectiveness and cost-utility of the interventions, the authors constructed a decision analytic model that compared the three interventions in pairs (Taxus versus BMS and Taxus versus CABG). The time horizon was 12 and 24 months when Taxus was compared with BMS, and 12 months when Taxus was compared with CABG. For the economic analysis, a 12-month horizon was applied. Further details of the model were not reported.
Outcomes assessed in the review
The input parameters used in the model were the probabilities of a repeat procedure (repeat revascularisation) for each intervention. The incidence of cardiac mortality and myocardial infarction were not accounted for in the model, as there were no observed differences between the three interventions in terms of these parameters.

Study designs and other criteria for inclusion in the review
Not reported.

Sources searched to identify primary studies
Not reported.

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

Methods used to judge relevance and validity, and for extracting data
The validity of the primary studies does not appear to have been assessed.

Number of primary studies included
Overall, 5 studies provided the effectiveness evidence.

Methods of combining primary studies
The results of the individual studies do not appear to have been combined.

Investigation of differences between primary studies
Differences between the primary studies do not appear to have been accounted for in the analysis.

Results of the review
In the total population, the target lesion revascularisation (TLR) rate was 15.10% for 12 months’ BMS, 4.4% for 12 months’ Taxus, 17.4% for 24 months’ BMS, and 5.6% for 24 months’ Taxus.

In diabetic patients, the TLR rate was 19.6% for 12 months’ BMS, 7.1% for 12 months’ Taxus, 22% for 24 months’ BMS, and 8% for 24 months’ Taxus.

In patients with small vessels, the TLR rate was 20.6% for 12 months’ BMS, 5.6% for 12 months’ Taxus, 25.4% for 24 months’ BMS, and 6.1% for 24 months’ Taxus.

In patients with long lesions, the TLR rate was 22.10% for 12 months’ BMS, 5.5% for 12 months’ Taxus, 22.4% for 24 months’ BMS, and 8.9% for 24 months’ Taxus.

At 12 months, the TLR rate was 3.8% for CABG and 7.4% for Taxus.

Measure of benefits used in the economic analysis
The authors used the number of revascularisations avoided and health utility (quality-adjusted life-years, QALYs) as the measures of benefit in the economic analysis. The health utility values were derived from the literature. Details are provided in a separate study (Serruys et al. 2001, see ‘Other Publications of Related Interest’ below for bibliographic details). Utility values were explicitly reported.
Direct costs
The health service costs included in the analysis were for CABG, PCI with BMS, PCI with Taxus, coronary angiography, cardiology outpatient visit, cardiology nurse visit, and clopidogrel (monthly). In addition, the authors estimated a price difference for DES and BMS that was used in the analysis and did not reflect hospital prices. However, the methods or assumptions used to derive this difference were not reported. The authors reported summary costs, with resources quantities were reported separately where necessary. The resource quantities were derived from published sources and actual data from the authors' setting, while the cost data were derived using actual data from the authors' setting. Drug costs were derived from national sources (i.e. the Pharmaceutical Benefits Board). Discounting was not relevant as the costs were incurred during less than 2 years. The price year was 2004.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not included in the analysis.

Currency
Swedish kronor (SEK). The exchange rate for the price year 2004 was SEK 9.13 = EUR 1.00.

Sensitivity analysis
A one-way sensitivity analysis was conducted on the following parameters:
clopidogrel in BMS (1 and 6 months) and in both arms (12 months);
angiography before treatment with PCI (50% and 90%);
the average number of stents per patient (1.1 and 1.8);
the price difference between DES and BMS (SEK 6,000 and SEK 11,000);
utility loss due to restenosis (0.05, 0.13 and 0.21); and
waiting time for re-intervention (2 weeks and 2 months).

A two-way sensitivity analysis was conducted by changing the TLR rates for both BMS and DES.
The following assumptions about TLR rates (BMS versus DES) were tested for moderate-risk patients: 19.9% versus 3.6%, 17.5% versus 4.1%, 14.3% versus 5.0%, and 12.7% versus 5.6%.

The following assumptions about TLR rates (BMS versus DES) were tested for high-risk patients: 27.5% versus 4.8%, 24.2% versus 5.5%, 20.0% versus 6.6%, and 17.6% versus 7.5%.

Estimated benefits used in the economic analysis
The estimated benefits were not reported separately.

Cost results
The annual total costs were reported per patient treated.

For the total population, the cost per patient was SEK 72,242 (EUR 7,913) for Taxus and SEK 66,907 (EUR 7,328) for
BMS. The cost of CABG was not reported.

For the high-risk group (diabetes, small vessels, long lesions) the total average cost per patient was SEK 72,995 (EUR 7,991) for BMS and SEK 71,731 (EUR 7,857) for Taxus. The cost of CABG was not reported.

The budget analysis addressed two scenarios. In one scenario, only 80% of all high-risk patients (i.e. 48% of all patients) switched from BMS to Taxus. In the other scenario, 80% of high-risk patients and 80% of normal-risk patients switched from BMS to Taxus, and 20% of CABG patients also changed to Taxus.

The first scenario resulted in a budget increase of 0.8%. The second scenario resulted in budget savings of 0.8%, owing to the fact that CABG is more expensive than Taxus.

**Synthesis of costs and benefits**
An incremental cost-effectiveness analysis was performed.

For the total population, when Taxus was compared with BMS it resulted in an incremental cost-effectiveness ratio (ICER) of SEK 2,350,844 (EUR 257,486) per QALY, or a cost of SEK 46,801 (EUR 5,126) per revascularisation avoided.

For the high-risk group, when Taxus was compared with BMS it resulted in an ICER of SEK 381,554 (EUR 41,791) per QALY, or SEK 7,648 (EUR 838) per revascularisation avoided.

When adopting a 24-month horizon, Taxus was dominant over BMS because of the lower probability of repeat revascularisation.

For patients with multi-vessel disease, Taxus was compared with and dominated CABG on account of the decreased intervention costs.

The one-way sensitivity analysis demonstrated that the results were sensitive to changes in clopidogrel usage patterns, TLR rates, the price difference between the stents, and disutility and waiting time with restenosis.

**Authors' conclusions**
The Taxus stent was cost-effective only in high-risk patients over a 24-month period. Although it may be less cost-effective for the general population, there is still a substantial offset of initial procedural costs through the lower rate of repeat revascularisation.

**CRD COMMENTARY - Selection of comparators**
The selection of the comparators was explicitly justified. Taxus represented a new DES that was not widely used in the authors' setting. BMS was a more common option, while CABG represented standard practice for patients with multi-vessel disease in the authors' setting. You should decide if these comparators are widely used in your own setting.

**Validity of estimate of measure of effectiveness**
A systematic review was not undertaken and the available data might have been used selectively. The quality of the studies was not assessed and differences between the studies were not investigated. Although the authors carried out a number of sensitivity analyses, which investigated uncertainty around the estimates used and improved the generalisability of the results, it was difficult to determine whether the ranges used in the sensitivity analyses were appropriate given that the methods used to derive these ranges were not discussed.

**Validity of estimate of measure of benefit**
The authors used the number of revascularisations avoided and QALYs as the measures of benefit in the economic analysis. The number of revascularisations was derived directly from the model, while QALYs were derived using...
utility data from the literature. QALYs enable broad comparisons to be made with a range of other health care-related technologies.

Validity of estimate of costs
The analysis of the costs was conducted from the perspective of the Swedish health care system. It appears that all the relevant categories of cost have been included in the analysis. Costs due to cardiac mortality and myocardial infarction were not included in the analysis since they were assumed to be common to all interventions. The authors only reported summary costs and it was therefore impossible to determine which specific costs were included in each category, for example whether capital or overhead costs were included. This would hinder the analysis being easily reworked for other settings. The costs were based on actual data from the authors' setting, while resource use was derived using data from the literature and from usual practice in the authors' setting. The costs were treated deterministically and only some cost parameters were investigated in the sensitivity analyses. This may introduce some uncertainty into the results. Discounting was unnecessary, as all the costs were incurred during a short time, and was appropriately not carried out. Currency conversions and the price year were reported, which will aid any future inflation exercises.

Other issues
The authors did not compare their findings with those from other studies, thus the extent to which their results agree with such studies cannot be assessed. However, the issue of the generalisability of the results to other settings was directly addressed, and the authors acknowledged the fact that the analysis was restricted to Swedish health care prices and practices. The authors do not appear to have presented their results selectively, although they did separately report the estimated benefits and total costs of the CABG intervention. The study considered individuals from the general population and patients at high risk of restenosis, and this was reflected in the authors' conclusions.

The authors acknowledged various limitations to their study. First, the effectiveness evidence was retrieved from a clinical trial setting and did not reflect real life clinical practice. It is therefore possible that angiographic follow-up might have introduced bias into the results as different monitoring protocols were used in the clinical trial environment. However, comparisons with data from the Swedish Coronary Angiography and Angioplasty Registry did not reveal any differences in terms of revascularisation rates. Second, given the lack of robust data on the quality of life of patients with restenosis, utility values were based on a study referring to patients with stable or unstable angina. This might have resulted in an overestimation of the utility gain.

Implications of the study
The authors did not make explicit recommendations for changes in policy or practice. They did, however, call for further research that will extend the investigation of possible benefits of Taxus beyond 2 years. The authors also recommended that actual current use of DES in clinical practice should be accurately recorded. The discussion highlighted areas where more research-based information is required.

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Other publications of related interest
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