Topic: Asthma

Learning Objectives: At the end of this learning experience, viewers will be able to:

1. Discuss the diagnosis of asthma with a family
2. Describe the side effects of inhaled and systemic steroids
3. Advise families about current recommendations for the influenza vaccine
4. Classify asthma severity based on the NHLBI criteria according to age.
5. Apply the Stepwise Approach based on the NHLBI criteria for managing asthma in children of various ages.

Note: Asthma treatment product names are used within this module. This information is for educational purposes only. No actual or implied endorsement or promotion of any specific product(s) is made or intended by the University of Pittsburgh School of Medicine, The Children’s Hospital of Pittsburgh of UPMC, authors, editors, producers and sponsors of this material.

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Revised by Sanjay Lambore MD and Alicia Haupt MD, 2010, 2013

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Case 1

On a cold December day, you are seeing A.J., a 2 and half year old African-American boy, for progressively worsening cough and nasal discharge for the last 5 days. In reviewing his chart, you notice that he was admitted to the hospital at age 6 months for RSV. He has had 4 sick visits over the last 6 months for URI symptoms and wheezing. He was given an albuterol nebulizer for which his mother reports has helped with his prior symptoms. She has been using it with A.J. every 4 hours for the past 2 days. A.J. had a normal CXR in the past with one of his visits. He was born at 40 weeks gestation of an unremarkable pregnancy. He attends day care and his family history is significant for asthma in his mother and an older sibling.

On exam, A.J. is afebrile with a respiratory rate of 35. Pulse oximeter reading is 99% on room air. He is happy, playful and appears well hydrated. He is well-perfused. His HEENT exam is notable only for profuse clear nasal discharge. On chest exam, you note no retractions, good aeration, and mild to moderate symmetric expiratory wheezes bilaterally. The remainder of his exam is unremarkable.

Question 1. What is your assessment for A.J.? Does he have asthma?
Question 1. What is your assessment for A.J.? Does he have asthma?

A.J.’s history has several features that suggest the diagnosis of asthma:

- Recurrent wheezing episodes
- **Response to bronchodilator medications** (one of the most important features); response should be relatively quick after therapy (10-15 min)
- No obvious alternative etiology for wheezing
- Family history of asthma
- Previous RSV infection
- An intercurrent illness which is serving as a trigger for asthma

Note: In children younger than 2 years of age who wheeze for the first time, the most likely diagnosis is bronchiolitis, while in children older than 2 years it is most likely asthma.

Question 2. How would you discuss the diagnosis of asthma with the family?
Question 2. How would you discuss the diagnosis of asthma with the family?

- Asthma is a chronic illness requiring close medical follow-up
- It may not be lifelong: > 50% of children with asthma outgrow symptoms by adulthood
- A.J. is less likely to outgrow symptoms if asthma is severe or if multiple allergies are present (i.e., if A.J. has a history of atopy)
- We need to recognize individual child's triggers to be proactive with avoidance and medications:
  - Identify precipitating factors (exposure at home, daycare and school to inhalant allergens, irritants such as tobacco smoke, or viral URIs)
  - Identify co-morbidities that may aggravate asthma (sinusitis, rhinitis, GERD)
  - Classify asthma severity, using measures in both impairment and risk domains

Note: Physicians may worry that the label of “asthma” may be stressful for the family, cause unnecessary restrictions on child’s activities, or harm self-esteem.

However, delaying use of the term “asthma” may result in:

- Lack of appropriate education and counseling for chronic care management (e.g., control of irritant exposure) for families
- Reduced severity classification and prescribing of controller medications by physicians
- Loss of parents' trust in their primary care provider if they are told in an ER or inpatient setting that their child has asthma

The 2007 NHLBI (National Heart Lung and Blood Institute) Expert Panel Report 3 recommends pulmonary function testing, specifically spirometry, to assess asthma severity: low FEV1 indicates current obstruction and risk of future exacerbation for children 5 years of age and older.

Question 3. Should A.J. be started on long-term control therapy? If so, what therapy would you choose?
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The NHLBI Expert Panel Report 3 addresses the difficulty of determining which young children require control therapy.

The Panel advises that one strongly consider **initiating long-term-control therapy in infants and young children who:**

- had four or more episodes of wheezing in the past year that lasted more than 1 day and affected sleep (Category A Evidence)
- had two or more exacerbations requiring steroids in the past year (Category D Evidence)

AND

- have a high risk of developing persistent asthma (positive asthma profile) as indicated by either:
  
  *one* of the following:
  - a physician’s diagnosis of atopic dermatitis
  - parental history of asthma
  - evidence of sensitization to aeroallergens

OR

*two* of the following:

- sensitization to foods
- greater than 4 percent peripheral blood eosinophilia
- wheezing apart from colds

Open and view Medscape Education’s presentation of the NHLBI Expert Panel Report 3 Guidelines Table: [Classifying Asthma Severity and Initiating Treatment in Children 0-4 Years of Age](http://www.nhlbi.nih.gov/guidelines/asthma/asthsumm.pdf)  
Source: National Heart, Lung, and Blood Institute; National Institutes of Health; U.S. Department of Health and Human Services

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The 2007 NHLBI Expert Panel Report 3 (EPR3): Guidelines for the Diagnosis and Management of Asthma

To view the **Summary Report**: [www.nhlbi.nih.gov/guidelines/asthma/asthsumm.pdf](http://www.nhlbi.nih.gov/guidelines/asthma/asthsumm.pdf)

A.J. meets criteria for control therapy: he has had multiple episodes of wheezing in the past year and his mother and sibling have asthma. You should:

- Use inhaled corticosteroids as a controller medication with albuterol as a rescue medication. Consider oral steroids if exacerbation not resolving.
- Stress making controller medicine part of the family’s daily routine to enhance compliance.

Question 4. When discussing possible medication options for A.J.’s treatment, his mother expresses concerns about the use of steroids. What are the side effects of both inhaled and systemic corticosteroids?
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Inhaled corticosteroids (ICS)

Inhaled corticosteroids are the most potent and consistently effective long-term control medication for asthma

Early intervention with inhaled steroids can:
- improve asthma control (major impact on child and family),
- reduce severity of symptoms,
- improve Peak Expiratory Flow (PEF) and spirometry,
- diminish airway responsiveness,
- prevent exacerbations, and
- reduce systemic corticosteroid courses, ED care, hospitalizations, and deaths due to asthma

Inhaled corticosteroids side effects
- Inhaled steroids have been associated with possible transient reduction of linear growth velocity during the first several months of treatment, considered small and non-progressive, but not a significant effect on overall height attainment (NHLBI Report Summary 3)
- Other side effects can include oral thrush (lessened by use of a spacer and rinsing after use), dysphonia, and cough

Systemic corticosteroids side effects
- Short term use of systemic steroids can cause reversible abnormalities in glucose metabolism, increased appetite, weight gain, mood alteration, and hypertension
- Long term use of systemic steroids can cause adrenal axis suppression, growth suppression, hypertension, Cushing’s syndrome, cataracts, muscle weakness, diabetes, etc.

Question 5. How can you soothe patient and parent qualms about inhaled corticosteroids?
Question 5. How can you soothe patient and parent qualms about inhaled corticosteroids?

Physicians who prescribe inhaled corticosteroids (ICS) continue to meet fear and resistance from patients and parents who are concerned about long-term use of corticosteroid medications. However, the 2007 Expert Panel report states that (ICS) are the preferred class of medication for treating asthma.

To help relieve concerns, you can help the patient and parent by comparing ICS doses with systemic corticosteroid doses, demonstrating the greater safety of ICS.

In everyday terms, explain to the patient and family that using ICS is much safer than using a prednisone burst for an asthma exacerbation of 40 mg po per day for five days.

A person would have to take the following amounts of medicine for many days to be exposed to the same amount of steroids in a 5-day course of prednisone, 40 mg/day.

<table>
<thead>
<tr>
<th>ICS Medication/Brand Name* (cost)</th>
<th>Typical Dose</th>
<th># of days to equal amount in 5 days of prednisone, 40 mg/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>fluticasone &amp; salmeterol ($41)</td>
<td>250/50 BID</td>
<td>400</td>
</tr>
<tr>
<td>Advair® ($324)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advair® ($262)</td>
<td>100/50 BID</td>
<td>1000</td>
</tr>
<tr>
<td>budesonide</td>
<td>0.25 mg BID</td>
<td>400</td>
</tr>
<tr>
<td>PULMICORT™ ($268-492)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fluticasone propionate ($15-33)</td>
<td>200 micrograms BID</td>
<td>500</td>
</tr>
<tr>
<td>Azmacort®</td>
<td></td>
<td></td>
</tr>
<tr>
<td>triamcinolone acetonide</td>
<td>88 micrograms BID</td>
<td>1136</td>
</tr>
<tr>
<td>FLOVENT® ($156-161)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Whereas oral prednisone is almost 100% bioavailable, only 1% to 6% of the ICS medications listed above are bioavailable

*Product information is for educational purposes only. No actual or implied endorsement or promotion of any specific product(s) is made or intended by the University of Pittsburgh School of Medicine, The Children’s Hospital of Pittsburgh of UPMC, authors, editors, producers and sponsors of this material.

Cost information sources: www.GoodRx.com, select pharmacy websites such as Rite Aid, CVS, and Walgreens

Parents and patients may feel more comfortable if they learn that ICS medications are targeted directly to the lungs and less likely to be absorbed by the body than systemic steroids.

A.J.’s mother asks you about the Influenza vaccine. As a pediatrician, you are aware that encouraging flu vaccination is a key quality improvement practice in asthma care as well as a key public health promotion practice.

Question 6: What are the most current recommendations for Influenza vaccine?
Question 6: What are the most current recommendations for Influenza vaccine?

The single best way to prevent influenza is to get a flu vaccine each fall.

The American Academy of Pediatrics has updated its recommendations for the prevention and treatment of influenza for 2016-2017 year. The policy statement is available at [http://dx.doi.org/10.1542/peds.2016-2527](http://dx.doi.org/10.1542/peds.2016-2527)

All children 6 months and above should receive inactivated influenza vaccine (IIV)

Quadrivalent live attenuated influenza vaccine (LAIV4) should not be used in any setting during the 2016-2017 influenza season.

Data collected by researchers in Pittsburgh area helped in demonstrating that the LAIV4 is ineffective in protecting children from contracting the influenza virus. This information was drawn from a study of 150 children who received the annual flu vaccine at Children's Hospital of Pittsburgh of UPMC and the Shadyside and Lawrenceville Family Medicine practice.

Click on the link below to see Pittsburgh Post-Gazette news clip:

[Pittsburgh research prompts decision to suspend use of the nasal flu vaccine](http://dx.doi.org/10.1542/peds.2016-2527)

Flu vaccine Effectiveness Network documented poor vaccine effectiveness of LAIV4 during each of the past 3 influenza seasons especially against 2009 influenza A (H1N1) and pandemic (H1N1pdm09) viruses. The vaccine efficacy for IIV was 63% as against 3% of LAIV4 for children 2 through 17 years of age.

The "flu shot" - inactivated influenza vaccine.

- contains killed virus
- given by intramuscular injection.
- approved for use in children 6 months and older.

Annual immunization with either trivalent or quadrivalent inactivated influenza vaccine (no preference) is recommended.

Children 6 months through 8 years receiving the vaccine for the first time should receive a second dose at least after 4 weeks of the first dose.
These children need only one dose if they have received at least 2 doses of any trivalent or quadrivalent vaccine (IIV or LAIV) even if not in the same or consecutive seasons. This is also true if they have received the LAIV4. Despite its poor vaccine effectiveness, it is believed that LAIV4 was still expected to have primed an individual’s immune system.

If you are working in one of Children’s Hospital of Pittsburgh’s Primary Care Centers, for the 2016-2017 flu season we are using:

**Injectable Fluzone quadrivalent vaccine** – approved for children 6 months and over.

Prefilled single dose syringe 0.25 ml for children 6 through 35 months

Prefilled single dose syringe 0.5ml for persons 36 months and older children

**Injectable Fluarix quadrivalent inactivated influenza vaccines (IIV4)** - Prefilled single dose syringe 0.5ml for persons 36 months and older children

If you are working elsewhere, please check with your practice setting.

**Children 9 years and older need only one dose** regardless of whether they have previously received any prior doses of the vaccine.

The AAP recommends that special outreach efforts be made to give seasonal influenza vaccine to the following groups:

- All children 6 months of age and older, both healthy and with conditions that increase the risk of complications from influenza
- Household contacts and out-of-home care providers of:
  - Children with high-risk conditions
  - Healthy children younger than 5 years of age
  - Infants younger than 6 months of age
- Health care personnel
- Pregnant women

Parents should be reassured that the protective immunity persists throughout the influenza season even if the disease has more than one peak. Prompt initiation and continued immunization throughout the entire season are critical components of effective influenza immunization strategy.

**Question 7: What are contraindications to influenza vaccination?**
Question 7: What are contraindications to influenza vaccination?

Contraindications to influenza vaccine (either form):

- Reactions to egg: symptoms such as angioedema, respiratory distress, lightheadedness, or recurrent emesis OR who required epinephrine or another emergency medical intervention: they are more likely to have a serious systemic or anaphylactic reaction upon re-exposure to egg proteins.

Before these individuals receive the vaccine, they should be referred to a physician who specializes in the management of allergic conditions (i.e. pediatric allergist) for further risk assessment.

People with egg allergy who report only hives after egg exposure should receive the influenza vaccine with several additional safety measures below: (http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6132a3.htm#fig2)

- ✔ Vaccine should be administered by a health-care provider familiar with the potential manifestations of egg allergy
- ✔ Vaccine recipients should be observed for at least 30 minutes for signs of a reaction after administering each dose

- Severe reaction to an influenza vaccination in the past
- History of Guillain-Barré syndrome (GBS) within 6 weeks of getting an influenza vaccine previously
- Age less than 6 months
- People who have a moderate or severe illness with a fever should wait to be vaccinated until their symptoms lessen.

Question 8: What are common influenza vaccine side effects?
Question 8: What are common influenza vaccine side effects?

Potential side effects: Injection (IIV): Minor side effects include:

- Soreness, redness, or swelling at the injection site
- Fever (low grade), less commonly drowsiness, irritability, headache and arthralgia
- Note: The viruses in the (IIV) are killed (inactivated), so one cannot get the flu from a flu shot.

Question 9: Is there any evidence to support concern about thimerosal in influenza vaccine?
Question 9: Is there any evidence to support concern about thimerosal in influenza vaccine?

The U.S. Court of Federal Claims ruled in March 2010 that routine childhood immunizations are not linked to autism. Specifically, the court ruled that there was no connection between thimerosal-containing vaccines and autism.

Some multi-dose IIV formulations contain a trace amount of thimerosal but single-dose IIV is thimerosal-free.

Note: Throughout the influenza season, healthcare providers and clinicians should check www.flu.gov or http://www.cdc.gov/flu/professionals/vaccination/index.htm for flu information, updates, and access to free materials to assist with educating staff and patients about the impact of influenza and the benefits of vaccination.
Case 2

Allison is a 14 year-old patient new to your practice. She reports symptoms of asthma since early childhood and feels that she has been fairly stable in the last year. She has about 3-4 ER visits per year and her last admission was 2 years ago. She has never been in the PICU. Her home medications include Flovent® 44 mcg 2 puffs BID and albuterol 2 puffs as needed. She reports being compliant with her Flovent®. She also uses a spacer whenever she uses her inhaler.

Allison reports using albuterol approximately 2-3 times per week for chest tightness. Her mother reports hearing her coughing at night at least 2 times per week and feels her sleep is disrupted. Allison generally avoids participating in sports and avoids dogs/cats because these triggers increase her asthma symptoms.

Question 10. How would you classify Allison’s asthma severity?
Question 10. How would you classify Allison’s asthma severity?

Open and view Medscape Education’s presentation of the NHLBI Expert Panel Report 3 Guidelines: **Classifying Asthma Severity and Initiating Treatment in Children >12 Years of Age**  
Source: National Heart, Lung, and Blood Institute; National Institutes of Health; U.S. Department of Health and Human Services

- Allison’s asthma is classified as **moderate persistent**
- Her daytime symptoms are more consistent with mild intermittent but the presence of frequent nighttime symptoms is enough to raise the classification
- Patients should be assigned to the most severe category in which any feature is present.

Question 11. Is Allison’s current control adequate? How do you define control of asthma?
Question 11. Is Allison’s current control adequate? How do you define control of asthma?

Her control is inadequate due to her frequent daytime and nighttime symptoms and her avoidance of sports.

Goals of therapy are:
- Minimal or no chronic symptoms day or night
- Minimal or no exacerbations
- No limitations on activities; no school or work missed, no excuses for gym
- PEF > 80% of personal best
- Minimal use of inhaled short acting beta$_2$-agonist ($\leq$2 days a week)
- Minimal or no adverse effects from medication

Question 12. What changes would you make to Allison’s therapy?
Question 12. What changes would you make to Allison’s therapy?

The 2007 Expert Panel Report outlines a stepwise approach to managing asthma:

Treatment decisions for initiating long-term control therapy are based on classifying severity (considering both the impairment and risk domains) and selecting a corresponding step for treatment.

Recommendations for managing asthma in children 0–4 and 5–11 years of age are presented separately from recommendations for managing asthma in youths ≥12 years of age and adults

Open and view the following tables presented by MedScape from the National Asthma Education and Prevention Program Information, Publication No. 07-4051. Source: National Heart, Lung, and Blood Institute; National Institutes of Health; U.S. Department of Health and Human Services.

- Stepwise Approach for Managing Asthma in Children 0-4 Years of Age
- Stepwise Approach for Managing Asthma in Children 5-11 Years of Age
- Stepwise Approach for Managing Asthma in Children > 12 Years of Age and Adults

Following the Approach for Managing Asthma in Youths ≥12 years old and Adults, treatment options include:

- Low to medium dose inhaled corticosteroids and long-acting inhaled beta₂-agonist (Preferred treatment):
  Options include:
  - Advair® (combination fluticasone and salmeterol)
  - Fluticasone and salmeterol separately

- Medium dose inhaled corticosteroids alone-- you could increase her FLOVENT® to 110 mcg 2 puffs BID (440 mcg/day)

- Low to medium dose inhaled steroids with leukotriene inhibitor

There has been an issue that fluticasone (Flovent) was not covered by some private insurance companies. It has been recommended that Beclomethasone (QVAR) could be used alternatively.

“Low” dose – 80 - 240 mcg daily
“Medium” dose -.240 to 480 mcg daily
“High” dose - >480 mcg daily

Question 13. Together with the family, you decide that Allison will discontinue FLOVENT® and begin Advair®. How will you monitor Allison’s response to this treatment change? When will you see her back?
Question 13. Together with the family, you decide that Allison will discontinue FLOVENT® and begin Advair®. How will you monitor Allison’s response to this treatment change? When will you see her back?

Dosage of Advair®

ADVAIR DISKUS® is available in 3 strengths (per inhalation):
- ADVAIR DISKUS® 100/50  (100 mcg fluticason propionate; 50 mcg salmeteral)
- ADVAIR DISKUS® 250/50  (250 mcg fluticason propionate; 50 mcg salmeteral)
- ADVAIR DISKUS® 500/50  (500 mcg fluticason propionate; 50 mcg salmeteral)

Patients 5-11 years of age:

For patients aged 5 to 11 years who are symptomatic on an inhaled corticosteroid the dosage is 1 inhalation of ADVAIR DISKUS® 100/50 twice daily, approximately 12 hours apart

Patients 12 years of age and older:

The recommended starting dosages for ADVAIR DISKUS® for patients 12 years of age and older are based upon patients’ current asthma therapy.

In addition:

For patients not currently on inhaled corticosteroids whose disease severity clearly warrants initiation of treatment with 2 maintenance therapies, the recommended starting dosage is ADVAIR DISKUS® 100/50 or 250/50 twice daily. The maximum recommended dosage is ADVAIR DISKUS® 500/50 twice daily. Patients currently on inhaled corticosteroid may need to be started on either 250/50 or 500/50 of Advair®. For all patients, it is desirable to titrate to the lowest effective strength after adequate asthma stability is achieved.

Response

Improvement in asthma control following inhaled administration of ADVAIR DISKUS® may occur within 30 minutes of beginning treatment; however maximum benefit may not be achieved for a week or longer after starting treatment. Individual patients will experience a variable time to onset and degree of symptom relief.

For patients who do not respond adequately to the starting dosage after 2 weeks of therapy, replacing the current strength of ADVAIR DISKUS® with a higher strength may provide additional improvement in asthma control.
Case continued: Follow-up plan

You ask Allison to return to see you in 2-4 weeks. At that visit, you will assess the frequency of Allison’s chest tightness and albuterol use, her nighttime cough, and her ability to participate in sports.

If her symptoms are not significantly improved, you may consider a number of possible next steps including:

- increasing her dose of inhaled corticosteroid
- evaluating her for avoidable environmental triggers
- assessing her medication delivery technique, or
- referring her to an asthma specialist, such as the Children’s Hospital of Pittsburgh Asthma Clinic or other specialty resource near to your practice

Asthma Action Plan

The 2007 Expert Panel advises that an asthma action plan (sample from NY Dept of Health – also available in Spanish) be created for all patients, including patient and family education on daily management of asthma and recognition and management of worsening of asthma.

A written asthma action plan details for the individual patient the daily management (medications and environmental control strategies) and how to recognize and handle worsening asthma.

Click here to see the asthma action plan utilized in the Primary Care Center at Children’s Hospital of Pittsburgh.

It is particularly recommended for patients who have moderate or severe asthma, a history of severe exacerbations, or poorly controlled asthma. The written asthma action plan can be either symptom or peak-flow based; evidence shows similar benefits for each.

See another example of an asthma action plan from the CA Child Health Initiative (http://www.wvasthma.org/Portals/4/2634%20ChildPlan_Eng.pdf)
Take Home Points

1. It is important to provide asthma education (and confirm if have asthma action plan) to families at all visits. Make sure triggers are identified and recognized to promote trigger avoidance and achieve increased control of symptoms.

2. Classify each child’s asthma severity level (intermittent, mild persistent, moderate persistent, severe persistent) to help determine whether controller therapy is warranted or whether a change in dose is necessary. Providers should assess degree of control at each visit.

3. Strongly recommend that all patients including asthmatic patients get the influenza vaccine each season. It is important as a provider to be knowledgeable regarding who is eligible for the flu vaccine and what factors are considered contraindications to the flu vaccine.

4. Be familiar with the stepwise approach for managing asthma since these guidelines help ensure that a child is on the appropriate medications to achieve better asthma control.
RESOURCES FOR PHYSICIANS AND PARENTS:

Allergy and Asthma network Mother of Asthmatics (AANMA)  
http://www.aanma.org/

Asthma and Allergy Foundation of America (AAFA)  
www.aafa.org

Asthma Guidelines: the complete NHLBI/NAEPP Guidelines  
https://www.nhlbi.nih.gov/health-pro/guidelines/current/asthma-guidelines/

Centers for Disease Control and Prevention website on Influenza  
www.cdc.gov/flu

Immunization Action Coalition  
www.immunize.org

Lung Line National Jewish Medical and Research Center  
https://www.nationaljewish.org/patients-visitors/ask-a-question

Summary of Recommendations for Childhood and Adolescent Immunization, Revised September 2006  

Department of Health New York Asthma Action Plan  
http://www.health.state.ny.us/diseases/asthma/pdf/4850.pdf

Other Web Resources

CDC. Preventing seasonal flu with vaccination.

Immunization Action Coalition: First do no harm.
REFERENCES

http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.pdf

AAP Policy Statement--Recommendations for Prevention and Control of Influenza in Children, 2012-2013 is available at the following site:
http://pediatrics.aappublications.org/content/early/2012/09/04/peds.2012-2308.full.pdf+html


Prevention and Control of Influenza with Vaccines: Recommendations of the Advisory Committee on Immunization Practices (ACIP.) MMWR. August 17, 2012 / 61(32);613-618. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6132a3.htm#fig2

The latest information on influenza is available at: