# Impact of Pediatric Asthma Treatment on Managed Care Organization Budget

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## Abstract

**Objective:** To estimate the impact of budesonide inhalation suspension (BIS) on exacerbations and budget from the perspective of a US managed care organization.

**Methods:** We developed a decision-analytic model using Excel to compare budget impact and effectiveness of BIS, non-nebulized inhaled corticosteroids, and leukotriene receptor antagonists. Hypothetical cohort of patients aged 1 to 4 years with chronic or seasonal persistent asthma were evaluated through the model. All patients were assumed to be prescribed a maintenance medication. Model inputs include: drug and nondrug healthcare costs, compliance, and exacerbation rates. Costs and resource use are from published literature. Compliance and exacerbation rates are from an analysis of MCO claims for the main analysis and clinical trials for sensitivity analysis. Model outputs include total drug and healthcare costs and resource use.

**Results:** Assuming 1,000,000 lives covered in an MCO population and all asthmatic patients are on maintenance medication, the annual number of hospital days, exacerbations, and emergency department (ED) visits, given current market share data, are estimated at 358, 2984, and 1969, respectively. Although increasing market share by 10% for BIS results in an increase in drug costs, it also results in a decrease in hospital days, exacerbations, and ED visits to 346, 2891, and 1908, respectively. Overall, per member per month increases by $0.01 and per treated member per month increases by $0.48.

**Conclusions:** An increase in BIS use reduces total hospital days, exacerbations, and ED visits, with little cost impact to a US MCO.

## Introduction

- Asthma-related emergency department (ED) visits and hospitalizations make up the single largest component of the direct expenditures relating to asthma.[1]
- Pediatric asthma accounts for more than 727,000 ED visits and nearly 200,000 hospitalizations annually in the United States.[2]
- Updated guidelines from the National Asthma Education and Prevention Program recommend inhaled corticosteroids (ICSs) as the preferred first-line treatment for persistent asthma in children of all ages.[3]
- Budesonide inhalation suspension (BIS) is the only nebulized ICS approved in the United States and the only ICS approved for use in children younger than 4 years and as young as 12 months.[4]
- BIS use in children ≤8 years of age has been associated with a significant reduction in the risk of recurrent ED visits and hospitalizations.[5,6]

## Objective

To estimate the impact of BIS use in pediatric asthma patients aged 1 to 4 years on asthma exacerbations and budget from the perspective of a United States managed care organization (MCO) using a decision-analytic model.

## Methods

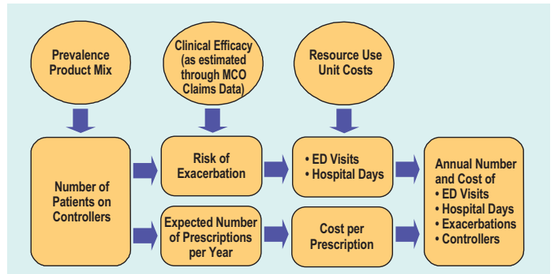
### Patient Population

Hypothetical cohort of patients aged 1 to 4 years with chronic or seasonal persistent asthma.

### Decision-Analytic Model

- A decision-analytic model was developed to help decision-makers in assessing the impact of specific pediatric asthma treatments on managed care budgets and patient well-being.
- Model estimates the expected number of exacerbations, exacerbation-related costs (ED visits, hospital days), and pharmacy cost of controller medications (Figure 1).
- Model inputs include asthma prevalence data, exacerbation rates, drug and nondrug healthcare costs (resource use), and compliance.
- Assumed number of patients in the MCO population is 1 million.
- Asthma characteristics, such as severity or category (ie, chronic or seasonal asthma) are not easily identifiable from claims analysis perspective and are therefore not differentiated.
- Asthma patients who are on controller medication are assumed to be on no more than 1 controller at one time.
- To mimic real-world prescribing practices, controllers chosen were those most likely to be prescribed among pediatric patients aged 1 to 4 years.
- Outpatient visits were not considered by the model.

**FIGURE 1. Decision-Analytic Model**




### Study Design

- The impact of BIS (Pulmicort Respules®), FP-MDI (Flovent® inhaled aerosol), and montelukast (Singulair®) on asthma exacerbations and medical costs was evaluated at baseline and after a projected 10% increase in market share of BIS.
- Input data
  - Percentage of pediatric patients aged 1 to 4 years in population: 5.4% (US Census Bureau, Census 2000).
  - Percentage of pediatric patients aged 1 to 4 years with asthma: 6.0% (National Health Interview Survey, 2002).
  - Baseline resource use and costs were identified from published literature (search of National Library of Medicine Gateway database from 1995 to present).
  - Compliance and exacerbation rates were derived from analysis of MCO claims (PHARMetrics Integrated Outcomes Database).

**TABLE 1. Cost, Compliance Rate, Market Share, and Relative Risk of Exacerbations by Asthma Controller Medications in Patients Aged 1 to 4 Years**

| Controller Medication | Cost per Prescription* | Number of Prescriptions per Year† | Compliance Rate‡ | Market Share at Baseline§ | Market Share After Projected 10% Increase in BIS Use§ | Relative Risk of Exacerbation¶ |
|---|---|---|---|---|---|---|
| BIS (0.5 mg, QD) | $144.89 | 12 | 51.50% | 43.73% | 53.73% | 76.40% |
| FP-MDI (110 µg, BID) | $59.58 | 12 | 43.17% | 6.76% | 5.56% | 107.70% |
| FP-MDI (44 µg, BID) | $48.06 | 12 | 43.17% | 6.76% | 5.56% | 107.70% |
| Montelukast# (5 mg, QD) | $94.46 | 12 | 64.00% | 42.75% | 35.15% | 104.40% |

BID: twice daily; BIS: budesonide inhalation suspension (Pulmicort Respules®); FP-MDI: fluticasone propionate inhaled aerosol (Flovent®); QD: once daily.

*Calculated from average wholesale price of each drug (Redbook, 2004),[7] strength of each package dose, and the number of inhalations per package.

†Assumption is 1 per month for 12 months.

‡Estimates based on mean number of prescriptions filled over a 6-month period from MCO claims data (PHARMetrics Integrated Outcomes Database).[8] Assumption of 100% compliance = 1 prescription per month.

§Data source: IMS National Prescription Analysis Plus (2003).[9]

¶Based on estimate of current market share from IMS National Prescription Analysis Plus (2003).[9] Projected 10% increase market share for BIS is assumed to be drawn equally from other controllers' market share.

¶Based on retrospective analysis of MCO claims data (PHARMetrics Integrated Outcomes Database) and adjusted for age (BIS and FP-MDI from McLaughlin et al[10]; montelukast from Robert et al[8]). The incidence of patients having at least 1 exacerbation (reported as a hospitalization or ED visit with a primary diagnosis of asthma) was converted into relative risk of exacerbation relative to no maintenance treatment for patients aged 1 to 8 years.[11] McLaughlin et al[10] and Robert et al[8] reported the relative risk of exacerbation for patients aged 1 to 8 years on BIS, non-nebulized ICS, leukotriene receptor antagonists, short-acting $\beta_2$-adrenergic agonist, and oral steroids. These relative risks were adjusted for patients aged 1 to 4 years and 5 to 8 years using a factor of 1.2 where the analysis of the MCO claims data (PHARMetrics Integrated Outcomes Database) found that patients aged 1 to 4 years were 1.2 times more likely to experience an exacerbation than patients aged 5 to 8 years.

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**TABLE 2. Resource Use/Cost**

| Resource | Annual Number of Visits at Baseline* | Unit Costs (per Day) |
|---|---|---|
| ED visit | 0.66 | $372.11† |
| Hospitalization | 0.12 | $1,188.09‡ |

ED: emergency department

*Source: Lozano et al, 1997[12]

†Source: Coventry et al, 1996[13]

‡Source: HCUP Kids' Inpatient Database[14]

## Results

**TABLE 3. Annual Number of ED Visits, Hospital Days, and Exacerbations at Baseline and After Projected 10% Increase in Market Share of BIS**

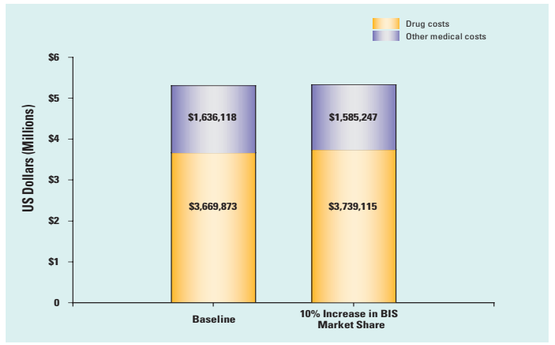
| | Baseline | 10% Increase in BIS Use |
|---|---|---|
| ED visits | 1969 | 1908 |
| Hospital days | 358 | 346 |
| Exacerbations* | 2984 | 2891 |

ED: emergency department

*Defined as an asthma attack requiring an ED visit or hospitalization.

- **A 10% increase in the use of BIS results in an estimated annual decrease of 61 ED visits, 12 hospital days, and 93 exacerbations incurred by asthma patients aged 1 to 4 years.**
- **The additional costs to avoid an ED visit and hospitalization are $300 and $1,650, respectively.**
- **MCOs could save approximately $22,800 in ED costs and $13,200 in hospitalization costs per 1 million lives in a managed care plan.**

**FIGURE 2. Drug and Medical Costs at Baseline and After Projected 10% Increase in Market Share of BIS**




- **Increasing market share of BIS by 10% decreased total annual medical costs by $50,871 and increased total annual drug costs by $69,241.**
- **Per member cost per month increased by $0.01 and per treated member cost per month increased by $0.48.**
- **The increased drug cost associated with increased BIS use is almost balanced by the cost savings from decreased medical resource utilization due to better asthma outcomes.**

## Conclusion

**Increased use of budesonide inhalation suspension in asthma patients aged 1 to 4 years was estimated to reduce total emergency department visits, hospital days, and asthma exacerbations with little cost impact to a United States MCO.**

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