Hand hygiene noncompliance and the cost of hospital-acquired methicillin-resistant Staphylococcus aureus infection

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Record Status
This is an economic evaluation that meets the criteria for inclusion on NHS EED.

CRD summary
The objective was to assess the impact of noncompliance with hand hygiene rules, and increasing compliance, during patient care by health care workers, on the costs and rate of methicillin-resistant Staphylococcus aureus (MRSA) infection. The authors concluded that hand hygiene noncompliance resulted in significant hospital costs, and that small improvements in compliance could lead to substantial savings and fewer MRSA infections. The reporting and methods were good, and the authors' conclusions appear to be appropriate.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
This study evaluated the cost and rate of methicillin-resistant Staphylococcus aureus (MRSA) without compliance with hand hygiene rules, by health care workers, during patient care, and the effects of increased compliance.

Interventions
No specific intervention was evaluated; non-compliance with hand hygiene guidelines, was compared with increased compliance. Two scenarios were considered, in which a health care worker contacted two patients consecutively and failed to comply with hand hygiene guidelines, after contact with the first patient, and before contact with the second patient. In the normal-risk scenario, both patients had unknown MRSA status; in the high-risk scenario, the first patient was assumed to be colonised with MRSA, and the second patient had unknown MRSA status.

Location/setting
USA/hospital.

Methods
Analytical approach:
Two stochastic models were constructed to simulate the two risk scenarios, in a 750-bed facility. An alternative scenario allowed contamination from surfaces, and a secondary analysis explored the impact of increased compliance, in a 200-bed facility. The authors stated that they included the costs from the hospital perspective.

Effectiveness data:
The key clinical data were the probabilities of MRSA transmission from the first patient to the health care worker, and from the health care worker to the second patient. These values were derived using data from the Duke University Medical Center, a 750-bed, tertiary care, hospital in North Carolina, and published reports. The final projected mean number of MRSA infections per contaminated event (0.001) was derived by incorporating a range of clinical inputs, including the probability of each patient being initially MRSA positive, the hospital length of stay, the number of daily room visits, the frequency of direct contact per visit, the incidence of hospital-acquired MRSA, and the hand hygiene compliance rate. If the health care worker complied with the hand hygiene guidelines, there was no infection transmission.

Monetary benefit and utility valuations:
Not applicable.

Measure of benefit:
The health benefit was measured by the number of hospital-acquired MRSA infections.
Cost data:
The total hospital cost, for each hospital-acquired MRSA infection, was the median cost from a published report. The lower and upper limits of the identified published costs were used for the 5% to 95% confidence interval. The cost per infection was multiplied by the total number of infections, and then amortised over all one million noncompliant events, to calculate the mean cost per noncompliant event. Costs were reported in US $.

Analysis of uncertainty:
A probability distribution was assigned to the costs to reflect the uncertainty in this estimate. Confidence intervals were calculated for the mean costs, and interquartile ranges were calculated for the median costs.

Results
Over the million noncompliant events, the normal-risk scenario resulted in 42 MRSA infections (0.0042% infection rate), with a mean cost per infection of $47,092 (95% CI 26,040 to 68,146), and a median cost per infection of $22,353 (IQR 17,006 to 42,996). The mean cost per noncompliant event was $1.98 (95% CI 0.91 to 3.04).

In the alternative normal-risk model, the mean cost per noncompliant event was $1.55 (95% CI 0.47 to 2.63).

The high-risk scenario resulted in 980 MRSA infections, with a mean cost of $53,598 (95% CI 50,098 to 57,097), and a median cost of $35,045 (IQR 18,106 to 72,022). The mean cost per noncompliant event was $52.53 (95% CI 47.73 to 57.32).

The secondary analysis showed that, for a 200-bed facility, increasing hand hygiene compliance by 1% resulted in a decrease of annual noncompliance events by 20,046, preventing 0.84 MRSA infections, with a mean decrease in expected MRSA-related costs of $39,650 (95% CI 18,286 to 61,014).

A 5% improvement in compliance resulted in 4.21 MRSA infections prevented with a decrease in MRSA-related costs of $198,250 (95% CI 91,429 to 305,072).

Authors’ conclusions
The authors concluded that hand hygiene noncompliance resulted in significant hospital costs, and that small improvements in compliance could lead to substantial savings and fewer MRSA infections.

CRD commentary
Interventions:
This analysis evaluated the effects of non-compliance to hand hygiene guidelines and of increasing compliance, rather than evaluating any particular intervention to increase compliance.

Effectiveness/benefits:
As this study evaluated the effect of compliance behaviour, rather than an intervention designed to increase compliance, there was no intervention effect estimate. The clinical estimates were clearly reported, and each stage of the process used to derive the effectiveness estimates was clearly reported. The sources for the clinical inputs were clearly reported. The clinical inputs were specific to the US hospital setting.

Costs:
The hospital cost associated with each MRSA infection was clearly reported. No specific details on the resource items were given, so it is difficult to assess if this cost was appropriate for the setting and population. The authors justified their choice of source for this value. The price year was not reported, and it was unclear if any cost adjustments were made. The costs were from a 1999 publication, so it is possible that 1999 prices were used. The authors highlighted a number of reasons why their model might have underestimated the cost of noncompliance. For example, the model only accounted for MRSA events occurring during hospital stay, while infections could occur after discharge; and it only included MRSA infections, while infections from other pathogens could increase hospital costs. They reported one reason why the costs may have been overestimated, which was that factors other than hygiene noncompliance could cause MRSA infections, such as contaminated shared equipment.

Analysis and results:
The models were clearly described, with diagrams provided. The results were clearly reported. The authors stated that the models were stochastic, but only reported an assigned distribution for the cost input. It appears that no probability distributions were assigned to the effectiveness inputs. The confidence intervals for the results, therefore, only reflect the uncertainty in the cost estimates, and partly analyse the uncertainty. The results that were reported seem robust. The authors suggested that a more complete and accurate estimate of the costs of hand hygiene noncompliance, required a analysis of the costs of the hospital transmission of other pathogens, as well as MRSA.

Concluding remarks:
The reporting and methods were good. The authors’ conclusions appear to be appropriate.

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