Comparison of racemic albuterol and levalbuterol in the treatment of acute asthma in the ED
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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.

Health technology
The use of racemic albuterol 2.5 mg or levalbuterol 1.25 mg delivered via a nebuliser, in the emergency department (ED), in addition to other standard treatments such as corticosteroids and oxygen. Treatment choice was determined by the attending physician.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised individuals aged 1 year or older, presenting to the ED with a primary or secondary diagnosis of acute asthma that required nebulisation with a short-acting beta2-agonist. Patients were excluded if they did not receive beta2-agonist treatment in the ED.

Setting
The setting was secondary care. The economic study was performed in two suburban community hospitals in New Jersey, USA. These were the Muhlenberg Regional Medical Center (MRMC) and Mercer Hospital (MH).

Dates to which data relate
The effectiveness data were retrospectively collected from June 2000 through February 2001 in the MRMC, and from August 2002 through October 2002 in the MH. The economic analysis was conducted only for the MRMC site. Hence, the cost data were collected (only in the MRMC) from June 2000 to February 2001. The price year was not reported.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The costing was conducted for the same sample of patients that provided the effectiveness evidence (MRMC site).

Study sample
Consecutive cases fulfilling the inclusion criteria were reviewed in the two hospitals. From the 736 patients in the MRMC, 608 received racemic albuterol and 128 levalbuterol. From the 186 patients in the MH, 121 received racemic albuterol and 65 levalbuterol. No power calculations were reported.
Study design
This was a retrospective cohort study that was conducted at two sites. Charts for a consecutive 9-month period were reviewed at the first site (the MRMC). Then, in an attempt to reproduce the disposition of the patients, charts were reviewed for a consecutive 3-month period at the second site (the MH). Only the MRMC results were presented in full and included in the economic analysis.

Analysis of effectiveness
Hospital admission rates were used as a proxy for treatment effectiveness. These were presented for each group, stratified by age. The baseline characteristics upon arrival at the ED (i.e. age, gender, or patient acuity) were similar between the groups at the MRMC, but they were not reported at the MH.

Effectiveness results
Ninety-eight (13.3%) patients were admitted at the MRMC. The admission rates were significantly lower in the levalbuterol group than in the racemic albuterol group (4.7% versus 15.1%; p=0.0016).

The racemic albuterol admission rate was also comparable with the previous average admission rate (16.4%) at the MRMC.

In adult patients (n=502), the admission rate was 4.5% in the levalbuterol group versus 17.6% in the racemic group, (p=0.00085).

In paediatric patients (n=234), the admission rate was 5.0% in the levalbuterol group versus 9.8% in the racemic group, (p=0.01).

Although not all results were presented in full, the authors reported that the MH results showed that there were also significant decreases in admission rates with levalbuterol (13.8%) versus racemic albuterol (28.9%), (p=0.021).

Clinical conclusions
The results of this observational study showed that levalbuterol treatment in the ED for patients with acute asthma resulted in lower admission rates, and subsequently higher patient discharge rates, compared with racemic albuterol.

Measure of benefits used in the economic analysis
No summary measure of benefit was used. In effect, a cost-consequences analysis was performed.

Direct costs
The authors reported that all hospital charges submitted to patients were collected and assessed at the MRMC. The cost categories that the authors reported were hospital charges (including drug costs) and collected funds. As the time horizon corresponded to the period of hospitalisation, discounting was appropriately not performed. Some quantities and costs were reported separately. The economic analysis was conducted only for the MRMC site, and data were collected during June 2000 through February 2001. The price year was not reported and the costs were not reflated to present values.

Statistical analysis of costs
The costs were treated stochastically and compared statistically, although the tests used for the cost analysis were not reported.

Indirect Costs
No indirect costs were included.

**Currency**
US dollars ($).

**Sensitivity analysis**
No sensitivity analysis was performed.

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

**Cost results**
The ED costs were found to be similar in the two groups.

The mean patient hospital charges for ED treatment in each treatment group were $404.56 (+/- 193.56) for levalbuterol and $422.30 (+/- 230.61) for racemic albuterol, (difference not statistically significant).

The corresponding collected funds amounted to $211.90 (+/- 107.56) for levalbuterol versus $207.16 (+/- 157.47) for racemic albuterol.

In terms of hospitalisation costs, with a mean length of stay of 3.8 days and an average per diem cost of $945, the mean hospitalisation cost was $3,625.

The cost per ED treatment was approximately $1.00 for the racemic isomer and $6.00 for levalbuterol.

Thus, for each 1,000 ED asthmatic patients presenting to the ED annually, the overall drug cost was $1,000 for albuterol and $6,000 for levalbuterol.

Considering admission costs, and with a projection of 150 admissions for each 1,000 patients treated with racemic albuterol versus 50 admissions for those treated with levalbuterol, the total costs of admission were $600,000 in the racemic albuterol group versus $200,000 in the levalbuterol group.

The inpatient cost-savings of $400,000 resulting from an investment of $5,000 cost for levalbuterol resulted in an 80:1 risk-benefit ratio favouring levalbuterol.

**Synthesis of costs and benefits**
The costs and benefits were not combined.

**Authors' conclusions**
Although levalbuterol has higher drug costs than racemic albuterol, the treatment costs were lower with levalbuterol mainly because of a decrease in hospital admissions. This makes levalbuterol treatment in the ED a cost-effective alternative to racemic albuterol for patients with acute asthma.

**CRD COMMENTARY - Selection of comparators**
The choice of the comparator was explicitly justified because of the possible effectiveness and side-effect profiles of the two albuterol formulations evaluated. In addition, authors stated that the exclusion of other comparators and the absence of standardised treatment regimens are some study limitations. You should judge whether the comparators are relevant in your own setting.
Validity of estimate of measure of effectiveness
Though the analysis suggested a clear benefit in hospital admission rates with levalbuterol, the observational and retrospective nature of the study design and the inherent potential biases precludes any definitive conclusion about the effectiveness of each comparator. Nevertheless, the groups were shown to be comparable at baseline in the MRMC, the sample was representative of the study population, and the results in the two study sites were found to be consistent.

Validity of estimate of benefit measure:
The authors did not derive a summary measure of benefit. The reader is thus referred to the comments in the 'Validity of estimate of measure of effectiveness' field (above).

Validity of estimate of costs
Though the authors did not state the perspective of the study, it appears to have been that of the hospital. Charges were reported as cost proxies, and were analysed only in the MRMC. No cost-to-charge ratio was used but, given that the perspective was not reported clearly, it is not possible to say whether this was appropriate or not. Although the authors reported few cost categories, all relevant costs for a hospital perspective seem to have been included in the analysis. Some quantities and costs were reported separately, which can help extrapolation of the results to other settings. As the price year was not reported, and it was unclear whether the costs were reflated to present values, any future reflation exercises will be difficult.

Other issues
The authors adequately compared their study results with those from other relevant studies. They also adequately addressed generalisability issues to other settings. The authors addressed several limitations of their study. First, the retrospective nature of the study. Second, the smaller number of patients in the levalbuterol group. Finally, the lack of comparisons of postdosing efficacy.

Implications of the study
The retrospective design of the study means that no cause and effect conclusions can be drawn from the data. Nevertheless, the study suggested that in geographically distinct ED settings, with varying physicians, patient populations and socioeconomic conditions, the substitution of racemic albuterol with levalbuterol was cost-effective and improved patient outcomes by reducing hospital admission rates. The authors suggest that a prospective trial is warranted to further validate these findings.

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