Therapeutic Class Overview
Intranasal Corticosteroids

INTRODUCTION

- Intranasal corticosteroids are primarily used to treat perennial allergic rhinitis (PAR) and seasonal allergic rhinitis (SAR) and may be useful in the treatment of some forms of nonallergic rhinitis (Wallace et al, 2008).
- Symptoms associated with allergic rhinitis include nasal congestion, rhinorrhea, sneezing and/or nasal itching. These symptoms result from a complex allergen-driven mucosal inflammation caused by resident and infiltrating inflammatory cells and a number of vasoactive and proinflammatory mediators (Wallace et al, 2008).
- Treatment should consist of patient education, allergen avoidance activities and pharmacological therapies. Patients should be educated on how to avoid known triggers, such as aeroallergens, dust mites, molds and irritants whenever possible. In addition to environmental control measures, pharmacological therapies may be used to control symptoms.
- Intranasal corticosteroids down-regulate the inflammatory response by binding to the intracellular glucocorticoid receptors of inflammatory cells and causing a conformational change, thereby controlling the rate of protein synthesis and suppressing the transcription of cytokine and chemokine genes (Clinical Pharmacology®, 2017).
- Most intranasal corticosteroids are approved by the Food and Drug Administration (FDA) for the treatment of PAR and SAR. Mometasone (NASONEX®) carries an additional indication for the prophylaxis of SAR. NASACORT ALLERGY 24HR® (triamcinolone acetate), FLONASE® ALLERGY RELIEF (fluticasone propionate), FLONASE® SENSIMIST ALLERGY RELIEF (fluticasone furoate), and RHINOCORT® ALLERGY (budesonide) are all FDA-approved for over-the-counter use (Drugs@FDA, 2017).
- Nasal polyposis is an inflammatory condition of the nasal and sinus mucosa and usually presents as persistent nasal obstruction (Wallace et al, 200flu8). Two currently available intranasal corticosteroids, beclomethasone (BECONASE AQ®) and mometasone (NASONEX®) are also FDA-approved for the management of nasal polyps.
- Beclomethasone (BECONASE AQ) and fluticasone propionate are approved for the management of nonallergic rhinitis (eg, infectious rhinitis, hormonal rhinitis and vasomotor nonallergic rhinitis with eosinophilia syndrome). Unlike allergic rhinitis, nonallergic rhinitis is characterized by periodic or perennial symptoms that are not a result of immunoglobulin E-dependent events (Wallace et al, 2008).
- Beclomethasone (QNASL™) and ciclesonide (ZETONNA®) are the only two intranasal corticosteroid products formulated as a “dry” nasal aerosol; all other products within the class are formulated as aqueous suspensions.
- Recently, VERAMYST® (fluticasone furoate) was withdrawn from the market after over-the-counter FLONASE® SENSIMIST™ ALLERGY RELIEF (fluticasone furoate) was launched (GlaxoSmithKline press release, 2017; Snyder-Bulik, 2017).
- Continuous administration of intranasal corticosteroids is more efficacious than as-needed dosing, and the onset of therapeutic effect occurs between three and twelve hours (Wallace et al, 2008).
- As a result of both the route of administration and the relatively low systemic bioavailability of these agents, intranasal corticosteroids are generally not associated with any clinically significant systemic adverse events. Moreover, drug interactions are limited when administered at recommended doses. The most common adverse events include nasal irritation and mild epistaxis.
- The agents included in this review are listed in Table 1 by brand name. Since there are some branded agents that contain the same generic component, the remaining tables in the review are organized by generic name.
- Medispan Class: Nasal Steroids

Table 1. Medications Included Within Class Review

Drug	Manufacturer	FDA Approval Date	Generic Availability
BECONASE AQ (beclomethasone dipropionate monohydrate)	GlaxoSmithKline	07/27/1987	-
FLONASE ALLERGY RELIEF† (fluticasone propionate)	GlaxoSmithKline	07/23/2014	✔
FLONASE SENSIMIST ALLERGY RELIEF† (fluticasone furoate)	GlaxoSmithKline	08/02/2016	-
flunisolide*	Various	09/24/1981	✔
fluticasone propionate*	Various	10/19/1994	✔
NASACORT ALLERGY 24HR† (triamcinolone acetonide)	Sanofi	10/11/2013	✔
NASONEX (mometasone furoate monohydrate)	Merck Sharp Dohme	10/01/1997	✔
OMNARIS® (ciclesonide)	Sunovion	11/21/2007	-
QNASL (beclomethasone dipropionate)	Teva Branded Pharm	03/23/2012	-
RHINOCORT ALLERGY† (budesonide)	McNeil Consumer Healthcare	03/23/2015	✔
RHINOCORT AQUA (budesonide)	AstraZeneca	10/01/1999	✔
triamcinolone*	Various	05/20/1996	✔
ZETONNA (ciclesonide)	Sunovion	01/20/2012	-

*Brand prescription FLONASE (fluticasone propionate), NASALIDE (flunisolide), and NASACORT AQ (triamcinolone) are no longer marketed; however, generics for these products are available.
†Over-the-counter product

(Drugs@FDA, 2017; Orange Book: Approved Drug Products with Therapeutic Equivalence Evaluations, 2017; Drug Facts and Comparisons, 2017)

INDICATIONS

Table 2. Food and Drug Administration-Approved Indications

Indication	Beclomethasone	Budesonide	Budesonide (OTC)	Ciclesonide	Flunisolide	Fluticasone furoate	Fluticasone furoate (OTC)	Fluticasone propionate	Fluticasone propionate (OTC)	Mometasone	Triamcinolone	Triamcinolone (OTC)
Indications for Prescription Products												
Treatment/relief of symptoms of SAR and PAR	✔ (age ≥6)*			✔ (age ≥12)†		✔ (age ≥2)						
Treatment of nasal symptoms of SAR	✔ (age ≥4)‡	✔ (age ≥6)		✔ (age ≥6)§	✔ (age ≥6)					✔ (age ≥2)	✔ (age ≥2)	
Treatment of nasal symptoms of PAR	✔ (age ≥4)‡	✔ (age ≥6)		✔ (age ≥12)§	✔ (age ≥6)					✔ (age ≥2)	✔ (age ≥2)	
Treatment/relief of nasal congestion associated with SAR										✔ (age ≥2)		
Prophylaxis of nasal symptoms of SAR										✔ (age ≥12)		
Relief of symptoms of nonallergic (vasomotor) rhinitis	✔ (age ≥6)*											
Management of nasal symptoms of perennial nonallergic rhinitis								✔ (age ≥4)				
Treatment of nasal polyps										✔ (age ≥18)		
Prevention of recurrence of nasal polyps following surgical removal	✔ (age ≥6)*											

OTC Uses												
Temporary relief of symptoms of hay fever or other upper respiratory allergies: nasal congestion, runny nose, sneezing, and itchy nose			✔ (age ≥6)									✔ (age ≥2)
Temporary relief of symptoms of hay fever or other upper respiratory allergies: nasal congestion, runny nose, sneezing, itchy nose, and itchy, watery eyes							✔ (age ≥2)‖		✔ (age ≥4)			

OTC = over-the-counter
*Beconase AQ
†Zetonna
‡Qnasl
§Omnaris
‖Itchy, watery eyes use is for patients ≥12 years of age

(Prescribing information: BECONASE AQ, 2015; FLONASE ALLERGY RELIEF, 2015; FLONASE SENSIMIST, 2017; flunisolide, 2016; fluticasone propionate, 2017; NASACORT ALLERGY 24HR, 2016; NASONEX, 2013; OMNARIS, 2016; QNASL, 2016; RHINOCORT ALLERGY, 2016; RHINOCORT AQUA, 2016; triamcinolone, 2013; ZETONNA, 2014)

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

- Daily administration of intranasal corticosteroids is associated with statistically significant improvements in allergy-related total nasal symptom score (TNSS) and health related quality of life scores. Numerous head-to-head clinical trials comparing the available intranasal corticosteroids have generally demonstrated no significant clinical differences among the available intranasal corticosteroids with regard to efficacy. Some studies have reported differences in sensory perceptions and patient preference with one agent compared to another. Patients administering the agents noted differences in odor, aftertaste, and severity of irritation, though these differences were not associated with differences in efficacy between the agents (Aasand et al, 1982; Al-Mohaimeid, 1993; Andersson et al, 1995; Bachert et al, 2002; Bachert et al, 2004; Berger et al, 2003; Day et al, 1998; Drouin et al 1996; Graft et al, 1996; Gross et al, 2002; Haye et al, 1993; Hebert et al, 1996; Khanna et al, 2005; LaForce et al, 1994; Langrick, 1984; Lumry et al, 2003; Mak et al, 2013; Mandl et al, 1997; McAllen et al, 1980; McArthur, 1994; Meltzer et al, 2005; Meltzer et al, 2008; Meltzer et al, 2010; Naclerio et al, 2003; Ratner et al, 1992; Sahay et al, 1980; Shah et al, 2003; Sipila et al, 1983; Small et al, 1997; Stern et al, 1997; Stokes et al, 2004; Svendsen et al, 1989; Van As et al, 1993; Vanzieleghem et al, 1987; Varshney et al, 2012; Welsh et al, 1987; Winder et al, 1993, Yonezaki et al, 2016).
- Head-to-head trials evaluating the efficacy and safety of beclomethasone, fluticasone propionate and flunisolide demonstrate that these agents are comparable to other agents within the class. However, additional results of these studies reinforce that all of the intranasal corticosteroids should be considered equally efficacious (Aasand et al, 1984; Bachert et al, 2004; Berger et al, 2003; Drouin et al, 1996; Mak et al, 2013; McAllen et al, 1980; Meltzer et al, 2010; Meltzer et al, 2008; Ratner et al, 1992; Sahay et al, 1980; Sipila et al, 1983; Small et al, 1997; Stokes et al, 2004; Van As et al, 1993).
- To date, the newly approved intranasal corticosteroid aerosol formulations have been demonstrated to be significantly more effective compared to placebo. In a six-week study of patients with PAR, aerosolized beclomethasone significantly improved reflective TNSS compared to placebo (-2.46 vs -1.63; P<0.001). Furthermore, beclomethasone was associated with a statistically significant improvement in quality of life score compared to placebo (P=0.001) (Meltzer et al, 2012). A two-week study of beclomethasone nasal aerosol 80 µg daily in pediatric patients 6 to 11 years of age with SAR also demonstrated improvement in reflective TNSS compared to placebo (-1.9 vs -1.2; P<0.001) (Storms et al, 2013). A 12-week study of beclomethasone nasal aerosol 80 µg daily in pediatric patients 4 to 11 years of age with perennial allergic rhinitis demonstrated improvement in both reflective and instantaneous TNSS compared to placebo (mean treatment difference -0.53 [P=0.009] and -0.52 [P=0.008], respectively) (Berger et al, 2015).
- The aerosolized ciclesonide formulation has also been shown to significantly improve symptoms of allergic rhinitis compared to placebo. In a study by Ratner et al, ciclesonide administered at a daily dose of 80 µg or 160 µg reduced reflective TNSS by 15.1 and 16%, respectively, compared to 3.7% in the placebo group (P<0.001 for both). In addition, significant improvements were observed with both doses of ciclesonide compared to placebo with regard to ocular symptom scores and quality of life (P<0.001 for both). Similar improvements in outcomes were reported in additional studies of up to 26 weeks duration (Berger et al, 2012; LaForce et al, 2009; Mohar et al, 2012; Ratner et al, 2010; Ratner et al, 2012).
- A systematic review of 40 studies evaluated the use of topical corticosteroids in the treatment or prevention of recurrence of nasal polyps. Topical corticosteroids were effective compared to placebo in the improvement in overall symptoms, nasal obstruction, and a reduction in the size of polyps. Additionally, topical corticosteroids prevented the regrowth of polyps following surgery. No differences in adverse events between topical corticosteroids and placebo were observed (Kalish et al, 2012).
- The Agency for Healthcare Research and Quality (AHRQ) published a comparative effectiveness review of pharmacological therapies for the treatment of SAR. A total of 59 randomized controlled trials met inclusion criteria to compare agents of six classes for relative efficacy. Agents included oral and nasal antihistamines and decongestants, intranasal corticosteroids, leukotriene modifiers, cromolyn, ipratropium, and normal saline. Overall, there was insufficient evidence to draw a conclusion about relative efficacy among most of the agents used for the treatment of SAR. For a few comparisons, sufficient evidence was available to draw a conclusion. Oral selective antihistamines and montelukast were equivalent for efficacy in reducing nasal and eye symptoms. Montelukast was superior to oral selective antihistamines for controlling asthma symptoms. Based on evidence, intranasal antihistamines and intranasal corticosteroids had equivalent efficacy for nasal and eye symptoms. Similarly, montelukast was comparable to intranasal corticosteroids for nasal symptoms. The combination of intranasal antihistamines and intranasal corticosteroids demonstrated equivalent efficacy in nasal and eye symptom resolution compared to either monotherapy. No information was available about the use of these agents for the treatment of SAR in pregnant women. For children, conclusions about relative efficacy were not determined due to insufficient evidence (Glacy et al, 2013).

- A meta-analysis evaluated nasal corticosteroids, sublingual allergen immunotherapy (SLIT), second generation H1-antihistamines, combination azelastine hydrochloride with fluticasone propionate nasal spray, and montelukast for the treatment of SAR. By indirect comparison, nasal corticosteroids and grass pollen SLIT tablets had a greater relative clinical impact on symptom scores compared to azelastine hydrochloride combined with fluticasone propionate nasal spray, second generation H1-antihistamines, and montelukast (Devillier et al, 2014). In a similar indirect, meta-analysis, SLIT (timothy grass and ragweed) and mometasone furoate improved TNSS to a greater extent than montelukast and desloratadine in the treatment of both SAR and PAR (Durham et al, 2016).
- A meta-analysis compared the effects of intranasal corticosteroids for treatment of chronic rhinosinusitis. A total of 9 randomized controlled trials were included. There was no evidence that one intranasal spray was more effective than another for disease severity or disease-specific quality of life. Epistaxis was more common with higher doses compared to lower doses (Chong et al, 2016).
- Intranasal corticosteroids are considered first-line agents for the treatment of allergic rhinitis, especially for patients with moderate to severe symptoms. Consensus guidelines do not recommend the use of one intranasal corticosteroid product over another. Intranasal corticosteroids combined with intranasal antihistamines are considered to be more effective than either alone in the treatment of allergic rhinitis. Addition of oral antihistamines is not effective (Brozek et al, 2010; Seidman et al, 2015; Snellman et al, 2013; Wallace et al, 2008).

SAFETY SUMMARY

- The intranasal corticosteroids are contraindicated in patients with an untreated infection of the nasal mucosa.
- Intranasal corticosteroids should not be used in patients with recent nasal septal ulcers, nasal surgery or trauma, as they may impair wound healing.
- Systemic corticosteroid effects such as hypercorticism and adrenal suppression may occur when intranasal steroids are used at higher-than-recommended doses or in susceptible individuals at recommended doses. Patients using corticosteroids may be more susceptible to infection; specific effects of the dose, route and duration of use are not known.
- However, as a result of both the route of administration and the relatively low systemic bioavailability of these agents, intranasal corticosteroids are generally not associated with any clinically significant systemic adverse events. Moreover, drug interactions are limited when administered at recommended doses. The most common adverse events include nasal irritation and mild epistaxis.

(Drug Facts and Comparisons, 2017)

DOSING AND ADMINISTRATION

Table 3. Dosing and Administration

Drug	Dosage Form: Strength	Usual Recommended Adult Dose	Usual Recommended Pediatric Dose	Administration Considerations
Beclomethasone (BECONASE AQ, QNASL)	Aerosol for nasal inhalation (QNASL): 40 µg/actuation (60 actuations) & 80 µg/actuation (120 actuations) Suspension for nasal inhalation (BECONASE AQ): 42 µg/inhalation (180 sprays)	PAR, SAR: Aerosol: 320 µg daily, administered as two actuations (80 µg strength) in each nostril once daily Suspension: one to two sprays in each nostril twice daily Nasal polyps, nonallergic (vasomotor) rhinitis: Suspension: one to two sprays in each nostril twice daily	Nasal polyps, nonallergic (vasomotor) rhinitis, PAR, SAR in children 6 to 12 years old: Suspension: initial, one inhalation in each nostril twice daily; maximum, two inhalations in each nostril twice daily PAR, SAR in children 4 to 11 years of age: Aerosol: 80 µg daily, administered	Suspension: The unit should be primed by releasing six sprays before initial use. If the pump is not used for seven days, it should be re-primed until a fine spray appears. Aerosol: The unit should be primed by releasing four sprays before

Drug	Dosage Form: Strength	Usual Recommended Adult Dose	Usual Recommended Pediatric Dose	Administration Considerations
			as one actuation (40 µg strength) in each nostril once daily	initial use. If not used for seven days, it should be re-primed by releasing two sprays.
Budesonide (RHINOCORT ALLERGY, RHINOCORT AQUA)	Rx suspension (RHINOCORT AQUA): 32 µg/inhalation (120 sprays) OTC suspension (RHINOCORT ALLERGY): 32 µg/inhalation (60 or 120 sprays)	PAR, SAR: Rx suspension: one spray in each nostril once daily; maximum, four sprays in each nostril once daily Hay fever or other upper respiratory allergies: OTC suspension: two sprays in each nostril once daily; once symptoms improve, reduce to one spray in each nostril once daily	PAR, SAR in children 6 to 12 years old: Rx suspension: one spray in each nostril once daily; maximum, two sprays in each nostril once daily Hay fever or other upper respiratory allergies in children 6 to 12 years old: OTC suspension: one spray in each nostril once daily; maximum, two sprays in each nostril once daily	The unit should be primed by releasing eight sprays before initial use. If not used for two consecutive days, it should be re-primed with one spray or until a fine spray appears.
Ciclesonide (OMNARIS, ZETONNA)	Aerosol for nasal inhalation (ZETONNA): 37 µg/actuation (60 actuations) Suspension for nasal inhalation (OMNARIS): 50 µg/inhalation (120 sprays)	PAR, SAR: Aerosol: one inhalation in each nostril once daily Suspension: two sprays in each nostril once daily	SAR in children ≥6 years old: Suspension: two sprays in each nostril once daily	Suspension: The unit should be primed by releasing eight sprays before initial use. If not used for four consecutive days, it should be re-primed with one spray or until a fine mist appears. Aerosol: The unit should be primed by actuating three times before initial use. If not used for ten consecutive days, it must be re-primed by actuating three times.

Drug	Dosage Form: Strength	Usual Recommended Adult Dose	Usual Recommended Pediatric Dose	Administration Considerations
Flunisolide	Suspension for nasal inhalation: 25 µg/inhalation (200 sprays)	PAR, SAR: Suspension: two sprays in each nostril twice daily; maximum, eight sprays in each nostril per day	PAR, SAR in children six to 14 years old: Suspension: one spray in each nostril three times daily or two sprays in each nostril twice daily; maximum, four inhalations in each nostril per day	The unit should be primed before initial use by releasing five or six sprays. It must be re-primed if it has not been used for five days or more, or if it has been disassembled for cleaning.
Fluticasone furoate (FLONASE SENSIMIST)	OTC suspension for nasal inhalation (FLONASE SENSIMIST): 27.5 µg/inhalation (30, 60, or 120 sprays)	Hay fever or other upper respiratory allergies: OTC suspension: two sprays in each nostril once daily for one week; maintenance, one or two sprays in each nostril once daily, as needed to treat symptoms	Hay fever or other upper respiratory allergies in children 2 to 11 years of age: OTC suspension: one spray in each nostril once daily	OTC suspension: The unit should be primed before initial use, when not used for 30 days or longer, or if the cap has been left off for five days or longer, by spraying until a fine mist appears.
Fluticasone propionate (FLONASE ALLERGY RELIEF, fluticasone)	Rx suspension for nasal inhalation: 50 µg/inhalation (120 sprays) OTC suspension for nasal inhalation: 50 µg/inhalation (30, 60 or 120 sprays)	Perennial nonallergic rhinitis: Rx suspension: two sprays in each nostril once daily or one spray in each nostril twice daily; patients may be able to reduce dose to one spray in each nostril once daily for maintenance therapy Hay fever or other upper respiratory allergies: OTC suspension: two sprays in each nostril once daily for one week; maintenance, one or two sprays in each nostril once daily, as needed to treat symptoms	Perennial nonallergic rhinitis in children 4 years of age and older: Rx suspension: one spray in each nostril once daily; maximum, two sprays in each nostril once daily Hay fever or other upper respiratory allergies in children 4 to 11 years of age: OTC suspension: one spray in each nostril once daily	Rx suspension: The unit should be primed by releasing six sprays until a fine spray appears before initial use and if not used for a week or more. OTC suspension: The unit should be primed by spraying until a fine mist appears before initial use, if not used for one week or more, and after cleaning the nozzle.
Mometasone (NASONEX)	Suspension for nasal inhalation:	PAR, SAR: Suspension: two sprays	PAR, SAR in children 2 to 11	The unit should be primed

Drug	Dosage Form: Strength	Usual Recommended Adult Dose	Usual Recommended Pediatric Dose	Administration Considerations
	50 µg/inhalation (120 sprays)	in each nostril once daily Nasal polyps in adults ≥18 years old: Suspension: two sprays in each nostril once or twice daily	years old: Suspension: one spray in each nostril once daily	before initial use by actuating 10 times or until a fine spray appears. If unused for more than seven days, it should be re-primed by actuating two times or until a fine spray appears.
Triamcinolone (triamcinolone, NASACORT ALLERGY 24HR)	Rx suspension for nasal inhalation (triamcinolone): 55 µg/inhalation (120 sprays) OTC suspension for nasal inhalation (NASACORT ALLERGY 24HR): 55 µg/inhalation (30, 60, or 120 sprays)	SAR and PAR: Rx suspension: two sprays in each nostril once daily; maintenance, one spray in each nostril once daily. Hay fever or other upper respiratory allergies: OTC suspension: two sprays in each nostril once daily; maintenance, one inhalation in each nostril once daily	SAR and PAR in children 6 to 12 years old: One spray in each nostril once daily; maximum, two sprays in each nostril once daily SAR and PAR in children 2 to 5 years old: One spray in each nostril once daily Hay fever or other upper respiratory allergies in children 6 to under 12 years: OTC Suspension: one spray in each nostril once daily; maximum, two sprays in each nostril once daily Hay fever or other upper respiratory allergies in children 2 to under 6 years: OTC Suspension: one spray in each nostril once daily	Rx suspension: The unit should be primed before initial use by releasing five sprays. If not used for more than two weeks, it can be re-primed with one spray. OTC suspension: The unit should be primed before initial use and if not used for more than two weeks by spraying until a fine mist is produced.

SPECIAL POPULATIONS

Table 4. Special Populations

Drug	Population and Precaution				
	Elderly	Pediatrics	Renal Dysfunction	Hepatic Dysfunction	Pregnancy* and Nursing
Beclomethasone	No dosage adjustment required in the elderly population.	BECONASE AQ is approved for use in children 6 years of age and older. QNASL is approved for use in children 4 years of age and older.	No dosage adjustment required.	No dosage adjustment required.	Pregnancy Category C Unknown whether excreted in breast milk
Budesonide	No dosage adjustment required in the elderly population.	Approved for use in children 6 years of age and older.	Not studied in renal dysfunction.	Not studied in hepatic dysfunction.	Pregnancy Category B Excreted in breast milk
Ciclesonide	No dosage adjustment required in the elderly population.	OMNARIS is approved for use in children 6 years of age and older for SAR and ages 12 years and older for PAR. ZETONNA is approved for use in children 12 years of age and older.	Not studied in renal dysfunction.	No dosage adjustment required.	Pregnancy Category C Unknown whether excreted in breast milk
Flunisolide	No dosage adjustment required in the elderly population.	Approved for use in children 6 years of age and older.	Not studied in renal dysfunction.	Not studied in hepatic dysfunction.	Pregnancy Category C Unknown whether excreted in breast milk
Fluticasone furoate	No dosage adjustment required in the elderly population.	Approved for use in children 2 years of age and older.	No dosage adjustment required.	No dosage adjustment required. Monitoring is recommended with moderate and severe hepatic dysfunction.	Pregnancy Category C Unknown whether excreted in breast milk

Drug	Population and Precaution				
	Elderly	Pediatrics	Renal Dysfunction	Hepatic Dysfunction	Pregnancy* and Nursing
Fluticasone propionate	No dosage adjustment required in the elderly population.	Approved for use in children 4 years of age and older.	Not studied in renal dysfunction.	Not studied in hepatic dysfunction.	Pregnancy Category C Unknown whether excreted in breast milk
Mometasone	No dosage adjustment required in the elderly population.	Approved for use in children 2 years of age and older for treatment of SAR and PAR (age ≥12 years for prophylaxis of SAR and age ≥18 years for nasal polyps).	Not studied in renal dysfunction.	No dosage adjustment required.	Pregnancy Category C Unknown whether excreted in breast milk
Triamcinolone	No dosage adjustment required in the elderly population.	Approved for use in children 2 years of age and older.	No dosage adjustment required.	No dosage adjustment required.	Pregnancy Category C Unknown whether excreted in breast milk

* Pregnancy Category B = No evidence of risk in humans, but there remains a remote possibility. Animal reproduction studies have failed to demonstrate a risk to the fetus, and there are no adequate and well-controlled studies in pregnant women.
Pregnancy Category C = Risk cannot be ruled out. Animal reproduction studies have shown an adverse effect on the fetus and there are no adequate and well-controlled studies in humans, but potential benefits may warrant use of the drug in pregnant women despite potential risks.

CONCLUSION

- Intranasal corticosteroids are used for the management of allergic rhinitis, some forms of nonallergic rhinitis and nasal polyps. They are generally well tolerated and are associated with limited drug interactions due to their localized administration and limited systemic absorption. Like other corticosteroids, intranasal corticosteroids carry warnings regarding use in patients with active infection and the development of signs of adrenal insufficiency, particularly with the administration of higher-than-recommended doses (Wallace et al, 2008).
- Intranasal corticosteroids are considered first-line agents for the treatment of allergic rhinitis, especially for patients with moderate to severe symptoms. Consensus guidelines do not recommend the use of one intranasal corticosteroid product over another (Brozek et al, 2010; Seidman et al, 2015; Snellman et al, 2013; Wallace et al, 2008).
- All available intranasal corticosteroids have demonstrated safety and efficacy for their respective indications. These agents have been shown to be effective in reducing rhinitis-related nasal symptoms such as congestion, rhinorrhea, sneezing, nasal itch, and postnasal drip. The differences in tolerability and sensory perceptions noted in clinical trials were minor and did not translate into differences in outcomes. The results of multiple head-to-head trials have generally failed to demonstrate clinically significant differences between products (Aasand et al, 1982; Al-Mohaimeid, 1993; Andersson et al, 1995; Bachert et al, 2004; Bachert et al; 2002; Berger et al, 2003; Day et al, 1998; Drouin et al. 1996; Graft et al, 1996; Gross et al, 2002; Haye et al, 1993; Hebert et al, 1996; LaForce et al, 1994; Langrick, 1984; Lumry et al, 2003; Mak et al, 2013; Mandl et al, 1997; McAllen et al, 1980; McArthur, 1994; Meltzer et al, 2005; Meltzer et al, 2008; Meltzer et al, 2010; Naclerio et al, 2003; Ratner et al, 1992; Sahay et al, 1980; Shah et al, 2003; Sipila et al, 1983; Small et al, 1997; Stern et al, 1997; Stokes et al, 2004; Svendsen et al, 1989; Van As et al, 1993; Vanzieleghem et al, 1987; Varshney et al, 2012; Welsh et al, 1987; Winder et al, 1993).
- Two nasal aerosol formulations, beclomethasone (QNASL) and ciclesonide (ZETONNA), have been approved by the FDA for the relief of symptoms associated with PAR and SAR. The other intranasal corticosteroid products are

formulated as aqueous suspensions, which may be bothersome to patients due to the potential of the suspension to drip down or out of the nose following administration.

REFERENCES

- Aasand G, Etholm BO, Skjostad M, Volden J. Flunisolide nasal spray compared to beclomethasone dipropionate in the treatment of seasonal rhinitis. Rhinology. 1982;20(4):205-11.
- Al-Mohaimeid H. A parallel-group comparison of budesonide and beclomethasone dipropionate for the treatment of perennial allergic rhinitis in adults. J Int Med Res. 1993;21(2):67-73.
- Andersson M, Berglund R, Greiff L, et al. A comparison of budesonide nasal dry powder with fluticasone propionate aqueous nasal spray in patients with perennial allergic rhinitis. Rhinology. 1995;33(1):18-21.
- Bachert C, El-Akkad T. Patient preferences and sensory comparisons of three intranasal corticosteroids for the treatment of allergic rhinitis. Ann Allergy Asthma Immunol. 2002;89:292-7.
- Bachert C, Lukat KF, Lange B. Effect of intranasal fluticasone propionate and triamcinolone acetonide on basal and dynamic measures of hypothalamic-pituitary-adrenal-axis activity in healthy volunteers. Clin Exp Allergy. 2004;34:85-90.
- BECONASE AQ prescribing information. GlaxoSmithKline. Research Triangle Park, NC. September 2015.
- Berger WE, Jacobs RL, Amar NJ, et al. Efficacy and safety of beclomethasone dipropionate nasal aerosol in children with perennial allergic rhinitis. Ann Allergy Asthma Immunol. 2015 Aug;115(2):130-6.
- Berger WE, Kaiser H, Gawchik SM, et al. Triamcinolone acetonide aqueous nasal spray and fluticasone propionate are equally effective for relief of nasal symptoms in patients with seasonal allergic rhinitis. Otolaryngol Head Neck Surg. 2003 Jul;129(1):16-23.
- Berger WE, Mohar DE, LaForce C, et al. A 26-week tolerability study of ciclesonide nasal aerosol in patients with perennial allergic rhinitis. Am J Rhinol Allergy. 2012 Jul;26(4):302-7.
- Brozek J, Bousquet J, Baena-Cagnani C, et al. Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines: 2010 revision. J Allergy Clin Immunol. 2010;126:466-76.
- Chong LY, Head K, Hopkins C, et al. Different types of intranasal steroids for chronic rhinosinusitis. Cochrane Database Syst Rev. 2016 Apr 26;4:CD011993. doi: 10.1002/14651858.CD011993.pub2.
- Clinical Pharmacology [database online]. Tampa, FL: Gold Standard, Inc; 2017. Available at: http://www.clinicalpharmacology.com. Accessed May 22, 2017.
- Day J, Carrillo T. Comparison of the efficacy of budesonide and fluticasone propionate aqueous nasal spray for once daily treatment of perennial allergic rhinitis. J Allergy Clin Immunol. 1998;102(6):902-8.
- Devillier P, Dreyfus JF, Demoly P, Calderon MA. A meta-analysis of sublingual allergen immunotherapy and pharmacotherapy in pollen-induced seasonal allergic rhinoconjunctivitis. BMC Medicine. 2014, 12:71. DOI: 10.1186/1741-7015-12-71.
- Drouin M, Yang WH, Bertrand B, et al. Once daily mometasone furoate aqueous nasal spray is as effective as twice daily beclomethasone dipropionate for treating perennial allergic rhinitis patients. Ann Allergy Asthma Immunol. 1996:77(2):153-60.
- Drug Facts and Comparisons 4.0 [database on the Internet]. St. Louis: Wolters Kluwer Health, Inc.; 2017. Available at: https://fco.factsandcomparisons.com. Accessed May 22, 2017.
- Drugs@FDA [database on the Internet]. Rockville (MD): Food and Drug Administration (US), Center for Drug Evaluation and Research; 2017. Available at: http://www.accessdata.fda.gov/scripts/cder/daf/. Accessed May 22, 2017.
- Durham SR, Creticos PS, Nelson HS, et al. Treatment effect of sublingual immunotherapy tablets and pharmacotherapies for seasonal and perennial allergic rhinitis: pooled analyses. J Allergy Clin Immunol. 2016;138(4):1081-1088.
- FLONASE ALLERGY RELIEF drug facts. GlaxoSmithKline. November 2015. Available at: http://www.accessdata.fda.gov/drugsatfda_docs/label/2015/205434s003lbl.pdf. Accessed May 22, 2017.
- FLONASE SENSIMIST ALLERGY RELIEF drug facts. GlaxoSmithKline. April 2017. Available at: https://www.accessdata.fda.gov. Accessed May 22, 2017.
- Flunisolide prescribing information. Bausch & Lomb Inc. Tampa, FL. June 2016.
- Fluticasone propionate prescribing information. West-Ward Pharmaceuticals Corp. Eatontown, NJ. April 2017.
- Glacy J, Putnam K, Godfrey S, et al. Treatments for seasonal allergic rhinitis. Comparative Effectiveness Review No. 120. (Prepared by the Blue Cross and Blue Shield Association Technology Evaluation Center Evidence-based Practice Center under Contract No. 290-2007-10058-I.) AHRQ Publication No. 13-EHC098-EF. Rockville, MD: Agency for Healthcare Research and Quality; July 2013.
- GlaxoSmithKline (GSK) press release. GSK Consumer Healthcare Launches Flonase Sensimist Allergy Relief Nationwide. Website. February 8, 2017. Available at: http://us.gsk.com/en-us/media/press-releases/2017/gsk-consumer-healthcare-launches-flonase-sensimist-allergy-relief-nationwide/. Accessed May 24, 2017.
- Graft D, Aaronson D, Chervinsky P, et al. A placebo- and active-controlled randomized trial of prophylactic treatment of seasonal allergic rhinitis with mometasone furoate aqueous nasal spray. Journal of Allergy and Clinical Immunology. 1996:98(4):724-31.
- Gross G, Jacobs RL, Woodworth TH, et al. Comparative efficacy, safety, and effect on quality of life of triamcinolone acetonide and fluticasone propionate aqueous nasal sprays in patients with fall seasonal allergic rhinitis. Ann Allergy Asthma Immunol. 2002;89(1):56-62.
- Haye R, Gomez EG. A multicentre study to assess long-term use of fluticasone propionate aqueous nasal spray in comparison with beclomethasone dipropionate aqueous nasal spray in the treatment of perennial rhinitis. Rhinology. 1993;31(4):169-74.
- Hebert JR, Nolop K, Lutsky BN. Once-daily mometasone furoate aqueous nasal spray (Nasonex™) in seasonal allergic rhinitis: an active- and placebo-controlled study. Allergy. 1996;51:569-76.
- Kalish L, Snidvongs K, Sivasubramaniam R, et al. Topical steroids for nasal polyps. Cochrane Database of Systematic Reviews. 2012, Issue 12. Art. No.: CD006549. DOI: 10.1002/14651858.CD006549.pub2.
- Khanna P, Shah A. Assessment of sensory perceptions and patient preference for intranasal corticosteroid sprays in allergic rhinitis. Am J Rhinol. 2005;19(3):316-21.
- LaForce C, van Bavel J, Meltzer EO, et al. Efficacy and safety of ciclesonide hydrofluoroalkane nasal aerosol once daily for the treatment of seasonal allergic rhinitis. Ann Allergy Asthma Immunol. 2009 Aug;103(2):166-73.
- LaForce CF, Dockhorn RJ, Findlay SR, et al. Fluticasone propionate: an effective alternative treatment for seasonal allergic rhinitis in adults and adolescents. J Fam Pract. 1994;38:145-52.

- Langrick AF. Comparison of flunisolide and beclomethasone dipropionate in seasonal allergic rhinitis. Curr Med Res Opin. 1984;9:290-5.
- Lumry W, Hampel F, LaForce C, et al. A comparison of once-daily triamcinolone acetonide aqueous and twice-daily beclomethasone dipropionate aqueous nasal sprays in the treatment of seasonal allergic rhinitis. Allergy Asthma Proc. 2003;24:203-10.
- Mak KK, Ku MS, Lu KH, et al. Comparison of mometasone furoate monohydrate (Nasonex) and fluticasone propionate (Flixonase) nasal sprays in the treatment of dust mite-sensitive children with perennial allergic rhinitis. Pediatr Neonatol. 2013 Aug; 54:239-245. DOI: 10.1016/j.pedneo.2013.01.007.
- Mandl M, Nolop K, Lutsky BN. Comparison of once daily mometasone furoate (Nasonex) and fluticasone propionate aqueous nasal sprays for the treatment of perennial rhinitis. The 194-079 Study Group. Ann Allergy Asthma Immunol. 1997:79(3):237-45.
- McAllen MK, Portillo PR, Parr EJ, et al. Intranasal flunisolide, placebo and beclomethasone dipropionate in perennial rhinitis. Br J Dis Chest. 1980;74:32-6.
- McArthur JG. A comparison of budesonide and beclomethasone dipropionate sprays in the treatment of seasonal allergic rhinitis. Clin Otolaryngol Allied Sci. 1994;19(6):537-42.
- Meltzer E, Andrews C, Journeay G, et al. Comparison of patient preference for sensory attributes of fluticasone furoate or fluticasone propionate in adults with seasonal allergic rhinitis: a randomized, placebo-controlled, double blind study. Ann Allergy Asthma Immunol. 2010;104:331-8.
- Meltzer E, Stahlman J, Leflein J, et al. Preferences of adult patients with allergic rhinitis for the sensory attributes of fluticasone furoate vs fluticasone propionate nasal sprays: a randomized, multicenter, double-blind, single-dose, crossover study. Clin Ther. 2008;30:271-9.
- Meltzer EO, Bardelas J, Goldsobel A, Kaiser H. A preference evaluation study comparing the sensory attributes of mometasone furoate and fluticasone propionate nasal sprays by patients with allergic rhinitis. Treat Respir Med. 2005;4(4):289-96.
- Meltzer EO, Jacobs RL, LaForce CF, et al. Safety and efficacy of once-daily treatment with beclomethasone dipropionate nasal aerosol in subjects with perennial allergic rhinitis. Allergy Asthma Proc. 2012 May-Jun;33(3):249-57.
- Mohar D, Berger WE, LaForce C, et al. Efficacy and tolerability study of ciclesonide nasal aerosol in patients with perennial allergic rhinitis. Allergy Asthma Proc. 2012 Jan-Feb;33(1):19-26.
- Naclerio RM, Baroody FM, Bidani N, et al. A comparison of nasal clearance after treatment of perennial allergic rhinitis with budesonide and mometasone. Otolaryngol Head Neck Surg. 2003;128:220-7.
- NASACORT ALLERGY 24HR drug facts. Chattem. August 2016. Available at http://www.accessdata.fda.gov/drugsatfda_docs/label/2016/020468Orig1s042lbl.pdf. Accessed May 22, 2017.
- NASONEX prescribing information. Schering Corporation. Whitehouse Station, NJ. March 2013.
- OMNARIS prescribing information. Sunovion Pharmaceuticals. Marlborough, MA. March 2016.
- QNASL prescribing information. Teva Respiratory. Horsham, PA. February 2016.
- Ratner P, Jacobs R, Mohar D, et al. Evaluation of the efficacy and safety of ciclesonide hydrofluoroalkane nasal aerosol, 80 or 160 µg once daily, for the treatment of seasonal allergic rhinitis. Ann Allergy Asthma Immunol. 2010 Dec;105(6):471-9. DOI: 10.1016/j.anai.2010.09.024.
- Ratner PH, Andrews C, Martin B, et al. A study of the efficacy and safety of ciclesonide hydrofluoroalkane nasal aerosol in patients with seasonal allergic rhinitis from mountain cedar pollen. Allergy Asthma Proc. 2012 Jan-Feb;33(1):27-35.
- Ratner PH, Paull BR, Findlay SR, et al. Fluticasone propionate given once daily is as effective for seasonal allergic rhinitis as beclomethasone dipropionate given twice daily. J Allergy Clin Immunol. 1992;90:285-91.
- RHINOCORT ALLERGY drug facts. AstraZeneca. August 2016. Available at: https://www.accessdata.fda.gov/drugsatfda_docs/label/2016/020746Orig1s036lbl.pdf. Accessed May 22, 2017.
- RHINOCORT AQUA prescribing information. AstraZeneca. Wilmington, DE. January 2017.
- Sahay JN, Chatterjee SS, Engler C. A comparative trial of flunisolide and beclomethasone dipropionate in the treatment of perennial allergic rhinitis. Clin Allergy. 1980;10:65-70.
- Seidman MD, Gurgel RK, Lin ST, et al. Clinical practice guideline: allergic rhinitis. Otolaryngol Head Neck Surg. 2015;152(1 Suppl):SI-S43.
- Shah SR, Miller C, Pethick N, et al. Two multicenter, randomized, single-blind, single-dose, crossover studies of specific sensory attributes of budesonide aqueous nasal spray and fluticasone propionate nasal spray. Clin Ther. 2003;25(8):2198-214.
- Sipila P, Sorri M, Ojala K, Palva A. Comparative trial of flunisolide and beclomethasone dipropionate nasal sprays in patients with seasonal allergic rhinitis. Allergy. 1983;38:303-7.
- Small P, Houle PA, Day JH, et al. A comparison of triamcinolone acetonide nasal aerosol spray and fluticasone propionate aqueous solution spray in the treatment of spring allergic rhinitis. J Allergy Clin Immunol. 1997;100(5):592-5.
- Snellman L, Adams W, Anderson G, et al. Diagnosis and treatment of respiratory illness in children and adults (Fourth edition; 2013 January). Institute for Clinical Systems Improvement. Available at: https://www.icsi.org/guidelines. Accessed May 22, 2017.
- Snyder-Bulik B. GSK looks for another OTC allergy crossover hit in newly launched Flonase Sensimist. Website. FiercePharma. Feburary 14, 2017. Available at: http://www.fiercepharma.com/marketing/gsk-launches-another-otc-allergy-crossover-flonase-sensimist-and-supporting-ad-campaign. Accessed May 24, 2017.
- Stern MA, Dahl R, Nielsen LP, et al. A comparison of aqueous suspensions of budesonide nasal spray (128 µg and 256 µg once daily) and fluticasone propionate nasal spray (200 µg once daily) in the treatment of adult patients with seasonal allergic rhinitis. Am J Rhinol. 1997;11(4):323-30.
- Stokes M, Amorosi SL, Thompson D, et al. Evaluation of patients' preferences for triamcinolone acetonide aqueous, fluticasone propionate, and mometasone furoate nasal sprays in patients with allergic rhinitis. Otolaryngol Head Neck Surg. 2004;131:225-31.
- Storms WW, Segall N, Mansfield LE, et al. Efficacy and safety of beclomethasone dipropionate nasal aerosol in pediatric patients with seasonal allergic rhinitis. Ann Allergy Asthma Immunol. 2013;111(5):408-414.e1.
- Svendsen UG, Frolund L, Madsen F, et al. Beclomethasone dipropionate vs flunisolide as topical steroid treatment in patients with perennial rhinitis. Clin Otolaryngol Allied Sci. 1989;14(5):441-5.
- Triamcinolone acetonide prescribing information. Winthrop U.S. Bridgewater, NJ. July 2013.
- Van As A, Bronsky EA, Dockhorn RJ, et al. Once daily fluticasone propionate is as effective for perennial allergic rhinitis as twice daily beclomethasone dipropionate. J Allergy Clin Immunol. 1993;91(6):1146-54.
- Vanzieleghem MA, Juniper EF. A comparison of budesonide and beclomethasone dipropionate nasal aerosols in ragweed-induced rhinitis. J Allergy Clin Immunol. 1987;79(6):887-92.
- Varshney J, Varshney H, Dutta SK, Hazra A. Comparison of sensory attributes and immediate efficacy of intranasal ciclesonide and fluticasone propionate in allergic rhinitis: a randomized controlled trial. Indian J Pharmacol. 2012 Sep-Oct;44(5):550-4. DOI: 10.4103/0253-7613.

- Wallace DV, Dykewicz MS, Bernstein DI, et al. The diagnosis and management of rhinitis: An updated practice parameter of the joint task force on practice parameters for allergy and immunology. J Allergy Clin Immunol. 2008;122:S1-S84. Available at: http://www.allergyparameters.org/published-practice-parameters/alphabetical-listing/rhinitis-download/. Accessed May 22, 2017.
- Welsh PW, Stricker WE, Chu C, et al. Efficacy of beclomethasone nasal solution, flunisolide, and cromolyn in relieving symptoms of ragweed allergy. Mayo Clin Proc. 1987;62:125-34.
- Winder J, Bell T, Brodsky L. A comparative study of intranasal triamcinolone acetonide aerosol and intranasal beclomethasone dipropionate aqueous spray in perennial allergic rhinitis. Immunol Allergy Pract. 1993;15(7):203-9.
- Yonezaki M, Akiyama K, Karaki M, et al. Preference evaluation and perceived sensory comparison of fluticasone furoate and mometasone furoate intranasal sprays in allergic rhinitis. Auris Nasus Larynx. 2016;43(3):292-7.
- ZETONNA prescribing information. Sunovion Pharmaceuticals. Marlborough, MA. October 2014.

Publication Date: May 25, 2017