Cost of screening intensive care unit patients for methicillin-resistant Staphylococcus aureus in hospitals

Nyman JA, Lees CH, Bockstedt LA, Filice GA, Lexau C, Lesher LJ, Como-Sabetti K, Lynfield R

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 assessed the costs of screening patients in the intensive care unit for methicillin-resistant Staphylococcus aureus and concluded that screening, using any of three tests, produced net savings for the hospital, but further research was needed. The selection process for the effectiveness data was poor, but other methods were satisfactory and these methods and the results were adequately reported. Given the scope of the analysis, the authors' conclusions may be valid, with further assessment of uncertainty.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The objective was to assess the cost savings, from a reduction in infections, with screening for methicillin-resistant Staphylococcus aureus (MRSA) for all patients in the intensive care unit (ICU) and isolation for those who were infected.

Interventions
Screening for MRSA was applied to all ICU patients and those who were colonised or infected with MRSA were isolated. This was compared with no screening.

Location/setting
USA/in-patient care.

Methods
Analytical approach:
A Markov model was adapted from one published by Garber (1989, see 'Other Publications of Related Interest' below for bibliographic details) to synthesise the published evidence. This model simulated the progression of MRSA infection. The cycle length was one hospital day and the time horizon was one year. The authors stated that they took a hospital perspective.

Effectiveness data:
The effectiveness data were from a review of the literature in a database maintained by the Minnesota Department of Health. For each parameter, the studies were quality assessed and the best one was selected. The probabilities of transitioning from no MRSA infection nor colonisation to MRSA colonisation and the probability of transitioning from MRSA colonisation to MRSA infection were from a study by Huang, et al. (2006, see 'Other Publications of Related Interest' below for bibliographic details). The probability of a patient being colonised upon admission; the probability of a patient being infected upon admission; the patient discharge rates; and mortality were from the other published studies. The main clinical effectiveness estimates were the MRSA infection and colonisation rates.

Monetary benefit and utility valuations:
Not relevant.

Measure of benefit:
The measure of benefit was the reduction in MRSA infections.
Cost data:  
The cost categories were screening, patient isolation, and treatment for MRSA infection. The screening costs were calculated for three different nasal swab, laboratory testing protocols; non-selective culture media (standard culture); selective media (chromogenic agar); and polymerase chain reaction (PCR). The screening and isolation costs were from the Minneapolis Veterans Affairs Medical Centre (MVAMC) teaching hospital and out-patient centre, collected during 2005 and 2006. A companion study estimated the costs of treatment and the average length of stay, for patients with MRSA infection, using the Veterans Affairs Decision Support System. All costs were in US dollars ($).

Analysis of uncertainty:  
Four alternative scenarios were developed to assess the uncertainty in the base-case results. One scenario did not include the isolation costs for patients with MRSA infections, to avoid double counting. The other three scenarios assumed: an MRSA colonisation rate of 2.58%; a colonisation rate of 7.73%; and an infection reduction of 33%.

Results  
The number of new MRSA infections, per hospital admission, in the base case, was 0.0159 with screening and 0.0480 without screening. The total annual costs of screening ICU patients were $126,788 for the standard culture, $135,906 for chromogenic agar and $192,709 for PCR. The total annual costs of isolating colonised cases were estimated to be $56,908.

The cost per admission, without screening, was $18,051. The cost per admission, using the standard culture test, was $17,567. This was a net saving of $484 per admission, which was due to the avoided costs of MRSA infections. Screening, using the chromogenic agar, saved $483 per admission, and using PCR testing, it saved $476 per admission.

The three screening strategies all produced net savings in all four alternative scenarios, in the sensitivity analysis.

Authors’ conclusions  
The authors concluded that screening ICU patients, using any of the three tests, produced net savings for the hospital. Further research was needed into the effectiveness of screening in reducing infection.

CRD commentary  
Interventions:  
The interventions were described and appear to have been appropriate comparators. It was unclear if all the relevant comparators were included, but these might be relevant interventions for other settings.

Effectiveness/benefits:  
The effectiveness data were identified by a review, but the search strategy and inclusion and exclusion criteria were not reported, so it is unclear if the search was systematic. Only one database, maintained by the Minnesota Department of Health, was searched making it unclear if all the relevant evidence was included. The authors reported that the studies were quality assessed and the best one was selected by consensus or an average if studies were tied. The recommended approach is to undertake a systematic review and meta-analysis of the data, to avoid bias and increase the overall power. The main focus of the analysis was the cost comparison, but this relies on robust effectiveness data. Given these limitations, further sensitivity analyses would have been appropriate.

Costs:  
The perspective was clearly stated and the costs appear to have been relevant to this perspective. The authors provided a thorough description of how the costs were measured and their sources were clearly stated. These costs might not be generalisable due to the specific data sources, but the resource use was presented and could be revalued. The price year and if the costs were appropriately adjusted for inflation were unclear.

Analysis and results:  
The analytic approach appears to have been appropriate, but Garber, et al. should be consulted to fully assess the model. The results were not combined into an incremental analysis, as the focus was on the net savings. Some sensitivity analysis was undertaken and the authors stated that little effect was found on the results and no additional analysis was needed. A probabilistic sensitivity analysis could have assessed the uncertainty in the model when all the parameters...
were varied, which would have been more comprehensive. Given the limitations in the clinical data, further sensitivity analysis was needed. The setting was one hospital, which was a Veterans Affairs Centre, and the results might not be generalisable to other settings. The authors discussed this limitation and some other limitations to their study.

Concluding remarks:
The methods for the selection of the effectiveness data were poor, but other methods were satisfactory and these methods and the results were adequately reported. Given the scope of the analysis, the authors' conclusions may be valid, but further assessment of uncertainty is needed.

Funding
Support received from the Centers for Disease Control and Prevention, USA.

Bibliographic details

PubMedID
21281884

DOI
10.1016/j.ajic.2010.09.006

Original Paper URL
http://www.ajicjournal.org/article/S0196-6553(10)00946-6/abstract

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Bacteriological Techniques /economics; Carrier State /diagnosis; Hospitals; Humans; Intensive Care Units; Mass Screening /economics; Methicillin-Resistant Staphylococcus aureus /isolation & purification; Staphylococcal Infections /diagnosis

AccessionNumber
22011000461

Date bibliographic record published
18/05/2011

Date abstract record published
27/01/2012