Improved outcomes for hospitalized asthmatic children using a clinical pathway

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.

Health technology
A clinical pathway for hospitalised children with asthma was examined. The pathway provided a protocol for admission, treatment and the discharge of asthmatic children, on the basis of a paediatric asthma score (PAS) and care provided by nursing and respiratory therapy staff. The staff were trained in four educational sessions.

Type of intervention
Patient care management.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised children aged 2 to 18 years, with a prior diagnosis of asthma by a physician, and no significant co-morbidities, such as sickle cell anaemia or cystic fibrosis.

Setting
The setting was secondary care. The economic study was carried out at the Children's Hospital of the King's Daughters in Norfolk (VA), USA.

Dates to which data relate
The effectiveness and resource use data were gathered from September to December 1996 for the control group, and from September to December 1997 for the intervention group. No price year was reported.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was carried out on the same sample of patients as that used in the effectiveness study. It was conducted prospectively in the intervention group and retrospectively in the control group.

Study sample
Preliminary power calculations were based on an expected 10% reduction in length of hospital stay due to the clinical pathway. These suggested that a sample of at least 32 children was required in each study group. Of the 177 children placed in the clinical pathway programme from September to December 1997, 149 completed the pathway and 34 were randomly selected to be included in the intervention group. The mean age in the intervention group was 7.3 (+/- 3.6) years and 76% were boys. A sample of 34 children, selected from those who attended the hospital during the same
period in the previous year and matched for demographics and clinical conditions, formed the control group. Their mean age was 7.1 (+/- 3.5) years and 76% were boys. Children could be removed from the clinical pathway on account of nursing implementation issues, the physician was uncomfortable with using the clinical pathway, a complicating diagnosis during hospitalisation, and PAS not reflecting patient conditions (the child's clinical status was considered to be better than that obtained with the PAS).

**Study design**
This was a prospective comparative study with a historical control, which was carried out in a single centre (Children's Hospital of the King's Daughters). Patients in the intervention group were randomly selected from a larger group of children, but the method of randomisation was not described. Patients in the control group were selected in order to match those in the intervention group. The length of follow-up was not explicitly stated. However, it seems that no patient was lost to follow-up.

**Analysis of effectiveness**
The analysis of the effectiveness was conducted on all children included in the initial study sample. The health outcomes used in the study were LOS, readmissions to the hospital or emergency department within 72 hours after discharge, and indicators of inpatient and discharge management strategies. Indicators of inpatient management strategies included the percentage of patients who completed asthma education, use of oral corticosteroids, use of ipratropium bromide, albuterol frequency at discharge, and use of peak flow meter during inpatient stay. Indicators of discharge management strategies were controller medication prescribed, primary form of albuterol prescribed at discharge, use of oral corticosteroids prescribed at discharge, and scheduled followed-up appointments. The study groups were comparable at baseline by definition, because the control patients were matched to those in the intervention group for age, race, gender, intensive care unit admission, presence of pneumonia, and the PAS after the fourth nebulised dose in the emergency department.

**Effectiveness results**
The LOS was 2.94 (+/- 0.71) days (95% confidence interval, CI: 2.69 - 3.18) in the control group and 1.51 (+/- 0.58) days (95% CI: 1.31 - 1.71) in the intervention group, (p<0.001).

There were no readmissions to the hospital or emergency department within 72 hours after discharge in either group.

For indicators of inpatient management, the percentage of patients who completed asthma education was significantly higher in the intervention group (65% versus 18%, p<0.001). The use of oral corticosteroids (instead of intravenous corticosteroids) was also higher (88% versus 35%, p<0.001), as was albuterol frequency at discharge, (p<0.001). However, the use of ipratropium bromide was lower in the intervention group (26% versus 56%, p<0.05) and there was no difference in the use of peak flow meter during inpatient stay.

For indicators of discharge management, controller medication prescribed (88% versus 53%, p<0.001), oral corticosteroids prescribed at discharge (97% versus 76%, p<0.001), and rescue medication (albuterol), (p<0.001), were significantly better in the intervention group. In addition, the children in the intervention group were statistically more likely to have a follow-up appointment scheduled within one week of discharge.

**Clinical conclusions**
The effectiveness study showed that the new clinical pathway for hospitalised asthmatic children was effective in reducing the LOS and improved the overall quality of the care.

**Measure of benefits used in the economic analysis**
The health outcomes were left disaggregated and no summary benefit measure was used in the economic evaluation. A cost-consequences analysis was therefore carried out.
**Direct costs**
Discounting was not relevant because the costs per patient were incurred in a short period of time. The unit costs were not reported separately from the quantities of resources used. A detailed breakdown of the costs was not provided. Professional fees were not included in the analysis. The cost/resource boundary adopted in the study appears to have been that of the hospital. Resource consumption was estimated using actual data from the charts of the same patients as those included in the effectiveness study. The hospital cost accounting information system provided the costs of care. The price year was not reported.

**Statistical analysis of costs**
The costs were reported as the average (+/- standard deviation), along with 95% CIs. A one-way analysis of variance was used to test for differences in the total costs.

**Indirect Costs**
The indirect costs were not considered.

**Currency**
US dollars ($).

**Sensitivity analysis**
Sensitivity analyses were not performed.

**Estimated benefits used in the economic analysis**
See the 'Effectiveness Results' section.

**Cost results**
The costs per patient were $2,829 (+/- $955) (95% CI: 2,496 - 3,162) in the control group and $1,685 (+/- $710) (95% CI: 1,437 - 1,933) in the intervention group, (p<0.001).

**Synthesis of costs and benefits**
Not relevant because a cost-consequences analysis was conducted.

**Authors' conclusions**
The implementation of a clinical pathway for the management (admission, therapy, and discharge protocol) of hospitalised asthmatic children led to a reduction in hospital stay and costs, and significantly improved the quality of the care. Since the pathway resulted in savings of about $1,144 per patient, the authors estimated that, based on the annual admission rates at their institution, the intervention would result in an annual cost reduction of $834,000 if all patients were managed with the new protocol.

**CRD COMMENTARY - Selection of comparators**
The rationale for the choice of the comparator was clear. Standard care provided to hospitalised asthmatic children was selected because it represented the routine approach for the management of such patients. You should decide whether it represents a valid comparator in your own setting.

**Validity of estimate of measure of effectiveness**
The effectiveness study used a prospective comparative study with historical control. This was appropriate for the study.
question, although this study design is associated with some disadvantages, most of which were noted by the authors. First, the lack of random allocation of the patients to the study groups may have resulted in bias and confounding factors affecting the observed outcomes. Second, the control group was retrospectively selected and evaluated, thus the impact of changes occurring between the two study periods cannot be ruled out. Third, the use of a specific score to admit patients was quite subjective and this instrument had not been validated before. These issues tend to limit the internal validity of the study.

The authors also noted some strengths of the analysis. For example, the groups were comparable at baseline, the management strategies did not seem to change substantially between the two study periods, and it would have been difficult to have performed a randomised trial in the study setting. It has to be noted that the study sample appears to have been representative of the study population. Further, power calculations were performed in the planning phase of the study to ensure that the sample size was appropriate for the detection of statistically significant differences in the main outcome measure (LOS).

Validity of estimate of measure of benefit
No summary benefit measure was used in the economic analysis. The analysis was therefore categorised as a cost-consequences study.

Validity of estimate of costs
Few details on the cost analysis were provided in the paper. The categories of costs included in the economic evaluation were not reported and the unit costs were not provided. The price year was not given, thus the reproducibility of the study is low. The cost estimates were specific to the study setting and sensitivity analyses were not performed. The authors conducted some statistical tests on resource use and costs to evaluate the statistical significance of the observed differences.

Other issues
The authors compared their findings with those from published studies that evaluated the impact of new clinical pathways among asthma patients. Although the outcomes and study designs were not comparable, the authors concluded that most of the studies provided evidence on the clinical and economic benefits of the new protocol. In terms of the issue of the generalisability of the study results to other settings, the authors stated that caution is required due to the limitations of their study. Sensitivity analyses were not conducted, thus the external validity of the analysis is weak. The conclusions of the analysis were consistent with the initial hypothesis of the study, both in terms of the patients enrolled and the objective of the analysis.

Implications of the study
The study results suggest that a clinical pathway can be safely and efficiently implemented for the management of asthmatic children. However, such a conclusion should be interpreted with caution due to the limitations of the study, as highlighted by the authors. These suggest that further research should be conducted to confirm the results of the present study. Also, to evaluate the impact of the pathway on post-discharge resource consumption and improvement in self-managed techniques for asthmatic patients.

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Bibliographic details
Other publications of related interest
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