Cost-effectiveness of metered-dose inhalers for asthma exacerbations in the pediatric emergency department

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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 examined the cost-effectiveness of a metered-dose inhaler (MDI) versus wet nebulisation to deliver bronchodilators, for the treatment of mild-to-moderately severe asthma, in children aged two to 18 years, who were admitted to the emergency department. The authors concluded that MDIs with spacers could yield significant cost savings, compared with wet nebulisers, for hospitals, the health care system, and families of children with asthma. The methods were appropriate, and the data sources and results were clearly reported. The authors’ conclusions are valid.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
This study examined the cost-effectiveness of a metered-dose inhaler (MDI) versus wet nebulisation to deliver bronchodilators, for the treatment of mild-to-moderately severe asthma, in children aged two to 18 years who had been admitted to the emergency department. The analysis focused on avoiding hospital admission as the key outcome of treatment.

Interventions
The interventions were the two modes of delivery for beta-agonist bronchodilators: MDIs or wet nebulisation. MDI treatment, with a spacer, consisted of three to six inhalations of albuterol 500 to 1,000 micrograms (μg), at 20-minute intervals. Wet nebulisation consisted of three to six treatments of albuterol 2,500 or 5,000 μg, at 20-minute intervals.

Location/setting
Canada/emergency department.

Methods
Analytical approach:
The analysis was based on a decision-tree model for emergency treatment of acute paediatric asthma exacerbations. The time horizon was restricted two days admission to the emergency department plus two days following this admission. The authors stated that the analysis was carried out from the perspective of the hospital.

Effectiveness data:
The clinical data were mainly from a Cochrane systematic review. This review provided the patients’ characteristics. Only data from randomised controlled trials that compared MDI with wet nebulisation were included. These data were pooled to produce the probability of averted hospital admission, which was the key input for the model.

Monetary benefit and utility valuations:
Not considered.

Measure of benefit:
The benefit measure was the reduction in the probability of hospital ward admission.

Cost data:
The economic analysis included the costs of the drugs (acquisition), devices (MDI and wet nebulisation kit).
administration by a registered nurse, and the hospital stay. The unit costs were the averages of data from two tertiary academic paediatric Canadian hospitals. The resource quantities were mainly from the Cochrane review. All costs were in Canadian dollars (CAD).

Analysis of uncertainty:
One-way sensitivity analyses were carried out on all the model inputs to identify the most influential parameters. A probabilistic analysis was carried out, using a Monte Carlo simulation and applying theoretical distributions to the model inputs. Cost-effectiveness acceptability curves were generated. The cost assumptions for MDI delivery and nebulisation were varied to estimate the difference in the cost of drugs and related devices that would change the incremental cost-effectiveness ratios (ICERs). An alternative scenario considered the addition of ipratropium bromide to albuterol treatment.

Results
The MDI strategy was associated with a reduction of 0.062 (95% CI -0.0043 to 0.1304) in the probability of hospital admission and saved CAD 154.95 compared with wet nebulisation. MDI treatment was dominant as it was more effective and less expensive.

MDI treatment was dominant in 98% of simulations. It remained dominant in 90% of simulations if its cost was as much as CAD 70 higher than that of nebulisation. This conclusion held when adding ipratropium bromide.

The deterministic analysis showed that the base-case findings were generally robust. The probability of hospital admission was the key model driver and the cost-effectiveness results were sensitive to variations in this input.

Authors’ conclusions
The authors concluded that MDIs with spacers could yield significant cost savings, compared with wet nebulisers, for hospitals, the health care system, and families of children with asthma.

CRD commentary
Interventions:
The comparators were appropriately selected, as treatments for asthma in children could be delivered by either MDIs or wet nebulisation.

Effectiveness/benefits:
The clinical data were from a published systematic review of the literature, which should have ensured the inclusion of all relevant trials. Only head-to-head randomised controlled trials were included ensuring high internal validity. These clinical data were varied in the sensitivity analyses. The benefit measure was specific to the disease and will not permit comparisons to be made with other disease interventions. It was chosen because the analysis focused on the reduction in hospitalisation and not long-term quality of life, as acknowledged by the authors.

Costs:
Only those costs relevant to the stated hospital perspective were analysed. The unit costs and resource quantities were presented separately, facilitating the replication of the study for other settings. Appropriate Canadian sources were used for both the unit costs and resource use data. The impact of variations in each cost category on the total costs was reported. The authors stated that physician costs for the treatment of asthma exacerbation were not included as they were assumed to be similar for the two groups. The price year was not explicitly reported, but seems to have been 2009.

Analysis and results:
An incremental analysis was appropriately conducted and showed that the MDI was the dominant option. The total costs and benefits were clearly reported for each strategy. The uncertainty was assessed in both deterministic and probabilistic analyses, varying all the parameters simultaneously. A very simple model was used, with a short time horizon, according to the study’s objectives. The authors stated that their use of clinical trials for the resource use and clinical data might have reduced the external validity of their analysis. They stated that their results should be considered to be specific to Canada. They acknowledged that the main limitation of their analysis was the use of retrospectively reported cost outcomes, instead of prospectively collected resource use.
Concluding remarks:
The methods were appropriate, and the data sources and results were clearly reported. The authors’ conclusions are valid.

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