Pediatric Asthma: A Clinical Summary

Megan Meier, PharmD Candidate 2021

Advisor: Thanh-Nga Thi Nguyen

University of Wyoming School of Pharmacy

Seminar Topic Lecture
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Oral Seminar Topic Presentation

Pediatric asthma is a heterogeneous and chronic airway inflammatory disease experienced by 7.7% of the world’s pediatric population (CDC, 2020). It is characterized by airway hyperresponsiveness and narrowing (Athari, 2019). Most patients present with shortness of breath, wheezing, cough, and expiratory airflow limitation worsening at night and upon wakening (Marchant et. al, 2006). Most asthma attacks are due to the underlying disease being triggered by exercise, allergen exposure, weather changes, or viral respiratory infections (Marchant et. al, 2006). Some populations have a higher risk of contracting asthma due to their genetic and environmental interactions (Hauptman et. al, 2020). These include males, infants with small gestational birth size, the obese, and children exposed to pollutants including tobacco smoke and vehicle exhaust (Hauptman et. al, 2020). Asthma diagnosis differs among pediatric patients. Children who are six years and older are diagnosed based on symptoms and measured lung function, while children five years and younger are diagnosed based on symptoms alone (GINA, 2020). Treatment is individualized to each patient based on guidelines. Pharmacotherapy includes controller, reliever, and add on medications with additional devices such as spacers and nebulizers to ease administration burden (GINA, 2020). Pediatric asthma is a common disease state that allows pharmacists to counsel patients and provide symptom management in the inpatient and outpatient setting.
PEDiATRIC ASTHMA

Megan Meier PharmD Candidate 2021 University of Wyoming School of Pharmacy
Objectives

At the completion of this presentation, participants should be able to...

- Identify difference between diagnosis of 6-11 year old patients versus 5 years or younger patients
- Apply appropriate therapy based on patient's age, history, and symptoms
- Identify when it is appropriate to escalate/deescalate patient's therapy
- Explain pharmacist's role in asthma symptom control and therapy
EPIDEMIOLOGY AND CLINICAL PRESENTATION
Epidemiology

- 7.7% of pediatric population affected by asthma
- 8.3% of pediatric males are affected
- 10.3% of asthma population is below 100% of poverty threshold
- Higher rate of prevalence in higher income countries
- 74.3 per 10,000 of pediatric population visit the emergency department for asthma exacerbations
- In 2018, 192 deaths of pediatric population were a result of asthma

Data, statistics, and surveillance, CDC, 2020.
Anandan C, Allergy, 2010;65:152-167.
Pathophysiology

- Heterogenous and chronic airway inflammation

- Airway hyperresponsiveness
  - Excessive contraction of smooth muscle
  - Thickening of airway

- Airway narrowing
  - Smooth muscle contraction
  - Edema
  - Thickening
  - Mucus hypersecretion

Global strategy for asthma management and prevention online appendix, Global Initiative For Asthma, 2020, 24.
Signs and Symptoms

- Shortness of breath (SOB), chest tightness, wheezing, cough, and/or expiratory airflow limitation
- Varies over time and intensity
- Worse at night and in the morning
- Triggers
  - Exercise
  - Allergen exposure
  - Weather changes
  - Viral respiratory infections

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 21 Marchant, Chest, 2006;129:1132-1141.
Risk Factors

- Genetic-environmental interactions
- "Window of opportunity" during mother's pregnancy and in early life
- Environmental factors: nutrition, allergens, pollutants (tobacco smoke, vehicle exhaust), microbes, psychosocial factors, diet, stress, and viral infections
- Host factors: genetic, obesity, male sex, pre-term birth, or small for gestational age birth
- <14 years: Prevalence of disease in boys is more than double to girls
- Socioeconomic: more prevalent in developed countries

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 21.
Diagnosis in Children 6-11 Years

- History of variable respiratory symptoms (wheeze, SOB, chest tightness, and cough)
  - More than one symptom present
  - Occur variably over time and in intensity
  - Worse at night and when waking
  - Triggered by exercise, laughter, allergens, cold air
  - Worsens with viral infections

- Excessive variability in lung function with spirometry test
  - Variation of >12% in forced expiratory volume (FEV$_1$) and >15% peak expiratory flow (PEF) between visits

- Average daily PEF variability >13%

- FEV$_1$ falls >12% predicted or PEF >15% after positive exercise challenge test

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 24.
Diagnoses in Children 5 Years and Younger

- Often hard to diagnose since many children experience symptoms of wheezing and coughing

- Diagnosis often based on:
  - Recurrent episodes of wheeze, wheezing cough at night or awakening
  - SOB during exercise, laughing, or crying
  - Reduced physical activity compared to other children
  - Presence of risk factors
  - Clinical response to controller treatment
  - Exclude other diagnoses

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 140-142.
THERAPY FOR PEDIATRIC ASTHMA
Goals of Therapy

- Gain control of symptoms and maintain activity levels
  - Highest importance for pediatric patients
- Minimize future risks (death, exacerbations, airflow limitation)
- Decrease flare ups
- Maintain lung function and development
- Minimize side effects
- Proper education for use of inhaler and effective adherence
- Monitor symptoms
- Written asthma action plan
- Individualize patient goals

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 140-146.
Non-Pharmacological Treatments

- Smoking cessation
- Avoid environmental smoke
- Regular exercise
- Healthy diet
- Avoid indoor and outdoor allergens/pollutants
- Weight reduction
- Breathing exercises for quality of life improvement
- Manage emotional stress
- Avoid food/chemical allergens
- Avoid Medications (NSAIDs)

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 70-71.
Pharmacologic Treatment

- **Controller medications**
  - control symptoms and future exacerbations while reducing inflammation
  - Inhaled corticosteroids (ICS)
  - MOA: Controls rate of protein synthesis and reverses capillary permeability to decrease or control inflammation

- **Reliever/Rescue medications**
  - As needed use for breakthrough symptoms in all patients
  - Short-term prevention of exercise induced asthma
  - MOA: Short-Acting Beta$_2$-Agonist (SABA)

- **Add-on therapies**
  - For severe asthma
  - Considered for persistent symptoms and exacerbations after optimization of treatment
  - High dose ICS + Long-Acting Beta$_2$-Agonist (LABA)
  - Multiple MOAs

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 48.
Pharmacologic Therapy- Adolescents

- **Step 1**: patient experiences symptoms <2 times a month
  - Preferred controller: as-needed low dose ICS-formoterol
  - Other controller: low dose ICS with SABA
  - Preferred reliever: as-needed low dose ICS-formoterol
  - Other reliever: SABA as-needed

- **Step 2**: patient experiences symptoms >2 times a month and less than daily
  - Preferred controller: low dose ICS or as-needed low dose ICS-formoterol
  - Other controller: LTRA daily or low dose ICS taken with SABA
  - Preferred reliever: as-needed low dose ICS-formoterol
  - Other reliever: SABA as-needed

- **Step 3**: patient experiences symptoms most days or upon waking >1 time a week
  - Preferred controller: low dose ICS-LABA
  - Other controller: low dose ICS-LTRA or ICS
  - Preferred reliever: ICS-formoterol as-needed
  - Other reliever: SABA as-needed

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 51.
Pharmacologic Therapy-Adolescents

- Step 4: patient experiences symptoms most days or upon waking >1 time a week or low lung function
  - Preferred controller: ICS-LABA medium dose
  - Other controller: ICS high dose, add on tiotropium or LTRA
  - Preferred reliever: ICS-formoterol as-needed
  - Other reliever: SABA as-needed

- Step 5: patients present with severely uncontrolled asthma
  - Preferred controller: ICS-LABA high dose
    - Based on phenotype add on tiotropium, anti-IgE, anti-IL5/5R, anti-IL4R
  - Other controller: add on oral corticosteroid (OCS) low dose
  - Preferred reliever: ICS-formoterol as-needed
  - Other reliever: SABA as-needed

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 51.
# Preferred ICS for Adolescents

<table>
<thead>
<tr>
<th>Generic</th>
<th>Brand</th>
<th>Adverse Effects</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclomethasone dipropionate (pMDI, standard, extrafine, HFA)</td>
<td>QVAR* QVAR Redihaler</td>
<td>Oral candidiasis</td>
<td>$169.30</td>
</tr>
<tr>
<td>Budesonide (DPI)</td>
<td>Pulmicort Flexhaler*</td>
<td>Dysphonia</td>
<td>$216.50</td>
</tr>
<tr>
<td>Ciclesonide (pDMI, extrafine)</td>
<td>Alvesco*</td>
<td>Reflex cough</td>
<td>$228.90</td>
</tr>
<tr>
<td>Fluticasone furoate (DPI)</td>
<td>Arnuity Ellipta</td>
<td>Bronchospasm</td>
<td></td>
</tr>
<tr>
<td>Fluticasone propionate (DPI)</td>
<td>Flovent Diskus</td>
<td></td>
<td>$159.00</td>
</tr>
<tr>
<td>Fluticasone propionate (pMDI, standard, HFA)</td>
<td>Flovent HFA*</td>
<td></td>
<td>$171.40</td>
</tr>
<tr>
<td>Mometasone furoate (DPI)</td>
<td>Asmanex HFA*</td>
<td></td>
<td>$191.60</td>
</tr>
</tbody>
</table>

pDMI= pressurized meter dose inhaler, HFA= hydrofluoroalkane propellant, DPI= dry powder inhaler

*need to be primed before first use, after non-use, and when dropped

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Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 56.
Drugs for asthma. Med Lett Drugs Ther. 2017;59(1528):139-146.
ICS Dosing for Adolescents

<table>
<thead>
<tr>
<th>Generic</th>
<th>Daily Low Dose (mcg)</th>
<th>Daily Medium Dose (mcg)</th>
<th>Daily High Dose (mcg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclometasone dipropionate (pMDI, standard particle, HFA)</td>
<td>200-500</td>
<td>&gt;500-1000</td>
<td>&gt;1000</td>
</tr>
<tr>
<td>Beclometasone dipropionate (pDMI, extrafine particle, HFA)</td>
<td>100-200</td>
<td>&gt;200-400</td>
<td>&gt;400</td>
</tr>
<tr>
<td>Budesonide (DPI)</td>
<td>200-400</td>
<td>&gt;400-800</td>
<td>&gt;400</td>
</tr>
<tr>
<td>Ciclofenicol (pDMI, extrafine particle, HFA)</td>
<td>80-160</td>
<td>&gt;160-320</td>
<td>&gt;320</td>
</tr>
<tr>
<td>Fluticasone furoate (DPI)</td>
<td></td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>Fluticasone propionate (DPI)</td>
<td>100-250</td>
<td>&gt;250-500</td>
<td>&gt;500</td>
</tr>
<tr>
<td>Fluticasone propionate (pMDI, standard particle, HFA)</td>
<td>100-250</td>
<td>&gt;250-500</td>
<td>&gt;500</td>
</tr>
<tr>
<td>Mometasone furoate (DPI)</td>
<td></td>
<td>200</td>
<td>400</td>
</tr>
</tbody>
</table>

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 56.
## Relievers for Adolescents

<table>
<thead>
<tr>
<th>Reliever</th>
<th>Brand</th>
<th>Dose</th>
<th>Side Effects</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuterol</td>
<td>ProAir HFA*</td>
<td>90-180 mcg q4-6 hrs PRN</td>
<td>Paradoxical bronchospasm</td>
<td>$56.20</td>
</tr>
<tr>
<td></td>
<td>Proventil HFA*</td>
<td></td>
<td>Tremor</td>
<td>$75.40</td>
</tr>
<tr>
<td></td>
<td>Ventolin HFA*</td>
<td></td>
<td>Tachycardia</td>
<td>$52.20</td>
</tr>
<tr>
<td></td>
<td>ProAir Respiclick</td>
<td></td>
<td>QT interval prolongation</td>
<td>$53.00</td>
</tr>
<tr>
<td>Levalbuterol</td>
<td>Xopenex HFA*</td>
<td>90 mcg q4-6 hrs PRN (HFA)</td>
<td>Hyperglycemia</td>
<td>$68.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.63-1.25 mg TID q6-8 hrs PRN (nebulizer)</td>
<td>Hypokalemia</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
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HFA= hydrofluoroalkane propellant

*need to be primed before first use, after non-use, and when dropped

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Drugs for asthma. Med Lett Drugs Ther. 2017;59(1528):139-146.
Pharmacologic Therapy-6-11 Years

- **Step 1:** patient experiences symptoms < 2 times a month
  - Preferred controller: None
  - Other controller: low dose ICS or low dose ICS with short-acting beta₂-antagonist (SABA)
  - Reliever: SABA as-needed

- **Step 2:** patient experiences symptoms > 2 times a month and less than daily
  - Preferred controller: low dose ICS daily
  - Other controller: leukotriene receptor antagonist (LTRA) daily or low dose ICS taken with SABA
  - Reliever: SABA as-needed

- **Step 3:** patient experiences symptoms most days or upon waking > 1 time a week
  - Preferred controller: low dose ICS-LABA or ICS medium dose
  - Other controller: low dose ICS-LTRA
  - Reliever: SABA as-needed

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 53.
Pharmacologic Therapy: 6-11 Years

- **Step 4:** patient experiences symptoms most days or upon waking >1 time a week or low lung function
  - Preferred controller: ICS-LABA medium dose, refer to expert
  - Other controller: ICS high dose, add on tiotropium or LTRA
  - Reliever: SABA as-needed

- **Step 5:** patients present with severely uncontrolled asthma
  - Preferred controller: Based on phenotype add on tiotropium, anti-IgE, anti-IL5/5R, anti-IL4R
  - Other controller: add-on anti-IL-5 or low dose OCS
  - Reliever: SABA as-needed

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 53.
## Preferred ICS for 6-11 Year Olds

<table>
<thead>
<tr>
<th>Generic</th>
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<th>Adverse Effects</th>
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<td>Budesonide (nebules)</td>
<td>Pulmicort Respules</td>
<td>Bronchospasm</td>
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Drugs for asthma. Med Lett Drugs Ther. 2017;59(1528):139-146.
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</tr>
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</tr>
<tr>
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<td>80</td>
<td>&gt;80-160</td>
<td>&gt;160</td>
</tr>
<tr>
<td>Fluticasone furoate (DPI)</td>
<td>50</td>
<td>N/A</td>
<td></td>
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Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 56.
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</tbody>
</table>

HFA= hydrofluoroalkane propellant  
*need to be primed before first use, after non-use, and when dropped

Drugs for asthma. Med Lett Drugs Ther. 2017;59(1528):139-146.  
## Combination Products- ICS/LABA

<table>
<thead>
<tr>
<th>Generic</th>
<th>Brand</th>
<th>Dose</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluticasone-salmeterol DPI</td>
<td>Advair Diskus</td>
<td>4-11 yrs: 1 puff BID</td>
<td>$290.90</td>
</tr>
<tr>
<td>Fluticasone-salmeterol MDI*</td>
<td>Advair HFA*</td>
<td>≥12 yrs: 2 puffs BID</td>
<td>$290.90</td>
</tr>
<tr>
<td>Fluticasone-vilanterol DPI</td>
<td>Breo-Ellipta</td>
<td>N/A</td>
<td>$321.70</td>
</tr>
<tr>
<td>Budesonide-formoterol MDI*</td>
<td>Symbicort*</td>
<td>6-11 yrs: 2 puffs BID</td>
<td>$270.00</td>
</tr>
<tr>
<td>Mometasone-formoterol MDI*</td>
<td>Dulera*</td>
<td>≥12 yrs: 2 puffs BID</td>
<td>$290.60</td>
</tr>
</tbody>
</table>

DPI- dry powder inhaler, MDI- metered dose inhaler, HFA= hydrofluoroalkane propellant
*need to be primed before first use, after non-use, and when dropped

Drugs for asthma. Med Lett Drugs Ther. 2017;59(1528):139-146.
Add On Therapy: Leukotriene Receptor Antagonist (LTRAs)

- For those unable or unwilling to take ICS
- MOA: selective leukotriene receptor that inhibits cysteiny1 leukotriene receptor that counteracts airway edema and smooth muscle contraction
- Monitor hepatic injury with liver function tests
- Discontinue medicine if patient reports abdominal pain, nausea, jaundice, itching, or lethargy

Drugs for asthma. Med Lett Drugs Ther. 2017;59(1528):139-146.
## Leukotriene Receptor Antagonists (LTRAs)

<table>
<thead>
<tr>
<th>Generic</th>
<th>Brand</th>
<th>Dose</th>
<th>Side Effects</th>
<th>Cost</th>
<th>Black Box Warnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montelukast</td>
<td>Singulair</td>
<td>≥1 yr: 4 or 5 mg PO QD</td>
<td>Well tolerated</td>
<td>$11.20</td>
<td>Serious neuropsychiatric events</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rare: Churg-Strauss vasculitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zafirlukast</td>
<td>Accolate</td>
<td>5-11 yrs: 10 mg PO BID</td>
<td>Hepatic injury</td>
<td>$99.60</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥12 yrs: 20 mg PO BID</td>
<td>Rare: Churg-Strauss vasculitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zileuton</td>
<td>Zyflo</td>
<td>≥12 yrs: 1200 mg PO BID</td>
<td></td>
<td>$3580.30 (ER)</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$3220.30</td>
<td></td>
</tr>
</tbody>
</table>

Drugs for asthma. Med Lett Drugs Ther. 2017;59(1528):139-146.
Pharmacologic Therapy: 5 years and younger

- **Step 1:** for any child with wheezing
  - Preferred: inhaled SABA as-needed

- **Step 2:** wheezing requires ≥3 uses of SABA per year or symptom pattern similar to asthma
  - Preferred controller: ICS low dose daily
  - Other controller: LTRA or short courses of ICS
  - Preferred reliever: SABA as-needed

- **Step 3:** asthma diagnosis and not well controlled with step 2
  - Preferred controller: double low dose ICS
  - Other controller: low dose ICS + LTRA
  - Consider specialist referral
  - Reliever: SABA as needed

- **Step 4:** asthma not well controlled with step 3
  - Preferred controller: continue and refer to specialist
  - Other controller: add LTRA or increase ICS frequency
  - Reliever: SABA as-needed

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 152
# Preferred ICS for 5 years and younger

<table>
<thead>
<tr>
<th>Age</th>
<th>Medication</th>
<th>Daily Low Dose (mcg)*</th>
<th>Adverse Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year and older</td>
<td>Budesonide nebulized</td>
<td>500</td>
<td>Oral candidiasis</td>
</tr>
<tr>
<td>4 years and older</td>
<td>Fluticasone propionate (pMDI, standard, HFA)</td>
<td>50</td>
<td>Dysphonia</td>
</tr>
<tr>
<td>5 years and older</td>
<td>Beclomethasone dipropionate (pMDI, standard, HFA)</td>
<td>100</td>
<td>Reflex cough</td>
</tr>
<tr>
<td></td>
<td>Beclomethasone dipropionate (pMDI, extrafine, HFA)</td>
<td>50</td>
<td>Broncho-spasm</td>
</tr>
<tr>
<td></td>
<td>Mometasone furoate (pMDI, standard, HFA)</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

pDMI = pressurized meter dose inhaler, HFA = hydrofluoroalkane propellant
## Relievers for ≤5 Years

<table>
<thead>
<tr>
<th>Reliever</th>
<th>Brand</th>
<th>Dose</th>
<th>Adverse Effects</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuterol</td>
<td>ProAir HFA*</td>
<td>90-180 mcg q4-6 hrs PRN (≥4 yrs)</td>
<td>Paradoxical bronchospasm, Tremor, Tachycardia</td>
<td>$56.20</td>
</tr>
<tr>
<td></td>
<td>ProVentil HFA*</td>
<td></td>
<td></td>
<td>$75.40</td>
</tr>
<tr>
<td></td>
<td>Ventolin HFA*</td>
<td></td>
<td></td>
<td>$52.20</td>
</tr>
<tr>
<td></td>
<td>ProAir Respiclick</td>
<td></td>
<td></td>
<td>$53.00</td>
</tr>
<tr>
<td>Levalbuterol</td>
<td>Xopenex HFA*</td>
<td>90 mcg q4-6 hrs PRN (≥4 yrs)</td>
<td>QT interval prolongation, Hyperglycemia, Hypokalemia, Hypomagnesemia</td>
<td>$68.20</td>
</tr>
</tbody>
</table>

HFA= hydrofluoroalkane propellant
*need to be primed before first use, after non-use, and when dropped

Drugs for asthma. Med Lett Drugs Ther. 2017;59(1528):139-146.
### Preferred Inhaler Device for 5 years and younger

<table>
<thead>
<tr>
<th>Age</th>
<th>Inhaler Device</th>
<th>Alternative Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3 years</td>
<td>pMDI + spacer + face mask</td>
<td>Nebulizer + face mask</td>
</tr>
<tr>
<td>4-5 years</td>
<td>pMDI + spacer with mouthpiece</td>
<td>pMDI+ dedicated spacer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nebulizer + mouthpiece/face mask</td>
</tr>
</tbody>
</table>

pMDI = pressurized meter dose inhaler

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 154.
Before Stepping Up

- Confirm symptoms are due to asthma
- Correct inhaler technique if necessary
- Check adherence with prescribed dose
- Consider other options within step
- Ask about allergens and tobacco smoke exposure

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 149.
Stepping Up

- Sustained step up (2-3 months)
  - Each step is therapeutic trial
  - Individualizes treatment
  - No response - step down to original medications

- Short-term step up (1-2 weeks)
  - Occasional increase in ICS Maintenance dosage needed in certain situations

- Day-to-day adjustment
  - Budesonide-formoterol or beclomethasone-formoterol

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 64.
Stepping Down

- When symptoms are well controlled and lung function stable for $\geq 3$ months
- If exacerbation risk factors exist, then step down occurs under close supervision
- Correct timing (no infection)
- Written asthma action plan
- Decrease ICS dose 25-50% every 3 months

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 66.
Monitoring

- Schedule follow-up visit at every appointment
- Lung function assessed at time of diagnosis, 3-6 months after start of treatment and then periodically
- Discuss patient's questions
  - Provide additional education materials
- Evaluate asthma control
  - Review symptoms
  - Identify past flare-ups, asthma diary
  - Examine PEF diary or encourage one if patient does not have one
  - Evaluate comorbidities
- Evaluate treatment issues
  - Assess inhaler technique
  - Review medication adherence and identify barriers
  - Update asthma action plan if necessary

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 84.
How Often?

**Lung function:**
- at time of diagnosis
- 3-6 months after start of treatment

**Follow Up Visit:**
- 1-3 months after beginning treatment
- 3-12 months thereafter

**Exacerbation:**
- visit within 1 week after

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 65.
Asthma Action Plan

- Calculate personal best peak flow
  - Monitor twice a day for 2-3 week period when asthma is controlled
  - Take upon waking and between noon and 2 pm
  - Take before and after rescue medication

- Green Zone- 80-100% of personal best

- Yellow Zone- 50-80% of personal best

- Red Zone- <50% of personal best (visit doctor or ED)
Vaccination Advice

- Insufficient evidence to recommend pneumococcal vaccination
- Children with moderate to severe asthma should receive annual influenza vaccine
  - No recent randomized control trials support that vaccine reduces exacerbations
  - Recent meta-analysis does show decrease in exacerbations

Global strategy for asthma management and prevention, Global Initiative For Asthma, 2020, 68-69.
SYGMA 1 Trial

- 3836 participants assigned to one of three groups after run-in period of 0.4 mg terbutaline during a randomized double-blind control trial
  - Placebo BID + terbutaline prn
  - Placebo BID + 200-6 mcg budesonide-formoterol prn
  - 200 mcg budesonide BID + 0.5 mg terbutaline prn

- Primary Endpoints
  - To demonstrate budesonide-formoterol superiority to terbutaline in terms of asthma control symptom control

- Secondary Endpoints
  - Demonstrate noninferiority of budesonide-formoterol prn to budesonide maintenance therapy in terms of weeks of controlled asthma, time to first severe exacerbation, and time to first moderate to severe exacerbations

- Statistical Analysis
  - 95% power for primary endpoint
  - 90% power for secondary endpoint

TREXA Trial

- 288 participants assigned to one of four groups in a randomized double-blind control trial after 4-week run in trial of beclomethasone 40 mcg 1 puff + rescue placebo + albuterol
  - BID Beclomethasone+beclomethasone+albuterol (combined group)
  - BID beclomethasone+placebo+albuterol (daily beclomethasone group)
  - BID placebo+beclomethasone+albuterol (rescue beclomethasone group)
  - BID placebo+placebo+albuterol (placebo group)

- Primary Endpoints
  - Time to first exacerbation that required oral corticosteroid (prednisone)

- Secondary Endpoints
  - FEV1, fractional exhaled nitric oxide (FENO), symptom diaries, QOL, and linear growth

- Statistical Analysis
  - 90% power for primary endpoint
  - Kaplan-Meier curves for time-to-event outcomes
  - Proportional hazard regression analyses test main effects

Martinez FD, Lancet, 2011, 377, 650-657
Counseling Points

- Avoid irritants
- Smoking cessation
- Create asthma action plan
  - Peak flow meter usage
  - Emphasize preventative care and symptom management
- Inhaler technique
  - Prime if necessary
  - Shake well if needed
  - Take deep breath before inhaling medication
  - Hold breath after inhalation for 30 seconds or as long as possible
  - Exhale and repeat if necessary

Yin HS, Pediatrics, 2016,137(1),e20150468
ICS Counseling Points

- Rinse mouth out after every use
- Low and medium doses considered more effective
- High doses for severe asthma
  - Monitor HPA-axis suppression, glaucoma/cataracts, and bone density

Drugs for asthma. Med Lett Drugs Ther. 2017;59(1528):139-146
Role of Pharmacist

- Successful asthma management depends on relationship between patient and provider
- Provide confidence and skills for patient to effectively manage asthma
- Recommend appropriate ICS treatment
- Create asthma action plan
- Self-management education
  - Smoking cessation
  - Medication use and adherence
  - Inhaler usage training
  - Action plan
  - Peak flow meter
  - Spacer use

Summary

- Diagnosing >5 years depends on symptoms and lung function, while ≤5 years is dependent on symptoms and risk factors.
- Child’s age, severity, and frequency of symptoms dictate appropriate therapy.
- Stepping up after specified time if asthma still uncontrolled and step down therapy when symptoms are controlled and lung function stable.
- Monitor lung function, flare ups, and inhaler techniques at follow up visits.
QUESTIONS?

Please email questions to mmeier6@uwyo.edu