Real-time polymerase chain reaction detection of methicillin-resistant Staphylococcus aureus: impact on nosocomial transmission and costs

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 determined the clinical and economic impact of real-time polymerase chain reaction (PCR) detection of methicillin-resistant Staphylococcus aureus, compared with a commercial PCR assay, on hospital costs and transmission in Canada. The study showed that the PCR-based strategy was more expensive than, and as effective as, the conventional strategy, which remained the preferred option. The study was well conducted with good presentation of methods and results. The authors’ conclusions appear appropriate.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The objective of the study was to determine the clinical and economic impact of real-time polymerase chain reaction (PCR) detection of methicillin-resistant Staphylococcus aureus (MRSA) on hospital costs and transmission in comparison with standard MRSA screening in Canada.

Interventions
Real-time PCR for the detection of MRSA was compared with standard MRSA screening, which involved a selective broth enrichment culture method. The key difference between the two strategies was the turn-around time, which was far shorter with the real-time PCR approach.

Location/setting
Canada/hospital.

Methods
Analytical approach:
The economic evaluation used data from a local hospital to determine the accuracy and clinical consequences of the diagnostic strategies, while a decision tree model was developed to compare the costs of the two options. The time horizon of the analysis appears to have been restricted to the admission period. The authors did not state explicitly which perspective was adopted.

Effectiveness data:
The clinical data were derived from records of patients admitted to a large local hospital where the new diagnostic approach was introduced in November 2004. Thus, clinical data 6 months before and 6 months after the implementation of the new real-time PCR approach were compared. Standard MRSA screening with culture was used as the ‘gold’ standard against which the accuracy of the new approach was tested. The main outcome measure was the incidence of nosocomial MRSA colonisation or infection due to transmission. A time series analysis was performed to assess the effect of using real-time PCR screening on the rate of nosocomial MRSA colonisation or infection.

Monetary benefit and utility valuations:
None.

Measure of benefit:
The key clinical end point was the mean monthly incidence of nosocomial MRSA colonisation or infection. It was not
combined with the costs because of the cost-consequences design of the analysis.

Cost data:
The health services included in the analysis were the screening costs for nursing time, disposable laboratory supplies, and laboratory labour costs to process the specimens. The analysis also included the costs of contact precautions, lost revenue because of private room use of blocked beds, and housekeeping. The initial acquisition cost of the PCR equipment and training of technologists was not included. Resource use was based on patients’ records at the authors’ institution. The costs were derived from the hospital’s finance, admission, laboratory and housekeeping departments. The costs were in Canadian dollars (CAD) for the year 2005. The total costs of the two strategies were calculated using the decision tree model.

Analysis of uncertainty:
The issue of uncertainty was addressed in order to determine the impact of variations in incidence, sensitivity, specificity and screening compliance on the expected total costs of the two strategies. The sources of the alternative values were not stated clearly.

Results
The mean monthly incidence of nosocomial MRSA colonisation or infection was 0.37 cases per 1,000 patient-days before the introduction of the new diagnostic approach.

The time-series model showed a non significant decrease of 0.14 cases per 1,000 patient-days per month (95% confidence interval: -0.18 to 0.46) after the introduction of real-time PCR detection, ($p=0.39$).

The total cost of MRSA control increased from CAD 605,034.60 for standard screening by culture to CAD 771,609.33 for screening by PCR.

The modelling analysis showed that the screening cost per patient was CAD 67 with the standard culture-based strategy and CAD 96 with the new real-time PCR-based strategy (cost-difference of CAD 29).

The expected costs were highly sensitive to changes in the incidence of MRSA colonisation or infection, the accuracy of real-time PCR and screening compliance. In particular, in this study, a very low positive predictive value for real-time PCR was used, which led to high costs associated with contact precaution. A higher positive predictive value would produce a reduction in costs for real-time PCR.

Authors’ conclusions
The authors concluded that the detection of MRSA by the PCR assay increased hospital costs without significantly reducing the rate of MRSA transmission.

CRD commentary
Interventions:
The rationale for the selection of the comparators was clear. The new intervention was compared against standard care in the authors’ setting.

Effectiveness/benefits:
The clinical data were derived from a large sample of patients admitted to the authors’ hospital. Before and after implementation data were compared using statistical analyses to take into account time-related biases. The key clinical end points were described. The authors acknowledged that the clinical data and accuracy results reflected those found in their institution and may differ in other contexts.

Costs:
The viewpoint of the analysis was not explicitly stated, but the categories of costs included in the analysis were explicitly reported and described. A justification for the exclusion or inclusion of specific cost categories was given. The sources of the data were clear. The use of a modelling framework to derive the total costs per patient was appropriate and was described clearly. Other details such as the price year, currency and use of alternative assumptions
were reported. The cost analysis appears to have been carried out satisfactorily.

Analysis and results:
The cost-consequences design of the analysis precluded the use of a cost-effectiveness ratio. In effect, the benefit measure used in the analysis only represented an intermediate end point of the clinical study. However, it might be relevant from the viewpoint of the hospital. The issue of uncertainty was addressed only with respect to total costs, using a deterministic sensitivity analysis. The authors did not address the issue of the generalisability of the study results to other settings and the results appear to reflect the authors’ context. In fact, changes in screening compliance, real-time PCR accuracy and incidence of MRSA could dramatically change the clinical and cost results of the two strategies.

Concluding remarks:
The study methodology was good, with extensive reporting of both the methods and results. The sources of data were appropriate for the analysis, and the authors’ conclusions appear valid.

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