Breathe Easy: Ensuring Care Coordination for Patients with Asthma
Target Audience: Pharmacists

ACPE#: 0202-0000-18-051-L01-P

Activity Type: Application-based
Disclosures

Lauren E. Bode – none

Dennis Williams declares that his spouse is employed by GSK and owns stock in the company.
Learning Objectives

1. Develop an appropriate plan for the initiation, titration, monitoring, and altering of pharmacotherapy for asthma management.
2. Demonstrate appropriate asthma management strategies in patients during transitions of care.
3. Describe examples of pharmacists' activities that have been found to reduce hospital readmission rates for patients with asthma.
1. Assessment Question

Which of the following long term control therapies is preferred for a 13 year old patient with mild persistent asthma?

A. Albuterol  
B. Montelukast  
C. Budesonide  
D. Cromolyn
2. Assessment Question

Which type of inhalation device should be inhaled with a slow deep breath?

A. Dry powder inhaler  
B. Metered dose inhaler  
C. Breath-actuated inhaler
3. Assessment Question

Which inhalation device does not require patient instruction and periodic observation?

A. Nebulizer
B. Dry powder inhaler
C. Metered dose inhaler
D. All inhalation devices require instruction and observation
4. Assessment Question

1. Which of the following statements is true regarding criteria for transitions of care programs to be effective for patients with asthma?
   A. Must be physician-directed
   B. Should include addressing access to medications
   C. Must emphasize adherence to rescue therapies
   D. Should focus on avoiding long-acting bronchodilator therapies as part of chronic management
Case Study: Terry

- Terry R. is a 12 year male who developed acute shortness of breath and wheezing during soccer tryouts.

- His mom later reported that he had symptoms of a head and chest cold earlier in the week.

- His parents took him to an urgent care center where he was treated with albuterol nebulization therapy and received a dose of methylprednisolone 40 mg intravenously.

- The patient improved significantly and he was discharged with an albuterol inhaler, 5 days of prednisone, and his parents were instructed to follow up with their primary care physician within 3 days.
Case Study: Terry

- The patient did well following the urgent care visit and his parents did not follow-up with his physician.
- He used his albuterol inhaler a few times during soccer practice when he developed wheezing, as well as at least twice when he was awaken with shortness of breath.
- One month after his initial visit, he awoke with shortness of breath and wheezing that was not relieved with albuterol.
- His parents took him to the emergency room.
Case Study: Terry

- Again, he is treated with albuterol nebulizations, as well as one treatment of albuterol and ipratropium combination.
- He is also given prednisone 40 mg orally.
- He responds well to treatment and is discharged after 2 hours with instructions, and an appointment, to follow-up with his physician the next day.
Polling Question: Should Terry have received other therapies at discharge?

A. Yes, he should start an inhaled corticosteroid
B. Yes, he should start a long-acting bronchodilator
C. No, nothing else is needed for discharge home
Case Study: Terry

- During the clinic visit 24 hours later, his physical examination is much improved.
- The clinician notes that the patient appears comfortable with a normal respiratory rate.
- There are scattered wheezes on lung examination.
- A peak flow measurement is reported as 200 L/min.
Case Study: Terry

- The patient’s mother reports that Terry has been relatively healthy his entire life.
- He experienced a few episodes of wheezing as a young child that were associated with respiratory infections but they resolved by age 6.
- The mom reports that he does have problems with a runny nose and sneezing during ragweed pollen seasons.
- He has not undergone allergy or spirometry testing.
Polling Question: Should spirometry be performed in Terry at this point?

A. Yes
B. No
C. Maybe
## Determining Asthma Severity

<table>
<thead>
<tr>
<th>Components of SEVERITY</th>
<th>Age (Years)</th>
<th>Classification of Asthma SEVERITY (Intermittent vs. Persistent)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Intermittent</td>
</tr>
<tr>
<td>symptoms</td>
<td>All</td>
<td>≤ 2 days/week</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>0 – 4</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>≥ 5</td>
<td>≤ 2x/month</td>
</tr>
<tr>
<td>SABA use for symptom control</td>
<td>All</td>
<td>≤ 2 days/week</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>All</td>
<td>None</td>
</tr>
<tr>
<td>Lung function:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEV₁ (predicted) or PEF (personal best)</td>
<td>≥ 5</td>
<td>Normal FEV₁ between exacerbations</td>
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<tr>
<td>FEV₁/FVC</td>
<td>5 – 11</td>
<td>&gt; 85%</td>
</tr>
<tr>
<td>≥ 12</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Exacerbations requiring oral corticosteroids</td>
<td>0 – 4</td>
<td>≤ 1x/year</td>
</tr>
<tr>
<td>5 – 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adapted from National Heart, Lung and Blood Institute. EPR 3 Guidelines 2007
<table>
<thead>
<tr>
<th>Components of Control</th>
<th>Well Controlled</th>
<th>Not Well Controlled</th>
<th>Very Poorly Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ages 0-4 years</td>
<td>≤2 days/week</td>
<td>&gt;2 days/week</td>
<td>Throughout the day</td>
</tr>
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<td>Ages 5-11 years</td>
<td>≤2 days/week but not more than once on each day</td>
<td>&gt;2 days/week or multiple times on ≤2 days/week</td>
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<tr>
<td>Ages ≥12 years</td>
<td>≤2 days/week</td>
<td>&gt;2 days/week</td>
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<tr>
<td></td>
<td>≤2x/month</td>
<td>&gt;1x/month</td>
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<td></td>
<td>≤2x/month</td>
<td>≥2x/month</td>
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<td></td>
<td>≥2x/month</td>
<td>1-3x/week</td>
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<tr>
<td></td>
<td>≥2x/month</td>
<td>≥4x/week</td>
<td></td>
</tr>
<tr>
<td>Interventions with normal activity</td>
<td>None</td>
<td>Some limitation</td>
<td>Extremely limited</td>
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<tr>
<td>SABA* use for symptom control (not to prevent EIB*)</td>
<td>≤2 days/week</td>
<td>&gt;2 days/week</td>
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<tr>
<td>Lung function</td>
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<td>&gt;80%</td>
<td>Not applicable</td>
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<td>FEV* (% predicted)</td>
<td>≥80%</td>
<td>60-80%</td>
<td>&lt;60%</td>
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<td>or peak flow (% personal best)</td>
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<td>&lt;60%</td>
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<td>FEV/FVC*</td>
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<td>Validated questionnaires†</td>
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<td>1-2</td>
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<td>ATAAQ*</td>
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<td>≤1.5</td>
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<td>ACO*</td>
<td>Not applicable</td>
<td>≥2.0</td>
<td>≥16-19</td>
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<tr>
<td>ACT*</td>
<td></td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Asthma exacerbations requiring oral systemic corticosteroids*</td>
<td>0-1/year</td>
<td>2-3/year</td>
<td>&gt;3/year</td>
</tr>
<tr>
<td>Risk</td>
<td>Consider severity and interval since last asthma exacerbation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment-related adverse effects</td>
<td>Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adapted from National Heart, Lung and Blood Institute. EPR 3 Guidelines 2007
Polling Question: Which of the following therapies would you recommend to start for Terry?

A. Leukotriene modifier (e.g., montelukast)
B. Inhaled corticosteroid (e.g., budesonide)
C. Long-acting beta agonist (e.g., salmeterol)
D. Inhaled corticosteroid/Long-acting beta agonist combo (e.g., Fluticasone/Salmeterol)
Intermittent Asthma

Persistent Asthma: Daily Medication
Consult with asthma specialist if step 4 or higher care is required
Consider consultation at step 3

Stepwise Approach to Managing Asthma in Individuals ≥12 Years of Age

**Provide Patient Education and Environmental Control Advice at Each Step**

**Step 1**
- Preferred: SABA prn
- Alternative: Cromolyn, Theophylline

**Step 2**
- Preferred: Low-dose ICS + LABA
- Alternative: LTRA, Theophylline, Or Zileuton

**Step 3**
- Preferred: Low-dose ICS + LABA
- Alternative: Medium-dose ICS

**Step 4**
- Preferred: Medium-dose ICS + LABA
- Alternative: Low-dose ICS + either LTRA, Theophylline, Or Zileuton

**Step 5**
- Preferred: High-dose ICS + LABA + oral Corticosteroid
- AND
- Consider Omalizumab For patients with allergies

**Step 6**
- Preferred: High-dose ICS + LABA + oral Corticosteroid + oral Theophylline
- AND
- Consider Omalizumab For patients with allergies

**Assess Control**

Step up if needed (check adherence, environmental control and co-morbidities)

Step down if possible (asthma well controlled for 3 months)

Adapted from National Heart, Lung and Blood Institute. EPR 3 Guidelines 2007
Monotherapy Treatment Options for Mild Persistent Asthma

- Inhaled corticosteroids are the most potent and effective long-term control therapy
  - ICS are the preferred single long-term control agent, independent of patient age

- Selected other therapies are alternatives to ICS depending on the patient’s age, and can be as effective as single agents
  - Cromolyn
  - Theophylline
  - Leukotriene modifiers (montelukast, zafirlukast)
ICS vs Other Monotherapies for Asthma

Efficacy

ICS

Other Therapies
Effect of ICS Therapy during Childhood on Adult Height

- CAMP study measured adult height at 24.9 years
- 43 participants who started inhaled steroids (400 mcg budesonide), or nedocromil 16 mcg, or placebo, between ages of 5 and 13 years of age

Kelly HW. NEJM 2012; 367: 904-912
Effect of Childhood Treatment with ICS on Adult Height

Mean Adult Height in Budesonide group was 1.2 cm less than placebo (-0.5 to -1.9) at 24.9 years of age (p = 0.001)

Kelly HW. NEJM 2012; 367: 904-912
Effect of ICS therapy for Asthma during Childhood on Adult Height

- Mean adult height was approximately $\frac{1}{2}$ inch shorter in patients treated with ICS
- The effect was mostly demonstrated within the first two years of treatment and primarily in prepubertal subjects
- There was a significant decrease in adult height but the effect was not progressive or cumulative

Kelly HW. NEJM 2012; 367: 904-912
How should Terry and his family be advised about ICS Therapy?

- ICS therapy poses less risk than poorly controlled asthma or oral steroids for toxicities in general

- ICS present dose-related risks and strategies should be employed to minimize these
  - Use lowest effective dose
  - Use with holding chamber and/or rinse & spit
  - Monitor growth rate in children

- In general, it is prudent to counsel about calcium and Vitamin D supplementation
### Comparative Doses of Selected ICS Products for Patients 12 years of Age and Older

<table>
<thead>
<tr>
<th>Agent</th>
<th>Low Daily Dose</th>
<th>Medium Daily Dose</th>
<th>High Daily Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclomethasone</td>
<td>80-240 mcg</td>
<td>&gt; 240-480 mcg</td>
<td>&gt; 480 mcg</td>
</tr>
<tr>
<td>Budesonide</td>
<td>180-600 mcg</td>
<td>&gt; 600-1200 mcg</td>
<td>&gt; 1200 mcg</td>
</tr>
<tr>
<td>Flunisolide</td>
<td>320 mcg</td>
<td>&gt; 320-640 mcg</td>
<td>&gt; 640 mcg</td>
</tr>
<tr>
<td>Fluticasone</td>
<td>88-264 mcg</td>
<td>&gt; 264-500 mcg</td>
<td>&gt; 500 mcg</td>
</tr>
<tr>
<td>Mometasone</td>
<td>200 mcg</td>
<td>400 mcg</td>
<td>&gt; 400 mcg</td>
</tr>
</tbody>
</table>

Adapted from National Heart, Lung and Blood Institute. EPR 3 Guidelines 2007
Counseling Patients with Concerns about ICS Safety

- ICS are safer than periodic oral steroid courses
- Lowest dose required to control asthma will be used
- Growth will be monitored for children and adolescents
- Strategies to improve overall safety of ICS will be employed

National Heart, Lung and Blood Institute. EPR 3 Guidelines 2007
Appropriate Checkpoints When Evaluating Asthma Control

- Adherence with prescribed therapy
- Avoidance of triggers
- Controlling co-morbidities
- Inhaler skills and technique
- Vaccine status
Case Study: Terry

- Eight months later, Terry is in for a clinic visit.
- Current asthma therapy included budesonide inhaler 180 mcg, 2 puffs twice daily, and PRN albuterol
- He reports using albuterol about 3x a week, in addition to waking up at least once weekly with asthma symptoms
- He has missed 3 days of school in the past 3 months due to asthma
- His allergies “act up” intermittently but haven’t been a problem recently
# Asthma Classification by Control (EPR3)

<table>
<thead>
<tr>
<th>Components of CONTROL</th>
<th>Age (Years)</th>
<th>Well Controlled</th>
<th>Not Well Controlled</th>
<th>Very Poorly Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Level of Asthma CONTROL</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Age (Years)</td>
<td>Symptoms</td>
<td>Nighttime awakenings</td>
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<tr>
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<td>≤ 2 days/week but ≤ 1x/day</td>
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<td></td>
<td></td>
<td>≥ 12</td>
<td>Throughout the day</td>
<td>&gt; 1x/week</td>
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<td></td>
<td>≥ 2x/month</td>
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<td></td>
<td>1–3x/month</td>
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<td>≥ 4x/month</td>
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</tbody>
</table>

Adapted from National Heart, Lung and Blood Institute. EPR 3 Guidelines; 2007
Polling Question: After evaluating the checkpoints for Terry, what change in drug therapy would you recommend?

A. Add a long-acting anticholinergic agent
B. Increase the ICS to medium dose
C. Add a long-acting beta agonist agent
D. Add a leukotriene modifier therapy
Stepwise Approach to Managing Asthma in Individuals ≥12 Years of Age

Intermittent Asthma

Persistent Asthma: Daily Medication
Consult with asthma specialist if step 4 or higher care is required
Consider consultation at step 3

Provide Patient Education and Environmental Control Advice at Each Step

Step 1
Preferred: SABA prn
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Or
Cromolyn, Theophylline, Or Zileuton

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Alternative: Medium-dose ICS
Alternative: Low-dose ICS + either LTRA, Theophylline Or Zileuton

Step 3
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Alternative: Medium-dose ICS + either LTRA, Theophylline Or Zileuton

Step 4
Preferred: Medium-dose ICS + LABA
Alternative: Medium-dose ICS + either LTRA, Theophylline Or Zileuton

Step 5
Preferred: High-dose ICS + LABA
AND
Consider Omalizumab
For patients with allergies

Step 6
Preferred: High-dose ICS + LABA + oral Corticosteroid
AND
Consider Omalizumab
For patients with allergies

Assess Control

Step up if needed (check adherence, environmental control and co-morbidities)

Step down if possible (asthma well controlled for 3 months)

Adapted from National Heart, Lung and Blood Institute. EPR 3 Guidelines 2007
Polling Question: LABAs have a BBW about an increased risk of asthma related deaths. Should that factor into my decision about using them in adolescents?

A. Yes, only use in severe asthma
B. Yes, but weight the risk, benefit, and available evidence
C. No, the BBW for LABAs has been removed
AUSTRI Study

- Multicenter, randomized, double-blind, placebo-controlled study
- 26 week duration
- Subjects ages 12 years or older
- All subjects had experienced a severe asthma episode during the previous year
- Primary safety endpoint was the first severe asthma related event (e.g., death, intubation, hospitalization)
- Non-inferiority design

Primary Outcome: Serious Asthma Related Event

Asthma and Long-acting Beta Agonist Therapy

- Many patients can be controlled with an ICS alone
- Combinations of ICS/LABA are a preferred therapy for patients requiring two or more medications
- LABA improve asthma control and reduce hospitalization rates
- Recent studies report non-inferiority to ICS alone based on safety outcomes
- When treating asthma, LABA should always be used with inhaled corticosteroids
Polling Question: Should Terry have a written asthma action plan?

A. Yes, and it should be based on peak flow readings
B. Yes, and he should have one for home and school
C. No, action plans are only for patients with severe asthma
D. No, action plans have been proven to be not effective
**Asthma Action Plan**

### Doing Well
- **Green Zone**
  - No cough, wheeze, chest tightness, or shortness of breath during the day or night
  - Can do usual activities
  - If a peak flow meter is used:
    - Peak flow: more than (80% or more of my best peak flow)
  - My best peak flow is: 
  - Before exercise

### Asthma Is Getting Worse
- **Yellow Zone**
  - Cough, wheeze, chest tightness, or shortness of breath, or
  - Waking at night due to asthma, or
  - Can do some, but not all, usual activities
  - Peak flow: to (60% to 79% of my best peak flow)

### Medical Alert!
- **Red Zone**
  - Very short of breath, or
  - Quick-relief medicine have not helped, or
  - Cannot do usual activities, or
  - Symptoms are worse or get worse after 24 hours in Yellow Zone
  - Peak flow: less than (50% of my best peak flow)

### DANGER SIGNS
- Trouble walking and talking due to shortness of breath
- Lips or fingernails are blue

---

Take these long-term control medicines each day (include an anti-inflammatory):

<table>
<thead>
<tr>
<th>Medicine</th>
<th>How much to take</th>
<th>When to take</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Add quick-relief medicine—and keep taking your GREEN ZONE medicine.

- 2 or 4 puffs, every 30 minutes for up to 1 hour
- Nebulizer, once

**Peak**

If your symptoms (and peak flow, if used) return to GREEN ZONE after 1 hour of above treatment:

- Continue monitoring to be sure you stay in the green zone.

If your symptoms (and peak flow, if used) do not return to GREEN ZONE after 1 hour of above treatment:

- Take another quick-relief medicine (short-acting beta-agonist)
- Nebulizer
- Add: 
  - Oral steroids
  - Call the doctor before/ within hours after taking the oral steroid.

Take this medicine:

- 1.4 or 1.6 puffs or 1 Nebulizer
- 1.2 or 1.3 mg per day. For 3-10 days

Then call your doctor NOW. Go to the hospital or call an ambulance immediately if:

- You are still in the red zone after 15 minutes AND
- You have not reached your doctor.

See the reverse side for things you can do to avoid your asthma triggers.

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Written Asthma Action Plans

- All patients with a persistent form of asthma should have an action plan.
- Action plans should list regular medications and actions to take to minimize exposure to triggers.
- Action plans (based on PEF or symptoms) describe actions to take when symptoms occurs, or PEF drops, and when to seek medical attention.
Ongoing process of care

- Assess barriers to control
  - Inhaler technique
  - Controller medication adherence
    - Affordability of controller medication
  - Exposure to risk factors such as smoking, beta blockers, NSAIDs, allergens
- Management of comorbidities (e.g. rhinitis, obesity, GERD, obstructive sleep apnea, depression or anxiety)
Inhaler mishandling is associated with reduced disease control

Cross-sectional, multi-site, observational study assessing associations of inhaler misuse and disease control

Study Design

- Prospective observational study
- 24 chest physician practices in Italy
- 1633 patients (703 with asthma) and 2288 observations of inhaler technique
- Tracking disease control with the ACT assessment and patient reported healthcare events (hospitalizations, ED visits)

Outcomes

- Associations between inhaler misuse (at least one critical error made during observation) and:
  - Demographic factors
  - ACT score
  - Disease markers (FEV1)
  - Hospitalizations, ED visits, corticosteroid use
Associations with inhaler misuse

Increased risk of inhaler misuse
- Older age
  - OR 1.12 ± 0.01; \( p = .008 \)
- Lower degrees of education
  - OR 1.23 ± 0.06; \( p = .001 \)
- Lack of instruction in inhaler technique
  - OR 2.28 ± 0.05; \( p < .001 \)

Outcomes associated with inhaler misuse
- Increased ACT score
  - 1.73 ± 0.26; \( p < .0001 \) (asthma patients)
- Report of low perceived benefit
  - OR 1.4 ± 0.2; \( p = .015 \)
- Increased hospitalizations, ED visits, and corticosteroid use

**Increased risk of health care utilization**

<table>
<thead>
<tr>
<th>Metric (# in last year)</th>
<th>No errors of technique</th>
<th>At least 1 error of technique</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study patients with asthma</td>
<td>% of patients</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hospital admissions</strong></td>
<td></td>
<td></td>
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<tr>
<td>0</td>
<td>86</td>
<td>76</td>
<td>1.47 ± 0.17</td>
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<tr>
<td></td>
<td>1</td>
<td>9</td>
<td>1.62 ± 0.20</td>
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<tr>
<td></td>
<td>2-3</td>
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<td><strong>ED visits</strong></td>
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<td>81</td>
<td>69</td>
<td>1.62 ± 0.20</td>
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<tr>
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<td>1</td>
<td>11</td>
<td>1.00 ± 0.00</td>
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<tr>
<td></td>
<td>2-3</td>
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<td>1.00 ± 0.00</td>
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<td><strong>Corticosteroid courses</strong></td>
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<tr>
<td>0</td>
<td>35</td>
<td>27</td>
<td>1.00 ± 0.00</td>
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</tbody>
</table>

Systematic Review of Errors in Inhaler Use

Systematic review of articles reporting direct observation of inhaler technique between the years of 1975-2014

Systematic Review: Inhaler Errors

Design

• Systematic review and meta analysis
• Patients > 5 years old with asthma or COPD
• Searched MEDLINE and reference lists of obtained articles

Studies included

• 144 articles
• 59,584 tests of technique

Inclusion Criteria

• Evaluation of inhaler use as main objective
• Done by direct observation

Inhaler technique – Essential steps defined

<table>
<thead>
<tr>
<th>MDI</th>
<th>DPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Prepare device – uncap, shake, then hold inhaler</td>
<td>▪ Prepare device – uncap and load inhaler</td>
</tr>
<tr>
<td>▪ Exhale completely</td>
<td>▪ Turn away from inhaler and exhale completely</td>
</tr>
<tr>
<td>▪ Place teeth and lips around mouthpiece and fire the device while inhaling</td>
<td>▪ Place teeth and lips around mouthpiece to form a seal</td>
</tr>
<tr>
<td>▪ Breathe in slowly and deeply</td>
<td>▪ Breathe in with one brisk, deep inhalation</td>
</tr>
<tr>
<td>▪ Hold breath for 5-10 seconds (or as long as possible)</td>
<td>▪ Hold breath for 5-10 seconds (or as long as possible)</td>
</tr>
</tbody>
</table>
## Prevalence of errors

### MDI (n = 23,720)

<table>
<thead>
<tr>
<th>Step</th>
<th>Mean % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation</td>
<td>30 (24-36)</td>
</tr>
<tr>
<td>Exhalation</td>
<td>48 (43-53)</td>
</tr>
<tr>
<td>Coordination</td>
<td>45 (41-49)</td>
</tr>
<tr>
<td>Inhalation</td>
<td>44 (40-47)</td>
</tr>
<tr>
<td>Breath hold</td>
<td>46 (42-49)</td>
</tr>
</tbody>
</table>

### DPI (n = 21,497)

<table>
<thead>
<tr>
<th>Step</th>
<th>Mean % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation</td>
<td>29 (26-33)</td>
</tr>
<tr>
<td>Exhalation</td>
<td>46 (42-50)</td>
</tr>
<tr>
<td>Placement</td>
<td>18 (11-25)</td>
</tr>
<tr>
<td>Inhalation</td>
<td>22 (19-25)</td>
</tr>
<tr>
<td>Breath hold</td>
<td>37 (33-40)</td>
</tr>
</tbody>
</table>

Frequency of poor technique

Correct
- All maneuvers were performed in accordance with the recommendations
- 31%

Acceptable
- Roughly 75% of the maneuvers as recommended
- All critical aspects
- 41%

Poor
- Fewer than 50% of the maneuvers as recommended
- One or more critical errors
- 31%

Systematic Review: Other findings

MDI had the highest frequency of errors

Adding a holding chamber did not reduce errors with MDIs substantially

The problem has not improved over the 40 year observed period
Role of the pharmacist

- Represent the medication experts and the most accessible health care professional
  - Repeat instruction required for effective use of inhalers
    - 3 times on average

- Study of physicians in their first year of practice in their ability to demonstrate appropriate inhaler technique:
  - Baseline – 5%
  - After a lecture and demonstration – 13%
  - After “intensive one-on-one session” – 73%

MDI Technique: The Effect of Two Educational Interventions Delivered in Community Pharmacy Over Time

Prospective, randomized, parallel-group study evaluating the effects of two methods of educational intervention delivered in a community pharmacy setting

Intervention

Standard Instruction

- Verbal instruction
  - Review of checklist
- Written information
  - Product information leaflet normally dispensed with prescription

Standard + Demonstration

- Verbal (same)
- Written (same)
- Physical demonstration by pharmacist with a placebo inhaler

Repeated after 4 weeks and 8 weeks for a total of 3 visits with patient demonstration and instruction at each step if inhaler technique not correct

### Results

<table>
<thead>
<tr>
<th>Time point</th>
<th>Patients with correct technique % (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard</td>
</tr>
<tr>
<td>Visit 1</td>
<td>n = 25</td>
</tr>
<tr>
<td>Pre</td>
<td></td>
</tr>
<tr>
<td>Post</td>
<td>75% (19)</td>
</tr>
<tr>
<td>Visit 2</td>
<td>n = 16</td>
</tr>
<tr>
<td>Post</td>
<td>75% (12)</td>
</tr>
<tr>
<td>Visit 3</td>
<td>n = 6</td>
</tr>
<tr>
<td>Post</td>
<td>50% (3)</td>
</tr>
</tbody>
</table>

Patient drop-out reasons

Standard

- 19 patients discontinued
- 12 lost for “not seeing any benefits”

Standard + Demonstration

- 8 patients discontinued
- None lost due to lack of benefit
- Due to relocation, lost to follow up, lack of time

Conclusions

- Written instruction and verbal counseling is effective

- Adding physical demonstration is more effective and preferred by patients
  - Call manufacturers to request demo inhalers

- Time may be a constraint
Improved asthma outcomes with a simple inhaler technique intervention by community pharmacists

Controlled trial in which community pharmacists provided brief inhaler teaching to patients with asthma over a course of 6 months

Brief Interventions: Inhaler Teaching

Design

- Pharmacists delivered verbal counseling with a physical demonstration of inhaler technique
- 5 visits: at baseline, 1, 2, 3, and 6 months

Outcomes

- Correct inhaler technique
- Peak flow readings
- Asthma related quality of life scores

Brief Interventions: Inhaler Teaching

Inhaler technique teaching lasting on average 2.5 minutes

- Improved inhaler technique
- Improved peak flow consistency
- Improved asthma related quality of life scores

Conclusions

- Quality teaching including a demonstration can be performed in a short amount of time

- These interventions are effective

- More so when they are done consistently
Case Study: Terry

Terry and his parents are at the pharmacy picking up his combination ICS/LABA, albuterol MDI, and a course of oral steroids to have on hand to use per his asthma action plan since he had to use his supply for a recent exacerbation. Would Terry benefit from additional counseling on inhaler technique?

A. No, he has been on it for years, so he knows.

B. Yes, an unknown error in technique may contribute to poor asthma control.
# Affordability of controller medication

<table>
<thead>
<tr>
<th>Medication dose per actuation</th>
<th>AWP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuterol 90 mcg (ProAir HFA)</td>
<td>$67.44</td>
</tr>
<tr>
<td>Albuterol 90 mcg (Proventil HFA)</td>
<td>$90.43</td>
</tr>
<tr>
<td>Albuterol 90 mcg (Ventolin HFA)</td>
<td>$24.96</td>
</tr>
<tr>
<td>Fluticasone 110 mcg (Flovent HFA)</td>
<td>$275.42</td>
</tr>
<tr>
<td>Beclomethasone 80 mcg (QVAR)</td>
<td>$251.84</td>
</tr>
<tr>
<td>Mometasone/formoterol 100/5 mcg (Dulera)</td>
<td>$236.02</td>
</tr>
<tr>
<td>Budesonide/formoterol 80/4.5 mcg (Symbicort)</td>
<td>$218.81</td>
</tr>
<tr>
<td>Fluticasone/salmeterol 250/50 mcg (Advair Diskus)</td>
<td>$167.04</td>
</tr>
</tbody>
</table>
Exposure to risk factors

- Smoking
  - Ask
  - Advise
    - Assess, Assist, Arrange → 1-800-QUIT-NOW
- Allergen exposure
- Profile review
  - Beta blockers
  - NSAIDs
Management of comorbidities

- Rhinitis
- GERD
- Obesity
- Obstructive sleep apnea
- Depression or anxiety
Exacerbation management
Case Study: Alysa

- Alysa is a 39 year old female with a longstanding history of asthma which has been poorly controlled partly due to non-adherence.

- She was brought to the emergency department by friends who reported that she was experiencing shortness of breath and wheezing for the past few days and became acutely worse this afternoon.

- Patient reports that she ran out of her ICS/LABA therapy over the weekend and has been relying on albuterol as needed.

- In the ED, a PEF is 40% of predicted and oxygen saturation is 92%.

- She received 3 doses of albuterol by nebulization and 50 mg of intravenous methylprednisolone.
Case Study: Alysa

- Patient responds to initial treatment with a PEF approaching 60% and improvements in tachypnea and dyspnea
- She is admitted for further treatment and placed on 3 liters of supplemental oxygen
- Albuterol 2.5mg/Ipratropium 500mcg nebulizations are ordered every 4 hours, along with prednisone 50 mg orally daily
Polling Question: Should Alysa be started on other therapies at this time?

A. Yes, an antibiotic
B. Yes, her home ICS/LABA therapy
C. Yes, a nebulized LABA
D. No, nothing is needed at this time
Treating Acute Asthma Exacerbations

- Intensify short (and fast) acting bronchodilator therapy
- Initiate a short course of systemic corticosteroids
- Consider ancillary therapies if response is suboptimal
- In hospitalized patients, re-establish long term medications as patient improves
- Ensure patient understanding of treatment plan (including changes)
- Assist patient with access to prescribed therapies
Transitions of Care and Readmission Reduction

- Exacerbation
  - Intensified bronchodilators
  - Systemic corticosteroids
- Transition
- Stable
  - Step therapy
Pharmacist Managed Asthma Programs

- Identified long ago as an area of impact for pharmacists
- Initial publications in the early 1990s by Self, Kelso, Pauley, and others
- Most identifying patients in the ED with frequent exacerbations
ED Based Pharmacist-Led Transitions of Care

- Collaboration between ED and ambulatory care pharmacists
- For patients with asthma, COPD, or CHF
- Provide comprehensive medication review and education in the ED setting
  - Medication adherence and administration technique
  - Access to medications at discharge
  - Modification of therapy
  - Vaccination administration
- 18 patients referred to follow-up care
  - 5 followed up with a pharmacist
  - 5 patients followed up with PCP

Childhood Asthma Hospital Discharge Medication Fills and Risk of Subsequent Readmission

Retrospective cohort analysis of Medicaid Analytic Extract files from 12 geographically diverse states from 2005-2007 hospitalization, outpatient, and prescription claims records for children ages 2-18 years with an index hospitalization for asthma
Prescription Bundles

- Association between medication fill and reduced readmission risk
- 14 day readmission risk
  - Beta agonist HR 0.67 (95% CI 0.51 - 0.87)
  - Inhaled steroid HR 0.59 (95% CI 0.42 - 0.85)
- 15 and 90 day readmission risk
  - Inhaled steroid HR 0.87 (95% CI 0.77, 0.98)
- Patients who filled all 3 medications had the lowest readmission risk
  - HR 0.31 (95% CI 0.16 - 0.60)

Kenyon CC. J Pediatr. 2015;166(5):1121-7
Reducing Readmission Rates for Asthma: A Case Study

- Children’s Hospital discovered their 30 day readmission rate for asthma was 7.98% (in 1/2013)
- Benchmark rate was 3.04%
- Institution located in large metropolitan area and serves as both a tertiary care pediatric hospital and a pediatric community hospital
- Developed a multifaceted quality improvement initiative with a goal to reduce the rate to 3.99% within 2 years

Reducing Readmission Rates for Asthma: Strategies

- Formed an Asthma Quality Council
  - Multidisciplinary group of physicians (various practices), acute care and clinic nurses, pharmacists, respiratory therapists, social workers and case managers, and clinical decision support
- Used LEAN value stream mapping to identify process steps of care and assess value
- Identified high yield interventions
- Implemented in stepwise fashion

## Reducing Readmission Rates for Asthma: Interventions

<table>
<thead>
<tr>
<th>Category</th>
<th>Pre-Intervention</th>
<th>Nature of Intervention</th>
<th>Cost</th>
<th>Potential Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow-up care</td>
<td>Approx. 4 weeks after discharge</td>
<td>Target visit within 1-2 weeks; expand High-Risk Clinic</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Education (2 steps)</td>
<td>Provided in classroom setting and lacked standard assessment of factors for admission</td>
<td>Bedside education (including inhaler technique) and development of Asthma Admission Assessment Tool;</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Access to medications</td>
<td>Inpatient inhalers discarded; new prescriptions not filled at discharge</td>
<td>Re-labeled inpatient inhalers at discharge</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Expansion of home visits</td>
<td>Public health nursing available with limited capacity</td>
<td>Established community partnerships for in home visits</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>

Reducing Readmission Rates for Asthma: Results

- Reduced asthma readmission rates to 1.65% by July 2014
  - 79.3% reduction

- Investigator observations:
  - Interventions were implemented across the spectrum of hospitalization and discharge
  - No single intervention was responsible for the success of the initiative

Case Study: Alysa

- What services should be offered to help prevent a readmission for a recurrent exacerbation for a patient like Alysa?
  A. Assist with access to medications (relabeling inpatient inhalers so the patient could take them home, finding copay cards, medication assistance programs)
  B. Ensuring appropriate steroid therapy prescribed and picked up
  C. Instruct patient in the use of inhaled medications
  D. All of the above
What about patients who fail to respond to the traditional stepped care approach to asthma management despite ensuring adherence, access, and ability to use therapies?
ATS/ERS Definition of Severe Asthma

- After confirmation of asthma diagnosis and management of comorbidities, severe asthma is defined as:

- “Asthma which requires treatment with high dose inhaled corticosteroids (ICS) plus a second controller (and/or systemic corticosteroids) to prevent it from becoming uncontrolled or which remains uncontrolled despite this therapy.”
Our Understanding of Asthma is Changing

The Challenge

- Many patients may not respond or be controlled on therapy considered to be the standard of care
- Asthma is a heterogenous disease and a personalized approach is required for optimal management

Evolving Understanding

- Clinical differences in treatment response are related to underlying variations in multiple mechanisms
  - genetic
  - pharmacologic
  - physiologic
  - biologic
  - immunologic

An Evolving Approach to Asthma using Biomarkers and Endotypes

Severe Asthma

Characterize Subtype

Phenotype
- Gender
- Age
- Obesity
- Ethnicity
- Smoking History

Endotype
- Blood Biomarkers
  - IgE
  - Eosinophils
  - Periostin
  - DPP-4
- Sputum Biomarkers
  - Eosinophils
  - Neutrophils
- Exhaled Biomarkers
  - FeNO

Genotype

Tailored Therapy

Examples of Therapeutic Targets in Asthma Management

APC = antigen presenting cells.

Future Directions

- Novel targets for treatment of asthma
- Establishment of additional pharmacist-driven transitions of care programs in health systems
- Use of collaborative practice agreements with community pharmacists to provide closer follow up for asthma patients
  - Use of assessment questionnaires and protocols to develop pharmacotherapy plans
  - Medication counseling and disease teaching
  - Vaccine administration
Summary

- Asthma is a chronic disease; assessment and ongoing monitoring is required for effective management.
- A stepwise approach to pharmacotherapy will work for 90+% of patients; when the disease is severe or control is difficult to achieve, consider other factors and endotypes.
- Smooth transitions from sites of care should be ensured in order to improve overall outcomes and safety for the patient.
- Pharmacists can work collaboratively with other clinicians to ensure that patients understand their treatment plan and can participate in self management.
1. Assessment Question

Which of the following long term control therapies is preferred for a 13 year old patient with mild persistent asthma?

A. Albuterol  
B. Montelukast  
C. Budesonide  
D. Cromolyn
2. Assessment Question

Which type of inhalation device should be inhaled with a slow deep breath?

A. Dry powder inhaler
B. Metered dose inhaler
C. Breath-actuated inhaler
3. Assessment Question

Which inhalation device does not require patient instruction and periodic observation?
A. nebulizer
B. Dry powder inhaler
C. Metered dose inhaler
D. All inhalation devices require instruction and observation
4. Assessment Question

1. Which of the following statements is true regarding criteria for transitions of care programs to be effective for patients with asthma?
   A. Must be physician-directed
   B. Should include addressing access to medications
   C. Must emphasize adherence to rescue therapies
   D. Should focus on avoiding long-acting bronchodilator therapies as part of chronic management
Breathe Easy: Ensuring Care Coordination for Patients with Asthma