Therapeutic Class Overview
Inhaled Steroids

INTRODUCTION

- Inhaled corticosteroids (ICSs) are approved by the Food & Drug Administration (FDA) for the treatment of asthma. These agents are effective in the treatment of asthma due to their wide range of inhibitory activities against multiple cell types (e.g., mast cells and eosinophils) and mediators (e.g., histamine and cytokines) involved in the asthmatic response.
- Asthma is a chronic lung disease that inflames and narrows the airways, making it difficult to breathe. Asthma causes recurring periods of wheezing, chest tightness, shortness of breath, and coughing. Asthma affects people of all ages, but most often starts during childhood. In the United States, more than 25 million people are known to have asthma, including about 7 million children (*National Heart, Lung, and Blood Institute [NHLBI] 2014*).
- The exact cause(s) of asthma are unknown. A combination of factors such as genetics, certain respiratory infections during childhood, and contact with airborne allergens can contribute to its development. Most patients with asthma have allergies (*NHLBI 2014*).
- Current pharmacologic options for asthma management are categorized as: (1) long-term control medications to achieve and maintain control of persistent asthma, and (2) quick-relief medications used to treat acute symptoms and exacerbations (*NHLBI 2007*).
- Long-term control medications include (*NHLBI 2007*):
  - Corticosteroids (ICSs for long-term control; short courses of oral corticosteroids to gain prompt control of disease, long-term oral corticosteroids for severe persistent asthma)
  - Cromolyn sodium and nedocromil
  - Immunomodulators (i.e., omalizumab)
  - Leukotriene modulators
  - Long-acting β-agonists (LABAs)
  - Methylxanthines (i.e., theophylline)
- Quick-relief medications include (*NHLBI 2007*):
  - SABAs as the therapy of choice for relief of acute symptoms and prevention of exercise-induced bronchospasm
  - Anticholinergics (i.e. ipratropium bromide), as an alternative bronchodilator for those not tolerating a SABA
  - Systemic corticosteroids, although not short-acting, are used for moderate and severe exacerbations as part of initial treatment.
- In recent years, additional medications have been made available for select subsets of patients with asthma, including mepolizumab and reslizumab for the management of severe asthma with an eosinophilic phenotype *(Prescribing information: Cinqair 2016, Nucala 2017)*. Additionally, tiotropium, long used for chronic obstructive pulmonary disease (COPD), has been FDA approved for the treatment of asthma *(Spiriva Respimat prescribing information 2017)*.
- ICSs are the most effective and most commonly recommended long-term control medications used for the treatment of asthma. The LABAs should not be used as monotherapy for the management of asthma due to increased risk for serious adverse events including death. However, they are effective adjunctive therapy in patients who are not adequately controlled with an ICS alone. Theophylline and mast-cell stabilizers have weak to low efficacy in asthma. Theophylline has an unfavorable side-effect profile and may be life-threatening at high doses. Mast-cell stabilizers have a more favorable safety profile. Tiotropium is an option for add-on therapy in patients with a history of exacerbations. Omalizumab, mepolizumab, or reslizumab may be added if patients require a higher level of care. Omalizumab is used in patients with moderate to severe allergic asthma while mepolizumab or reslizumab are used for severe eosinophilic asthma. SABAs are the medication of choice for the relief of bronchospasm during acute exacerbations of asthma (*NHLBI 2007, Global Initiative for Asthma [GINA] 2017*).
- This review includes single-agent ICSs. While corticosteroids are commonly available in combination with other bronchodilators such as LABAs, combination agents are not included within this review. Although inflammation is also a component of COPD pathogenesis, no single-entity ICS has been FDA-approved for use in COPD.
- Of note, QVAR RediHaler, a new formulation of beclomethasone manufactured by Teva, was approved by the FDA in August 2017. It is not currently available, but is planned for launch in 2018 to replace the existing QVAR product, which will be discontinued. As QVAR RediHaler is not currently available, it is not included within this review.
- Medispan class: Steroid Inhalants

Table 1. Medications Included Within Class Review

Drug	Generic Availability
Aerospan (flunisolide)	-
Alvesco (ciclesonide)	-
ArmonAir Respiclick (fluticasone propionate)	-
Arnuity Ellipta (fluticasone furoate)	-
Asmanex HFA (mometasone furoate)	-
Asmanex Twisthaler (mometasone furoate)	-
Flovent Diskus (fluticasone propionate)	-
Flovent HFA (fluticasone propionate)	-
Pulmicort Flexhaler (budesonide)	-
Pulmicort Respules (budesonide)	✔
Qvar (beclomethasone)	-

(*Drugs@FDA 2017, Orange Book: Approved Drug Products with Therapeutic Equivalence Evaluations 2017*)

INDICATIONS

Table 2. Food and Drug Administration Approved Indications

Drug	Maintenance treatment of asthma as prophylactic therapy
Aerospan (flunisolide)	✔ (age ≥6 years)
Alvesco (ciclesonide)	✔ (age ≥12 years)
ArmonAir Respiclick (fluticasone propionate)	✔ (age ≥12 years)
Arnuity Ellipta (fluticasone furoate)	✔ (age ≥12 years)
Asmanex HFA (mometasone furoate)	✔ (age ≥12 years)
Asmanex Twisthaler (mometasone furoate)	✔ (age ≥4 years)
Flovent Diskus & Flovent HFA (fluticasone propionate)	✔ (age ≥4 years)
Pulmicort Flexhaler (budesonide)	✔ (age ≥6 years)
Pulmicort Respules (budesonide)	✔ (age 12 months to 8 years)
Qvar (beclomethasone)	✔ (age ≥5 years)

(*Prescribing information: Aerospan 2017, Alvesco 2013, ArmonAir Respiclick 2017, Arnuity Ellipta 2017, Asmanex HFA 2016, Asmanex Twisthaler 2014, Flovent Diskus 2017, Flovent HFA 2017, Pulmicort Flexhaler 2016, Pulmicort Respules 2016, Qvar 2017*)

- Information on indications, mechanism of action, pharmacokinetics, dosing, and safety has been obtained from the prescribing information for the individual products, except where noted otherwise.

CLINICAL EFFICACY SUMMARY

- Several trials demonstrate the efficacy of ICSs compared to placebo for preventing exacerbations, improving FEV_1 and peak expiratory flow (PEF), improving symptoms, reducing use of SABAs, reducing oral corticosteroid requirements, and/or improving quality of life (*Baker et al 1999, Bleecker et al 2014, Corren et al 2001, Fish et al 2000, Karpel et al 2007, Lotvall et al 2014, Meltzer et al 2009, Meltzer et al 2012, Nathan et al 2010, Nelson et al 1999, Rowe et al 1999, Sheffer et al 2005, Study #321, Study #322, Study #323/324, Study #3030, Study #3031*).

- Numerous head-to-head trials have compared various ICS regimens to one another. Several clinical trials demonstrated no significant differences between different ICSs:
  - A trial comparing budesonide 750 mcg twice daily to fluticasone propionate 375 mcg twice daily in children 5 to 16 years of age demonstrated no statistically significant differences between treatment groups in PEF, symptom scores, physician/patient/parent assessment of efficacy, or frequency of exacerbations (*Fitzgerald et al 1998*).
  - A trial comparing fluticasone propionate 250 mcg twice daily to various doses of mometasone twice daily demonstrated comparable efficacy between fluticasone propionate and mometasone for improvement in FEV_1, forced expiratory flow at 25 to 75% of FVC ($FEF_{25\ to\ 75\%}$), and PEF (*O'Connor et al 2001*).
  - A trial comparing fluticasone propionate 250 mcg twice daily to mometasone 400 mcg every evening demonstrated no significant differences between groups in FEV_1, FVC, PEF, albuterol use, or asthma symptom scores (*Wardlaw et al 2004*).
  - A trial comparing fluticasone propionate 500 mcg twice daily to mometasone 500 mcg twice daily demonstrated no significant differences in PEF, FEV_1, symptom scores, or rescue albuterol use (*Harnest et al 2008*).
  - A trial comparing beclomethasone 168 mcg twice daily to mometasone 100 or 200 mcg twice daily demonstrated no significant differences in FEV_1, PEF, asthma symptoms, nocturnal awakenings, or albuterol use (*Nathan et al 2001*).
  - A trial comparing ciclesonide 160 mcg every evening to budesonide 400 mcg every evening in children aged 6 to 11 years demonstrated no significant differences between groups in FEV_1, morning PEF, asthma symptom score, or need for rescue medication (*Von Berg et al 2007*).
  - A trial comparing fluticasone furoate 100 mcg daily to placebo also included fluticasone propionate 250 mcg twice daily as a reference arm; comparable results were seen between fluticasone propionate and fluticasone furoate for FEV_1, percentage of rescue-free days, and severe asthma exacerbations (*Lotvall et al* 2014).
  - A trial comparing fluticasone furoate 200 mcg daily to fluticasone propionate 500 mcg twice daily demonstrated that fluticasone furoate was non-inferior to fluticasone propionate based on effect on FEV_1 (*O'Byrne et al 2014*).
- Overall, comparative trials have not conclusively demonstrated one ICS to be significantly more effective than another. However, in several individual trials, significant differences in some endpoints were observed. For example, comparative trials have demonstrated:
  - In a trial comparing fluticasone propionate 200 mcg twice daily to budesonide 400 mcg twice daily in children 4 to 12 years of age, patients treated with fluticasone propionate had superior results for mean morning PEF compared to patients receiving budesonide (271 ± 82 and 259 ± 75 L/minute, respectively, P=0.002) (*Ferguson et al 1999*).
  - In a trial comparing budesonide 200 mcg twice daily to fluticasone propionate 100 mcg twice daily in children six to nine years of age, effectiveness measures were comparable between groups; however, the mean growth velocity was significantly greater in the fluticasone propionate group (5.5 cm/year) compared to the budesonide group (4.6 cm/year) (*Ferguson et al 2007*).
  - A trial comparing beclomethasone 168 or 336 mcg twice daily to fluticasone propionate 88 to 220 mcg twice daily demonstrated greater improvement in FEV_1 for fluticasone propionate-treated patients than beclomethasone-treated patients. At endpoint, mean FEV_1 values in the low- and medium-dose fluticasone propionate groups improved by 0.31 (14%) and 0.36 L (15%), respectively, compared to improvements of 0.18 (8%) and 0.21 L (9%) in the low-and medium-dose beclomethasone treatment groups, respectively. Improvements were also superior in the fluticasone propionate group for $FEF_{25\ to\ 75\%}$, FVC, morning PEF, and use of albuterol (*Raphael et al 1999*).
  - In a trial comparing budesonide 400 mcg twice daily to various doses of mometasone twice daily, the FEV_1 was significantly improved from baseline in the mometasone 200 and 400 mcg treatment groups compared to the budesonide treatment group. In addition, morning wheezing scores were significantly improved in the mometasone 400 mcg twice daily group compared to the budesonide group, and patients treated with mometasone 200 or 400 mcg twice daily required significantly less albuterol compared to patients treated with budesonide (*Bousquet et al 2000*).
  - In a trial comparing budesonide 400 mcg once daily to mometasone 440 mcg once daily, the mometasone group had superior results for the percent change in FEV_1, $FEF_{25\ to\ 75\%}$, FVC, evening asthma symptom scores, albuterol use, percentage of asthma symptom-free days, and physician–evaluated response to therapy (*Corren et al 2003*).
- Meta-analyses have evaluated ciclesonide and mometasone compared to other inhaled corticosteroids:
  - A meta-analysis comparing ciclesonide to other inhaled corticosteroids (budesonide or fluticasone propionate) in children with asthma demonstrated no significant differences between ciclesonide and budesonide on asthma symptom scores, symptom-free days, rescue medication-free days, or exacerbations. When ciclesonide and fluticasone propionate were compared, no significant differences were found in asthma symptoms or rescue medication-free days. One of the four studies of ciclesonide vs fluticasone propionate demonstrated a higher incidence of exacerbations with ciclesonide; however, the dose of fluticasone was relatively higher in this study (*Kramer et al 2013*).

- A meta-analysis comparing mometasone furoate to other inhaled corticosteroids (beclomethasone dipropionate, budesonide, or fluticasone propionate) in patients with moderate to severe asthma demonstrated superior results with mometasone for pulmonary function measures (FEV_1, FVC, $FEF_{25 \text{ to } 75\%}$, and morning PEF). Mometasone furoate was also shown to be superior on some symptom indices (morning difficulty breathing scores and rescue medication use), but not others (morning wheeze scores, morning cough scores, and nocturnal awakenings). However, based on the pooled results for the comparative arms, it is not possible to make conclusions about the relative efficacy of mometasone compared to other individual agents (*Yang et al 2012*).

- Fluticasone propionate has also been compared to a leukotriene receptor, montelukast, in several randomized controlled trials in both adults and children. Although differences were not detected for all endpoints, in general these trials demonstrated superior outcomes for fluticasone propionate for FEV_1, symptom-free days, asthma symptom scores, nighttime awakenings, rescue albuterol use, physician's global assessments, frequency of exacerbations, and/or quality of life measures (*Busse et al 2001, Garcia et al 2005, Sorkness et al 2007, Szefler et al 2005, Zeiger et al 2006*).
- The safety and efficacy of ArmonAir RespiClick were evaluated in 2130 patients with asthma, including two 12-week confirmatory trials, a 26-week safety trial, and two dose-ranging trials. The efficacy of ArmonAir RespiClick is based primarily on the dose-ranging and confirmatory trials.
  - The first phase 3 trial (n = 647, of which 389 were randomized to ArmonAir or placebo) was a randomized, double-blind, placebo-controlled efficacy and safety study that compared ArmonAir RespiClick 55 mcg and 113 mcg one inhalation twice daily, AirDuo RespiClick (fluticasone/salmeterol) 55/14 mcg and 113/14 mcg one inhalation twice daily, and placebo in patients ≥ 12 years of age with persistent symptomatic asthma despite low-dose or mid-dose ICS or ICS/LABA therapy. For the primary endpoint of change from baseline in trough FEV_1, a significantly greater improvement was seen in ArmonAir 55 mcg and 113 mcg as compared to placebo at the end of 12 weeks (lease squares means change of 0.172 L, 0.204 L, and 0.053 L, respectively). Secondary endpoints of weekly average of daily trough morning PEF, total daily use of rescue medication, and Asthma Quality of Life Questionnaire improvement were also evaluated and supported efficacy of ArmonAir *(ArmonAir prescribing information 2017)*.
  - The second phase 3 trial (n = 728, of which 437 were randomized to ArmonAir or placebo) was similarly designed, but evaluated different doses: ArmonAir RespiClick 113 mcg and 232 mcg, AirDuo RespiClick 113/14 mcg and 232/14 mcg, and placebo. Results for the primary endpoint of change from baseline in trough FEV_1 mirrored that of Trial 1, with significantly greater improvement in the ArmonAir Respiclick 113 mcg and 232 mcg groups as compared to placebo at the end of 12 weeks (lease squares mean change of 0.119 L, 0.179 L, and -0.004 L, respectively). Secondary endpoints of weekly average of daily trough morning PEF and total daily use of rescue medication also supported efficacy of ArmonAir RespiClick *(ArmonAir prescribing information 2017)*.

CLINICAL GUIDELINES

- The National Asthma Education and Prevention Program (NAEPP) guideline from the NHLBI states that the initial treatment of asthma should correspond to the appropriate asthma severity category, and it provides a stepwise approach to asthma management. Long-term control medications such as ICSs, long-acting bronchodilators, leukotriene modifiers, cromolyn, theophylline, and immunomodulators should be taken daily on a long-term basis to achieve and maintain control of persistent asthma. ICSs are the most potent and consistently effective long-term asthma control medication. Quick-relief medications such as SABAs and anticholinergics are used to provide prompt relief of bronchoconstriction and accompanying acute symptoms such as cough, chest tightness, and wheezing. Systemic corticosteroids are important in the treatment of moderate or severe exacerbations because these medications prevent progression of the exacerbation, speed recovery, and prevent relapses (*NHLBI 2007*).
  - LABAs are used in combination with ICSs for long-term control and prevention of symptoms in moderate or severe persistent asthma.
  - Of the adjunctive treatments available, a LABA is the preferred option to combine with an ICS in patients 12 years of age and older. This combination is also an option in selected patients 5 to 12 years of age.
- The GINA guideline also provides a stepwise approach to asthma management. It recommends an ICS as a preferred controller medication choice, with an increased ICS dose and/or addition of a LABA for increasing symptom severity (higher steps). At the highest step, it is recommended that the patient be referred for add-on treatment (e.g., tiotropium, omalizumab, mepolizumab) (*GINA 2017*). The Institute for Clinical Systems Improvement (ICSI) endorsed the updated GINA guideline (*ICSI 2016*).

SAFETY SUMMARY

- Inhaled corticosteroids are generally contraindicated in patients with hypersensitivity to components of the product. ArmonAir Respiclick, Arnuity Ellipta, Asmanex Twisthaler, Flovent Diskus, and Pulmicort Flexhaler are also

contraindicated in patients with hypersensitivity to milk proteins. All ICSs are contraindicated as primary treatment of status asthmaticus or other acute episodes of asthma where intensive measures are required.

- ICSs have no boxed warnings. Key warnings and precautions are similar among products, and generally include:
  - The occurrence of *Candida albicans* infections in the mouth and pharynx
  - Eosinophilic conditions and Churg-Strauss Syndrome
  - Glaucoma, increased intraocular pressure, and cataracts
  - Hypercorticism and adrenal suppression
  - The risk of oral corticosteroid withdrawal or adrenal insufficiency in patients transitioning from oral to inhaled corticosteroids
  - Paradoxical bronchospasm
  - Reduction in bone mineral density with long-term use
  - Reduction in growth velocity in pediatric patients
- Adverse effects are similar among products. Common adverse effects include allergic rhinitis, back pain, conjunctivitis, cough, bronchitis, diarrhea, dyspepsia, dysphonia, ear infections, epistaxis, fever, gastrointestinal discomfort, gastroenteritis, headache, increased asthma symptoms, musculoskeletal pain, nasal congestion, nasopharyngitis/pharyngitis, nausea and vomiting, oral candidiasis, pharyngolaryngeal pain, rash, sinusitis, throat irritation, and upper respiratory infection.

DOSING AND ADMINISTRATION

Table 3. Dosing and Administration

Drug	Available Formulations	Route	Usual Recommended Frequency	Comments
Aerospan (flunisolide)	Inhalation Aerosol (HFA): 80 mcg per actuation	Oral	Adults and adolescents 12 years of age and older: initial, 160 mcg twice daily; maximum, 320 mcg twice daily	Children 6 to 11 years of age: initial, 80 mcg twice daily; maximum, 160 mcg twice daily
Alvesco (ciclesonide)	Inhalation Aerosol (HFA): 80 or 160 mcg per actuation	Oral	Patients treated previously with only bronchodilators: initial, 80 mcg twice daily; maximum, 160 mcg twice daily Patients treated previously with an inhaled corticosteroid: initial, 80 mcg twice daily; maximum, 320 mcg twice daily Patients treated previously with oral corticosteroids: initial, 320 mcg twice daily; maximum, 320 mcg twice daily	Not indicated for children <12 years of age.
ArmonAir Respiclick (fluticasone propionate)	Dry powder inhaler: 55, 113, or 232 mcg per inhalation	Oral	Dependent on asthma severity: 55, 113, or 232 mcg twice daily	Not indicated for children <12 years of age.
Arnuity Ellipta (fluticasone furoate)	Dry powder inhaler: 100 or 200 mcg per actuation	Oral	Patients not previously on inhaled corticosteroids: initial, 100 mcg once daily; maximum, 200 mcg once daily	Not indicated for children <12 years of age.

Drug	Available Formulations	Route	Usual Recommended Frequency	Comments
			Patients treated previously with an inhaled corticosteroid: Starting dose should be based on previous asthma drug therapy and disease severity, 100 mcg or 200 mcg once daily	
Asmanex HFA (mometasone)	Inhalation aerosol (HFA): 100 or 200 mcg per actuation	Oral	Patients previously receiving inhaled medium-dose corticosteroids: 100 mcg, 2 inhalations twice daily Patients previously receiving inhaled high-dose corticosteroids: 200 mcg, 2 inhalations twice daily Patients currently receiving oral corticosteroids: 200 mcg, 2 inhalations twice daily	Not indicated for children <12 years of age.
Asmanex Twisthaler (mometasone)	Dry powder inhaler: 110 or 220 mcg per actuation	Oral	Patients treated previously with bronchodilators alone or inhaled corticosteroids: initial, 220 mcg once daily in the evening; maximum, 440 mcg administered as once daily in the evening or as 220 mcg twice daily Patients treated previously with oral corticosteroids: initial, 440 mcg twice daily; maximum, 880 mcg per day	Children 4 to 11 years of age: initial, 110 mcg once daily in the evening; maximum, 110 mcg per day. When administered once daily, should be taken only in the evening.
Flovent Diskus (fluticasone propionate)	Dry powder inhaler: 50, 100, or 250 mcg per actuation	Oral	Patients who are not on an inhaled corticosteroid: initial, 100 mcg twice daily; maximum, 1000 mcg twice daily For other patients and those who do not respond adequately to the starting dose after 2 weeks, higher dosages may provide additional control.	Children 4 to 11 years of age: initial, 50 mcg twice daily; maximum, 100 mcg twice daily
Flovent HFA (fluticasone propionate)	Inhalation Aerosol (HFA): 44, 110, or 220 mcg per actuation	Oral	Patients who are not on an inhaled corticosteroid: initial, 88 mcg twice daily; maximum, 880 mcg twice daily	Children 4 to 11 years of age: 88 mcg twice daily

Drug	Available Formulations	Route	Usual Recommended Frequency	Comments
			For other patients and those who do not respond adequately to the starting dose after 2 weeks, higher dosages may provide additional control.	
Pulmicort Flexhaler (budesonide)	Dry powder inhaler: 90 or 180 mcg per actuation	Oral	Initial, 360 mcg twice daily (selected patients can be initiated at 180 mcg twice daily); maximum, 720 mcg twice daily	Children 6 to 17 years of age: Initial, 180 mcg twice daily (selected patients can be initiated at 360 mcg twice daily); maximum, 360 mcg twice daily
Pulmicort Respules (budesonide)	Suspension for nebulization: 0.25 mg/2 mL, 0.5 mg/2 mL, or 1 mg/2 mL	Oral	Children 12 months to eight years of age treated previously with only bronchodilators: initial, 0.5 mg total daily dose administered either once daily or divided into two doses; maximum, 0.5 mg total daily dose Children 12 months to eight years of age treated previously with an inhaled corticosteroid: initial, 0.5 mg total daily dose administered either once daily or divided into two doses; maximum, 1 mg total daily dose Children 12 months to eight years of age treated previously with an oral corticosteroid: initial, 1 mg total daily dose administered either as 0.5 mg twice daily or 1 mg once daily; maximum, 1 mg total daily dose	Not indicated in adults.
Qvar (beclomethasone)	Inhalation aerosol (HFA): 40 or 80 mcg per actuation	Oral	Patients treated previously with only bronchodilators: initial, 40 to 80 mcg twice daily; maximum, 320 mcg twice daily Patients treated previously with an inhaled corticosteroid: initial, 40 to 160 mcg twice daily; maximum, 320 mcg twice daily	Children 5 to 11 years of age: initial, 40 mcg twice daily; maximum, 80 mcg twice daily regardless of previous therapy

See the current prescribing information for full details

CONCLUSION

- Inhaled corticosteroids are considered the cornerstone of drug therapy for long-term asthma control. Consensus guidelines emphasize the important role of inhaled corticosteroids as long-term controller medications. The NHLBI, GINA, and ICSI asthma guidelines agree that ICSs are the preferred treatment for initiating therapy in children and adults with persistent asthma. It is important to note that the current consensus guidelines do not give preference to one ICS over another (*GINA 2017 ICSI 2016, NHLBI 2007*).
- Although individual head-to-head clinical trials have demonstrated some differences among inhaled corticosteroids on certain endpoints, results have not conclusively demonstrated one agent to be significantly more effective than another in the management of asthma. Contraindications, warnings/precautions, and adverse effects are also similar among products.
- There are several differences among products with respect to their available formulations, dosing, and use in the pediatric population. Notably, some products are available as dry-powder formulations, while others are available as inhalation aerosols. Most ICSs are dosed twice daily; however, Arnuity Ellipta is administered once daily. Asmanex Twisthaler and Pulmicort Respules may be administered either once or twice daily. Also, while most ICSs are approved for use in children, the starting age varies among products. Table 5 summarizes some of these key characteristics.

Table 5. Characteristics of Inhaled Corticosteroids

Drug	Formulation	Advantages	Disadvantages/Limitations
Aerospan (flunisolide)	Inhalation aerosol	• Approved in children ≥6 years	• Pregnancy Category C
Alvesco (ciclesonide)	Inhalation aerosol	-	• Not approved in children <12 years of age • Pregnancy Category C
ArmonAir Respiclick (fluticasone propionate)	Dry powder inhaler	-	• Contraindicated with hypersensitivity to milk proteins • Not studied in pregnant women
Arnuity Ellipta (fluticasone furoate)	Dry powder inhaler	• Once daily dosing	• Not approved in children <12 years of age • Pregnancy Category C • Contraindicated with hypersensitivity to milk proteins
Asmanex HFA (mometasone)	Inhalation aerosol	-	• Not approved in children <12 years of age • Not studied in pregnant women
Asmanex Twisthaler (mometasone)	Dry powder inhaler	• Approved in children ≥4 years • May be given either once or twice daily	• Contraindicated with hypersensitivity to milk proteins • Pregnancy Category C
Flovent Diskus (fluticasone propionate)	Dry powder inhaler	• Approved in children ≥4 years	• Contraindicated with hypersensitivity to milk proteins • Not studied in pregnant women
Flovent HFA (fluticasone propionate)	Inhalation aerosol	• Approved in children ≥4 years	• Not studied in pregnant women
Pulmicort Flexhaler (budesonide)	Dry powder inhaler	• Approved in children ≥6 years • Pregnancy Category B	• Contraindicated with hypersensitivity to milk

Drug	Formulation	Advantages	Disadvantages/Limitations
			proteins
Pulmicort Respules (budesonide)	Suspension for nebulization	• Approved in children 12 months to 8 years • May be given either once or twice daily • Pregnancy Category B (although not indicated in adults) • Generic availability	• Pediatric only; not approved in ages >8 years
Qvar (beclomethasone)	Inhalation aerosol	• Approved in children ≥5 years	• Pregnancy Category C

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