Strict hand hygiene and other practices shortened stays and cut costs and mortality in a pediatric intensive care unit

Harris BD, Hanson C, Christy C, Adams T, Banks A, Willis TS, Maciejewski ML

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
The study examined clinical and economic impacts of improving practices of hand hygiene, oral care and central-line catheter aimed at reducing hospital-acquired infections (ventilator-associated pneumonia and central-line bloodstream infections) in the setting of a paediatric intensive care unit. The authors concluded that the quality improvement programme improved clinical outcomes and reduced mortality and hospital costs. The study methodology had potential limitations that might affect the validity of the authors’ conclusions but the results appear quite robust.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The study examined the clinical and economic impact of improving practices of hand hygiene, oral care and central-line catheter aimed to reduce hospital-acquired infections (ventilator-associated pneumonia and central-line bloodstream infections) in the setting of a paediatric intensive care unit.

Interventions
The infection control and patient safety protocol consisted of three main components: hand hygiene (careful cleaning of hands with soap and running water or an alcohol-based rub); ventilator-associated bundle (elevating the head of the patient's bed when the person is put on the ventilator; giving the patient daily breaks from sedation with medications; assessing the patient’s readiness to come off the ventilator; applying measures as needed to prevent peptic ulcer disease and deep vein thrombosis; and providing daily oral care with chlorhexidine); and ensure compliance with care practices for accessing and maintaining the dressings for central-line catheters. The comparator was no infection control and patient safety protocol.

Location/setting
USA/hospital.

Methods
Analytical approach:
The analysis was based on a single study with a short-term horizon (hospitalisation). The authors stated that the perspective was that of the hospital.

Effectiveness data:
The assessment of intervention effectiveness was based on a retrospective comparative study with historical control as most data were derived retrospectively from the hospital database. A total of 2,379 patients was included in the study: 817 (44.8% female) in the baseline period (January 2007 to January 2008) during which no specific intervention was implemented, 601 patients (43.1% female) in the intervention period (February to October 2008) and 961 patients (43.7% female) in the post-intervention period (November 2008 to December 2009) when all interventions were already in place. All children admitted to the paediatric intensive care unit during these periods were enrolled in the study and followed until hospital discharge. The primary endpoints were the probability of a patient developing ventilator-associated pneumonia or a central-line bloodstream infection and in-hospital mortality.

Monetary benefit and utility valuations:
Measure of benefit:
No summary benefit measure was used as a cost-consequences analysis was carried out. The primary outcomes were the rates of ventilator-associated pneumonia and central-line bloodstream infection and in-hospital mortality.

Cost data:
The economic analysis included the costs of the intervention programme (mostly posters for an educational campaign, a training fair and hand sanitisers attached to the walls outside patients’ rooms) plus in-patient hospital costs. Length of stay in both paediatric intensive care unit and normal wards was a key item of the cost calculation. Resource quantities were derived from the hospital database for the three periods under examination. Costs were estimated by applying the hospital-specific cost-to-charge ratio to the reported charges. Costs were in US dollars ($). The price year was 2010.

Analysis of uncertainty:
Two specific sensitivity analyses were carried out: the effect of the programme was tested for all patients in the paediatric intensive care unit (whether or not they had a hospital-acquired infection) and a time-series analysis was carried out by dividing the study period into three quarter years.

Results
All clinical and economic outcomes improved in the post-intervention period compared to the baseline period. Differences were statistically significant. In the adjusted analysis the odds ratio of ventilator-associated pneumonia risk was 0.37 (95% CI 0.15 to 0.97), the odds ratio of central-line bloodstream infection was 0.42 (95% CI 0.22 to 0.80) and the odds ratio of in-hospital mortality was 0.51 (95% CI 0.30 to 0.85). Adjusted cost-savings were estimated to be $12,136. Differences in costs were statistically significant for the comparison between baseline and post-intervention periods for paediatric intensive care unit only and for both paediatric intensive care unit and normal wards (p<0.001)

The results of the sensitivity analysis did not alter substantially the base case findings.

Authors’ conclusions
The authors concluded that the quality improvement programme improved clinical outcomes and reduced mortality and hospital costs.

CRD commentary
Interventions:
The selection of the comparators was appropriate as the quality improvement intervention was compared against the period before the programme implementation. There was an extensive description of the programme.

Effectiveness/benefits:
The clinical analysis was based on a study, the main limitations of which were the retrospective design and the non-concurrent assessment of study groups. The authors stated that using data from a single hospital for both the intervention and control groups might have limited the ability to isolate the causal effect of the quality improvement effort. Study groups were comparable at baseline with respect to demographic and clinical characteristics but some differences in age or admission physician were pointed out. The authors pointed out that there were no changes in personnel in the unit during the study period but the potential impact of other factors (such as unrelated efforts to improve quality and changes in risk of hospital-acquired infection) could not be ruled out. Such issues might have effected the validity of the clinical analysis. The authors attempted to address these issues by regression analyses to identify adjusted differences in outcomes between the study periods after controlling for various explanatory variables. Various outcomes were considered and most of them were disease specific. Mortality was the only endpoint that might allow comparisons with the benefits of other health care interventions.

Costs:
The included cost categories and sources used reflected the hospital perspective reported by the authors. Details on resource quantities were reported for hospital length of stay and were based on the hospital accounting system (which provided costs instead of charges). Details on unit costs were not provided. Total costs for each time period were reported. Non-normality of the cost distribution was taken into account appropriately using generalised linear models.
The price year was provided and enabled reflation exercises.

Analysis and results:
The study results were presented clearly. Cost-effectiveness ratios were not calculated because of the cost-consequences framework of the analysis. The issue of uncertainty in costs and benefits results was not addressed by means of sensitivity analyses but the significance of differences was estimated with statistical techniques. The authors stated that the main limitations of the analysis were related to the design of the clinical study. The authors pointed out the limited generalisability of the study findings because all data came from a single institution that might not be representative of other hospitals.

Concluding remarks:
The study methodology presented some potential limitations that might affect the validity of the authors’ conclusions but the study results appear quite robust.

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