Cost-effectiveness of supplementing a broth-enriched culture test with the Xpert meticillin-resistant Staphylococcus aureus (MRSA) assay for screening inpatients at high risk of MRSA

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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.

CRD summary
This study evaluated the cost-effectiveness of the addition of the Xpert methicillin-resistant Staphylococcus aureus (MRSA) assay to a broth-enriched culture test, for patients with a high risk of MRSA who were admitted to hospital. The authors concluded that the Xpert assay was less costly, and had more favourable outcomes than the standard culture, under various assumptions. Poor reporting of the methods means that there was an unclear risk of bias, which limits the reliability of these conclusions.

Type of economic evaluation
Cost-effectiveness analysis, cost-utility analysis

Study objective
To evaluate the cost-effectiveness of the addition of the Xpert methicillin-resistant Staphylococcus aureus (MRSA) assay to a broth-enriched culture test, for patients who were admitted to hospital and had a high risk of MRSA.

Interventions
Three strategies were compared: standard care, consisting of the broth-enriched culture test; daytime Xpert assay; and 24-hour Xpert assay.

For daytime Xpert assay, a polymerase chain reaction (PCR) test was conducted, in addition to bacteriologic culture testing, for patients who were admitted between 8am and 2.15pm; those admitted outside these hours were isolated and tested the next day. For 24-hour Xpert assay, both tests were performed at all times. The PCR tests took, on average, 75 minutes to detect MRSA.

Routine bacteriologic testing was available between 8am and 3pm, and the results were communicated back to the wards as soon as available. The cultures required 48 hours, on average, to detect MRSA. Patients were isolated until their results were received.

Location/setting
Norway/in-patient care.

Methods
Analytical approach:
A decision tree was constructed and populated mainly with data from one trial and from the Ulleval Oslo University Hospital. Additional evidence was from the literature. The trial took place between 22 July and 15 September 2009. The authors did not explicitly state their perspective.

Effectiveness data:
The primary measures of effectiveness were the sensitivity and specificity of the the Xpert assay. These values were derived from the trial, and modified using the weighted average of the results of six other studies of the sensitivity and specificity of the assay. Other outcomes were the length of pre-emptive isolation, unavailable room hours, and patient quality of life while in hospital. The length of pre-emptive isolation and unavailable room hours were from face-to-face interviews and questionnaires with the hospital staff. Patient quality of life was from a published study of patients who
were isolated on hospital wards, primarily due to resistant infection, or a high risk of resistant infection.

Monetary benefit and utility valuations:
The utility values were derived from Hospital Anxiety and Depression Scale (HADS) scores, from a published study.

Measure of benefit:
Three measures of benefit were used: the length of pre-emptive isolation, the unavailable room hours, and patient quality of life, expressed in quality-adjusted life-years (QALYs).

Cost data:
All the cost data were from the Oslo hospital and were reported in 2009 Norwegian Kroner (NOK). The costs were organised by procedure, in three categories: testing, pre-emptive isolation, and disinfection. Each category included the costs of labour, materials, and capital. Labour costs were derived from wage agreements, with a 45% wage increase for night-shift laboratory work. Capital costs included depreciation. Resource use and units used were reported.

Analysis of uncertainty:
One-way sensitivity analyses were conducted for all model parameters, over their 95% confidence intervals. Additional one-way analyses tested extreme values for the waiting time, Xpert assay specificity, and annual incidence of MRSA. A two-way sensitivity analysis assessed the combined influence of varying assay specificity and MRSA incidence. The results were presented as incremental cost-effectiveness ratios in a table.

Results
The expected total costs were NOK 16,984 for standard care, NOK 7,360 for daytime Xpert assay, and NOK 3,690 for 24-hour Xpert assay.

The 24-hour Xpert assay required the least time in isolation and unavailable room time; standard care required the most of both. Both Xpert strategies produced more QALYs than standard care; daytime Xpert produced 0.00024 QALYs more, while 24-hour Xpert produced 0.0003 QALYs more.

Assumed a threshold for willingness to pay of NOK 500,000 per QALY gained, both Xpert strategies were less costly and more effective (dominant) than standard care, and the 24-hour Xpert assay was dominant over daytime Xpert assay.

The sensitivity analyses indicated that the results were robust to extreme values, including increasing the MRSA incidence to 300 patients per 1,000, and lowering the Xpert assay specificity to 50%.

Authors' conclusions
The authors concluded that the Xpert MRSA assay was less costly, and had more favourable outcomes, compared with standard MRSA culture, under a wide variety of assumptions.

CRD commentary
Interventions:
The interventions were generally well reported. Standard care was included and described with sufficient detail to allow comparisons with standard care in other settings. This should increase the generalisability of the study.

Effectiveness/benefits:
Very few details of the trial were reported. It was unclear how or whether patients were randomised, or whether they had similar baseline characteristics. There was no reference to a publication for the trial. The authors reported that they searched MEDLINE to find studies that measured the sensitivity and specificity of the Xpert assay, but they did not report the details, making it unclear whether all relevant studies were found. They stated that a weighted average was used for sensitivity and specificity. Without further details, the validity of these estimates remains unclear. Two of the measures of benefit were from interviews: length of pre-emptive isolation and unavailable room hours. It was unclear which members of staff were interviewed, and how often. There was potential for bias. The third measure of benefit was QALYs, but it was unclear how these were derived. The authors indicated that HADS data were used, but HADS scores are not utility scores and no details of any transformation were presented.
Costs:
The costs appear to have been from appropriate sources, and their generalisability was appropriately addressed by the authors. Both the price year and the details of resource use were presented, which will allow reflation and was transparent. The costing was well conducted, but it was specific to the setting.

Analysis and results:
The model was reported with sufficient details, but may have been too simple to fully capture the complexities of infection transmission. The authors ran a large number of sensitivity analyses, but reported their results only as incremental cost-effectiveness ratios, many of which were negative. Negative ratios could indicate that an intervention is less costly and more effective, or more costly and less effective. As the authors defined a threshold for willingness-to-pay of NOK 500,000 per QALY gained, for clarity, they could have transformed the ratios into net benefits. It should be noted that the QALY differences were very small and might not have been meaningful; uncertainty in their values could affect the conclusions.

Concluding remarks:
Poor reporting of the methods means that there was an unclear risk of bias, which limits the reliability of the conclusions.

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