# CDC Science Ambassador Workshop
## 2014 Lesson Plan

# Keep Calm and Get Vaccinated

### Developed by


**Katherine E. Freshwater, MEd, NBCT**
Western Pines Middle School
West Palm Beach, FL

**Wanda S. Williamson, MEd**
Clemmons Middle School
Winston-Salem, NC

**Jenny M. Yergin, BS**
Christ the King Catholic School
Indianapolis, IN



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CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

## Acknowledgements

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**Justin O'Hagan, PhD**
Mathematical and Computer Modeler
Division of Healthcare Quality Promotion

**Cristina Da Silva Carias, PhD, MSc**
Economist
Division Of Preparedness And Emerging Infections

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## Contact Information

Please send questions and comments to scienceambassador@cdc.gov.

## Contents

# Keep Calm and Get Vaccinated

## Summary

Two main types of influenza (flu) virus exist, type A and type B, which infect humans. The influenza A and B viruses that routinely spread among persons are responsible for seasonal flu epidemics each year. Influenza A viruses can be broken down into subtypes, depending on the genes that make up the surface proteins. During a flu season, different influenza types (A or B), and influenza A subtypes (e.g., H1N1or H3N2) circulate and cause illness. Influenza viruses change constantly, which can lead to persons having little or no immunity against a circulating virus. During certain years, the spread of these viruses causes outbreaks of a global magnitude, known as pandemics.

In this lesson, students will learn about flu virus, vaccination, and the possible effects of a flu pandemic. Through an interactive PowerPoint and Webquest© (San Diego State University, San Diego, California), students learn about how the flu virus can change, spread, and, in certain cases, result in a pandemic. Students will also learn about flu surveillance (Figure 1). They will collect data about flu transmission and analyze data from two flu pandemics. As an extension, students can create a public service announcement (PSA) for the seasonal flu vaccination.

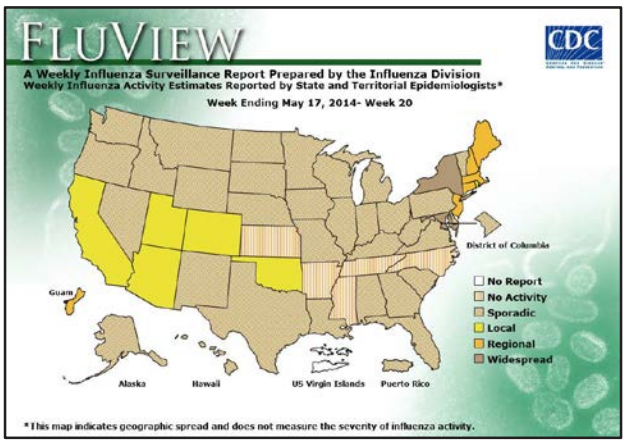


Figure 1: The Epidemiology and Prevention Branch in the Influenza Division at CDC collects, compiles, and analyzes information about influenza activity year round in the United States and produces FluView, a weekly influenza surveillance report. The U.S. influenza surveillance system is a collaborative effort between CDC and its partners in state, local, and territorial health departments, public health and clinical laboratories, vital statistics offices, health care providers, clinics, and emergency departments. Information in 5 categories is collected from 8 different data sources that allow CDC to find out when and where influenza activity is occurring, track influenza-related illness, determine what influenza viruses are circulating, detect changes in influenza viruses, and measure the effect influenza is having on hospitalizations and deaths in the United States. This sample figure is from the week ending May 17, 2014. Source: http://www.cdc.gov/flu/weekly/FluViewInteractive.htm

The target grade level of this lesson is grades 6–8. Students should have basic knowledge of cells, tissues, and organ systems. Students should also have a basic understanding of the differences between bacterial and viral structure and function.

## Learning Outcomes

After completing this lesson, students should be able to

- describe how to collect data regarding influenza using public health surveillance systems;
- discuss how mathematical modeling (e.g., pandemic severity index, pandemic severity assessment framework) can be used to explain the cause (e.g., viral severity, viral transmissibility) and effect relationships (e.g., pandemic classification, pandemic response) that influence influenza pandemics;
- use a targeted health promotion and communication approach to design a public service announcement (Extension Activity).

## Total Duration

This lesson can be conducted as one-, 90-minute lesson, or divided into two-, 45-minute lessons.

## Procedures

### Day 1: Disease Transmission . . . What's the Big Deal? (45 Minutes)

#### Preparation

Before Day 1,

- have students complete Worksheet 1: Look Around! What Do You See? (Appendix 2) for homework, and
- prepare a PowerPoint presentation by using Background Materials: Disease Transmission . . . What's the Big Deal? PowerPoint (Appendix 1).

#### Materials

- Background Materials: Disease Transmission . . . What's the Big Deal? PowerPoint (Appendix 1)
  Description: Provides a detailed outline and key content that can be copied and pasted into a PowerPoint slide set. This PowerPoint is used to introduce students to this lesson and to help students complete Worksheet 2.
- Worksheet 1: Look Around! What Do You See? (Appendix 2), 1 copy per student
- Worksheet 2: Disease Transmission . . . What's the Big Deal? PowerPoint worksheet (Appendix 3A), 1 copy per student
- Worksheet 3: Two Deadly Pandemics (Appendix 4A), 1 copy per student

#### Online Resources

- Video 1: *Contagion* Movie Trailer
  Website: https://youtu.be/4sYSyuuLk5g
  Description: This clip shows a fictional pandemic caused by an emerging disease. This video is designed to be incorporated into the Disease Transmission . . . What's the Big Deal? PowerPoint slide set.
- Video 2: 10 Deadliest Diseases
  Website: https://www.youtube.com/watch?v=PyorDyoabhs
  Description: This video ranks the top 10 deadliest infectious diseases. This video is also intended to be incorporated into the Disease Transmission . . . What's the Big Deal? PowerPoint.

#### Activity

1. Ask students to share their observations of human behavior from their homework assignment Worksheet 1: Look Around! What Do You See? (Appendix 2). While students are sharing observations, make a list of their answers. Prompt students to discuss the effects that these behaviors can have on their health. Guide them toward a realization that some diseases can be spread by multiple means, such as droplets and contact. Prevention requires attention to these multiple modes of transmission.
2. Ask students to complete Worksheet 2: Disease Transmission . . . What's the Big Deal? (Appendix 3A) while you present your PowerPoint presentation on disease transmission (see Appendix 1). Encourage questions and open discussion.
3. Instruct students to work in pairs or get into their laboratory groups and work together to complete Worksheet 3: Two Deadly Pandemics (Appendix 4A).
4. Review Worksheet 3 as a class. Assign the bonus section as homework (optional).

## Day 2: Influenza Webquest (45 minutes)

### Preparation

Before Day 2,

- schedule computer laboratory or reserve student laptop cart, and
- make copies of Worksheet 4: Influenza Webquest (Appendix 5A), 1 copy per student.

### Materials

- Worksheet 4: Influenza Webquest (Appendix 5A), 1 per student
- Computers and Internet access, 1 per student

### Online Resources

- FLU.gov
  Website: http://www.flu.gov
  Description: The website provides information regarding flu symptoms and treatment, prevention and vaccination, risk, and preparedness and planning. It is a federal government website managed by the U.S. Department of Health & Human Services.

### Activity

1. Instruct students to complete Worksheet 4: Influenza Webquest (Appendix 5A) while working in groups. Guide students in locating web address for the first group of questions. Student should access the website and find the answers to the group of questions in that category.
2. If time permits, students can complete Extension: Public Service Announcement (120 minutes) or Assessment: Keep Calm and Get Vaccinated Quiz (15 minutes).

## Extension

### Extension: Public Service Announcement (PSA) Project (120 minutes)

#### Preparation

- Schedule computer laboratory or reserve student laptop cart.

#### Materials

- Extension: Public Service Announcement Project (Appendix 7), 1 copy per student.
  Description: Worksheet provides instructions for the project.
- Phones or video equipment to shoot PSAs
- Computers and Internet access, 1 device per every 2–3 students

#### Online Resources

- CDC Public Service Announcements for Influenza
  URL: http://www.cdc.gov/flu/freeresources/media-psa.htm
  Description: These PSAs were developed as outreach materials. Students will review these PSAs prior to making their own.
- FLU.gov Videos on Influenza
  URL: http://www.flu.gov/video/
  Description: This website provides videos that provide information about the flu. Students will review these video prior to making their own.
- Center for Digital Education, How to Create the Perfect Public Service Announcement
  URL: http://www.centerdigitaled.com/artsandhumanities/How-to-Create-the-Perfect-Public-Service-Announcement.html
  Description: This website provides detailed instructions for creating a PSA.
- Ad Council
  URL: http://www.adcouncil.org/
  Description: This website provides samples of PSAs.

#### Activity

1. Have students review CDC's PSAs and FLU.gov's videos on Influenza.
2. Explain that a PSA is used to educate the public about a specific topic with the goal of getting the desired audience to take a specific action. Emphasize the importance of having accurate and current information. Note that including data and statistics may be beneficial, depending on the audience.
3. Decide who the primary audience is with your students; certain groups might want to target their parents, although others might want to target their peers. Explain to students that their PSA needs to grab the audience's attention. However, caution students against using scare tactics in their PSA.
4. Instruct them in making a video including that writing a script is a necessary part of the process. The goal is to have a 30-second PSA; approximately 5–7 statements will work best.
5. Describe what a storyboard (a graphic outline) is to your students, and that this will go along with the script for the video. This will give you a complete guide for the PSA.
6. Videotape the PSA using phones or available video equipment.

## Conclusion

Students learn how to use data, tables, and figures to identify patterns in disease transmission and spread. Using two influenza pandemics as examples, students learn how to analyze public health surveillance data to provide an evidence-based explanation about the causes that can lead to pandemic situation. By creating a public service announcement for the seasonal flu vaccination, students recognize the social, economic, ethical, environmental, cultural, and political factors that may influence decision-making.

## Assessment

- Assessment: Keep Calm and Get Vaccinated Quiz (Appendix 6A)
  Learning Outcome(s) Assessed:
  - describe how to collect data regarding influenza using public health surveillance systems;
  - discuss how mathematical modeling (e.g., pandemic severity index, pandemic severity assessment framework) can be used to explain the cause (e.g., viral severity, viral transmissibility) and effect relationships (e.g., pandemic classification, pandemic response) that influence influenza pandemics;
  - use a targeted health promotion and communication approach to design a public service announcement (Extension Activity).

  Description: The assessment incorporates learning outcomes 2–5. Ten short-answer questions are included. The quiz should take approximately 15 minutes to complete.

- Extension: Public Service Announcement Project (Appendix 7)
  Learning Outcome(s) Assessed:
  - use a targeted health promotion and communication approach to design a public service announcement.

  Description: The goal of a PSA is to create awareness, educate, demonstrate the importance of a problem, and persuade the audience to take the desired action. Students are asked to consider elements that include ways to prevent transmission, why vaccination is important, the likely effect of vaccination, the likely effect of no vaccination, as well as the ideas given to you below.

## Educational Standards

In this lesson, the following CDC Epidemiology and Public Health Science (EPHS) Core Competencies for High School Students[1], Next Generation Science Standards* (NGSS) Science & Engineering Practices[2], and NGSS Cross-cutting Concepts[3] are addressed:

**HS-EPHS1-1.** Describe how epidemiologic thinking is used to provide an evidence-based explanation about the causes and correlations of health and disease.

| NGSS Key Science & Engineering Practice[2] |
|---|
| **Constructing Explanations and Designing Solutions**<br>Apply scientific ideas, principles, and/ or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. |
| NGSS Key Crosscutting Concept[3] |
| **Cause and Effect**<br>Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. |

**HS-EPHS 2-1:** Describe how to collect reliable data regarding priority health-related phenomena using public health surveillance systems.

| NGSS Key Science & Engineering Practice[2] |
|---|
| **Planning & Carrying out Investigations**<br>Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. |
| NGSS Key Crosscutting Concept[3] |
| **Systems and System Models**<br>Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. |

**HS-EPHS4-1.** Describe a model illustrating how scientific, social, economic, environmental, cultural, and political systems influence intervention performance patterns

| NGSS Key Science & Engineering Practice[2] |
|---|
| **Developing and Using Models**<br>Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system |
| NGSS Key Crosscutting Concept[3] |
| **Patterns**<br>Patterns of performance of designed systems can be analyzed and interpreted to reengineer and improve the system. |

*Next Generation Science Standards is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards was involved in the production of, and does not endorse, this product.

[1] Centers for Disease Control and Prevention (CDC). Science Ambassador Workshop—Epidemiology and Public Health Science: Core Competencies for high school students. Atlanta, GA: US Department of Health and Human Services, CDC; 2015. Not currently available for public use.

[2] NGSS Lead States. Next Generation Science Standards: For States, By States (Appendix F–Science and Engineering Practices). Achieve, Inc. on behalf of the twenty-six states and partners that collaborated on the NGSS. 2013. Available at: http://www.nextgenscience.org/sites/ngss/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FINAL%20060513.pdf

[3] NGSS Lead States. Next Generation Science Standards: For States, By States (Appendix G–Crosscutting Concepts). Achieve, Inc. on behalf of the twenty-six states and partners that collaborated on the NGSS. 2013. Available at: http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf.

## Appendices: Supplementary Documents

## Appendix 1: Background Materials: Disease Transmission . . . What's the Big Deal? PowerPoint

# Disease Transmission . . . What's the Big Deal? PowerPoint

Directions: Design a PowerPoint or similar presentation by using the following outline. Resources are available as endnotes.

Part 1: Introduction to Disease Transmission

1. Video 1: *Contagion* Movie Trailer, Available at: https://youtu.be/4sYSyuuLk5g
   Did you know? In the initial production stages of *Contagion,* some cast and crew members visited CDC for preliminary research. CDC′s real life disease detectives hope the movie spurs an increase of interest in the EIS program, as well as public health in general. Dr. Rima Khabbaz comments, "I think it is great if they make a good movie that portrays the work we do at CDC and the passion that CDC staff bring to preventing and controlling disease and improving health." Since 1951, over 3,000 EIS officers have responded to requests for epidemiologic assistance within the United States and throughout the world. Yet, CDC′s EIS program is only one part of a complex infrastructure designed to protect people from emerging disease threats at home and around the globe. For more information, see: http://www.cdc.gov/24-7/SavingLives/disease_detectives/contagion_hollywood.html.

Part 2: Terminology

2. Cluster versus Epidemic[1]
   - Cluster: an aggregation of cases of a disease, injury, or other health condition grouped in place and time that are suspected to be greater than the number expected, although the expected number might be unknown.
   - Epidemic or outbreak: the occurrence of more cases of disease, injury, or other health condition than expected in a given area or among a specific group of persons during a specific time period. Outbreaks are typically more limited than epidemics.

3. Examples of Epidemics
   - Salmonella[2]
   - Measles[3]
   - Meningococcal infections[4]
   - Dengue fever[5]

4. Knowledge Check
   - Name 3 diseases that have resulted in epidemics throughout history.
   - Define the word *epidemic*.
   - List 3 ways that diseases can spread from one person to another.

5. Pandemic versus Epidemic[1]
   - Epidemic or outbreak: the occurrence of more cases of disease, injury, or other health condition than expected in a given area or among a specific group of persons during a specific time period. Outbreaks are typically more limited than epidemics.
   - Pandemic: an epidemic occurring over a widespread area (multiple countries or continents) and usually affecting a substantial proportion of the population.

6. Examples of Pandemics
   - Human immunodeficiency virus and acquired immune deficiency syndrome (HIV/AIDS)[6]
   - Bubonic Plague[7]
   - Cholera[8]
   - Influenza[9]
     (a) 1918 H1N1 *(*Spanish flu, so called because it was first identified in Spain, although the virus might have originated elsewhere)
     (b) 1957 H2N2; (c) 1968 H3N2; and
     (d) 2009 A/H1N1 (in the initial stages of the pandemic, it was sometimes referred to as swine flu).
   - Ebola[10]
   - Smallpox[11]

Part 3. Characterizations of an epidemic

7. Video 2: 10 Deadliest Diseases (https://www.youtube.com/watch?v=PyorDyoabhs).
   - Discuss reasons as to why these diseases are so deadly.
   - Discuss which 1 of the 10 deadliest diseases is the biggest threat to students living in the United States. (Students should be able to name influenza.)

8. Disease Transmission[1]
   - Direct transmission: immediate transfer of an agent from a reservoir to a host by direct contact (e.g., blood, skin-to-skin contact, kissing or sexual intercourse, or direct contact with soil or vegetation harboring infectious agents) or direct spray of droplets onto susceptible mucous membranes (droplet spread) through sneezing, coughing, speaking, or singing.
   - Indirect transmission: transfer of an agent from a reservoir to a host either by being suspended in air particles (airborne), carried by an inanimate object (vehicleborne), or carried by an animate intermediary (vectorborne).

9. Speed of Transmission
   - Basic reproduction number $R_0$ (pronounced R nought): average number of infectious cases produced by an average infectious person in an entirely susceptible population in the absence of interventions (e.g., no immunity, no vaccination, and no quarantine).
   - In other words, $R_0$ tells us how many persons are likely to be infected when someone is sick, if no one has immunity to the disease.
   - Example: measles has an $R_0$ of 15. This means that if no vaccination existed and no one had ever had measles before, if you were to be infected with measles, you would likely infect 15 other persons.

10. Severity of Infection[12]
    - Measured by case-fatality ratio (number of deaths/number of persons with the illness).

11. Pandemic Severity Index (PSI)[12]
    - In 2007, PSI was introduced as a tool to define the severity of a future influenza outbreak. To facilitate risk communication, the index had five categories similar to the hurricane severity scale, ranging in severity from category 1 (moderate severity) to category 5 (most severe) and was based on a hypothetical 30% attack rate and ranges of case-fatality ratios associated with a particular novel influenza virus.
    - Note: Experiences from the 2009 H1N1 pandemic identified that early data on the less severe but highly transmissible characteristics of the virus in the community were limited. Consequently, the Pandemic Severity Index, which based severity solely on mortality, tended to overestimate severity because more severe cases are likely to be reported at the initiation of a pandemic

12. Pandemic Severity Assessment Framework (PSAF)[12]
    - The PSAF incorporates both transmissibility and severity. It replaced PSI in 2014.
    - The results of PSAF assessments help national, state, and local decision-makers determine whether to implement additional community mitigation measures, including those that can be very disruptive and might have a more serious economic and societal impact on individual persons and communities (e.g., school dismissals or quarantine of contacts).

Part 4. What we can do about an epidemic?

10. Preventing Transmission[1]
    - Precautions: Take everyday precautions, like washing your hands, to protect your health.
    - Vaccination: administration of a vaccine to promote development of specific antibodies that protect against infection (i.e., immunity)
    - Herd immunity: the resistance to an infectious agent of an entire group or community (and, in particular, protection of susceptible persons) as a result of a substantial proportion of the population being immune to the agent. Herd immunity is based on having a substantial number of immune persons, thereby reducing the likelihood that an infected person will come in contact with a susceptible one among human populations
    - Herd Immunity threshold: the fraction of a population that is needed to be immune to avoid widespread outbreaks, or, in the case of influenza, a pandemic.

11. Eradication vs. Elimination[1]
    - Explain to students that through a combination of science and public health, the possibility exists to eliminate and eradicate diseases.
    - Elimination of disease occurs when infection caused by a specific agent in a large – but not global – area is reduced to zero (e.g., polio in the U.S.).
    - Eradication of disease is global (e.g., smallpox worldwide).

Resources:


[1] Centers for Disease Control and Prevention [CDC]. *Principles of Epidemiology*, 3rd ed. Atlanta, GA: US Department of Health and Human Services, CDC, 2012.

[2] CDC. Salmonella. Available at: http://www.cdc.gov/salmonella/

[3] CDC. Measles. Available at: http://www.cdc.gov/measles/index.html

[3] CDC. Meningococcal. Available at: http://www.cdc.gov/meningococcal/index.html

[4] CDC. Dengue Fever. Available at: http://www.cdc.gov/Dengue/

[6] CDC. HIV. Available at: http://www.cdc.gov/hiv/

[7] CDC. Plague. Available at: http://www.cdc.gov/plague/history/

[8] CDC. Cholera. Available at: http://www.cdc.gov/cholera/index.html

[9] CDC. Flu. Available at: http://www.cdc.gov/flu/index.htm

[10] CDC. Ebola. Available at: http://www.cdc.gov/vhf/ebola/

[11] CDC. Smallpox. Available at: http://emergency.cdc.gov/agent/smallpox/overview/disease-facts.asp

[12] Reed C, Biggerstaff M, Finelli L, et al. Novel framework for assessing epidemiologic effects of influenza epidemics and pandemics. Emerg Infect Dis 2013;19:85–91. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6306a1.htm

## Appendix 2: Worksheet 1: Look Around; What Do You See?

# Look Around,
# What do you see?

Name: _____ Date: _____

Directions: Observe a group of persons. Count how many times anyone in that group completes one of the actions listed in the following table. Use tally marks to keep score. Make sure to guess their approximate age!

| **Behavior** | **Age (yrs) ≤6** | **Age (yrs) >6 but ≤14** | **Age (yrs) >14 but ≤30** | **Age (yrs) >30 but ≤60** |
|---|---|---|---|---|
| Eye rubbing | | | | |
| Mouth touching | | | | |
| Nose touching | | | | |
| Uncovered sneezing | | | | |
| Covered sneezing | | | | |
| Uncovered coughing | | | | |
| Covered coughing | | | | |
| Hand washing | | | | |
| Hand sanitizing | | | | |
| Object touching | | | | |
| Sharing drinks | | | | |
| Sharing food | | | | |
| Touching others | | | | |
| *Other | | | | |

*List and tally any other activities that you observe that might have a connection to spreading or stopping germs.

Discussion: On the basis of your data and findings, which of the following diseases are more likely to spread and that should be of greater concern to public health officials:

- Diseases that are spread only through contacts with fluids of infectious persons?
- Diseases that are spread through droplets?
- Diseases that are airborne?

Write a paragraph below to explain you answer. Be sure to use your data and findings to support your answer.

## Appendix 3A: Worksheet 2: Disease Transmission . . . What's the Big Deal?

# Disease Transmission . . . What's the Big Deal?

Name: _____ Date: _____

Directions: Complete the handout during the time that we discuss the PowerPoint presentation in class.

1. An epidemic or outbreak is the occurrence of _____cases of disease, injury, or other health condition than expected in a given area or among a specific group of persons during a specific time period. Outbreaks are typically more limited than epidemics.

2. When an epidemic affects multiple countries or multiple continents it has become a _____.

3. List 5 diseases that have resulted in major pandemics in human history.

4. Name 2 strains of influenza that caused pandemics during the last century.

5. List the two ways that diseases can be transmitted. Provide an example of each.

6. What does $R_0$ mean?

8. What is the main different between the Pandemic Severity Index and the Pandemic Severity Index Framework?

9. What is the difference between disease elimination and eradication?

## Appendix 3B: Worksheet 2: Disease Transmission . . . What's the Big Deal? Answer Key

# Disease Transmission . . . What's the Big Deal?

Name: _____ Date: _____

Directions: Complete the handout during the time that we discuss the PowerPoint presentation in class.

1. An epidemic or outbreak is the occurrence of _____cases of disease, injury, or other health condition than expected in a given area or among a specific group of persons during a specific time period. Outbreaks are typically more limited than epidemics. **Answer:** More.

2. When an epidemic affects multiple countries or multiple continents it has become a ____. **Answer:** Pandemic.

3. List 5 diseases that have caused major epidemics in human history. **Answer:** Smallpox, influenza, Bubonic plague, Ebola, and cholera.

4. Name 2 strains of influenza that caused pandemics during the last century. **Answer:** Answer should include two of the following: (a) 1918 H1N1 *(*Spanish flu, so called because it was first identified in Spain, although the virus might have originated elsewhere); (b) 1957 H2N2; (c) 1968 H3N2; and (d) 2009 H1N1 (in the initial stages of the pandemic, it was sometimes referred to as swine flu).

5. List two ways that diseases can be transmitted. Provide an example of each. **Answer:** Direct or Indirect. Examples of direct can include blood, skin-to-skin contact, kissing or sexual intercourse, or direct contact with soil or vegetation harboring infectious agents) or direct spray of droplets onto susceptible mucous membranes (droplet spread) through sneezing, coughing, speaking, or singing. Examples of indirect include transfer of an agent from a reservoir to a host either by being suspended in air particles (airborne), carried by an inanimate object (vehicleborne), or carried by an animate intermediary (vectorborne).

6. What does $R_0$ mean? **Answer:** $R_0$, the basic reproduction number, represents the average number of persons an untreated infected person will infect assuming the other persons have no immunity and that no interventions to present transmission of disease are used.

7. What is the main different between the Pandemic Severity Index and the Pandemic Severity Assessment Framework? **Answer:** PSI accounts for severity, while PSAF incorporates both transmissibility and severity.

8. What is the different between disease elimination and eradication? **Answer:** The elimination of disease occurs when infection caused by a specific agent in a large – but not global – area is reduced to zero (e.g., polio in the U.S.). The eradication of disease is global (e.g., smallpox worldwide).

## Appendix 4A: Worksheet 3: Two Deadly Pandemics

# Two Deadly Pandemics

Name: _____ Date: _____

Directions: Analyze the following 3 graphs and answer the following questions.

**1918 Spanish Flu**
During 1918, approximately 20%–40% of the world's population became ill, and an estimated 50 million persons died, from the Spanish Flu. This accounted for 3-5% of the world's population at the time making this among the most serious flu pandemics in history.

Using Figure 1, answer the following questions regarding the 1918 Spanish flu.

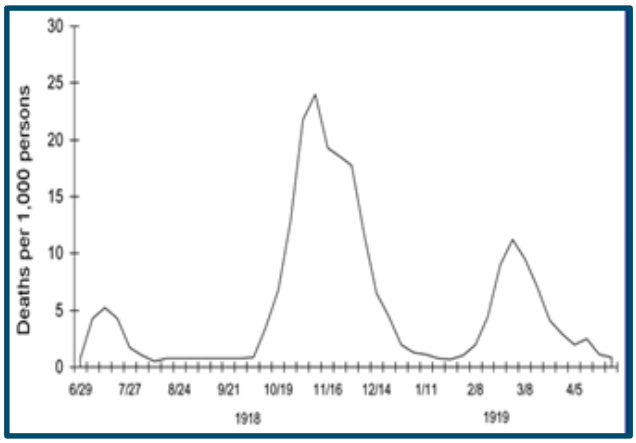


Figure 1. Three pandemic waves: weekly combined influenza and pneumonia mortality, United Kingdom, 1918–1919.(Taubenberger JK, Morens DM. 1918 influenza: the motherof all pandemics. Emerg Infect Dis 2006:12;15–22.)

1. On the basis of the data displayed in Figure 1, when was the highest death rate from Spanish flu?

2. Approximately, how many deaths occurred during the week ending November 16?

3. During which seasons was the pandemic at its worst?

4. What happened to the death rate during July–September 1918?

5. Based on your answers to questions 3 and 4, what could you hypothesize about the seasonality of the flu?

**2009 A/H1N1 Pandemic (initially called "Swine Flu")**

During 2009, a substantially different strain of the H1N1 influenza virus was transmitted to humans. It was thought that some older populations were thought to have some immunity directly or via cross-protection from earlier flus. However, since most humans did not have immunity to the virus, the result was pandemic. In the initial stages of the pandemic, it was sometimes referred to as Swine Flu.

Using Figure 2, answer the following questions regarding the 2009 A/H1N1 Pandemic.

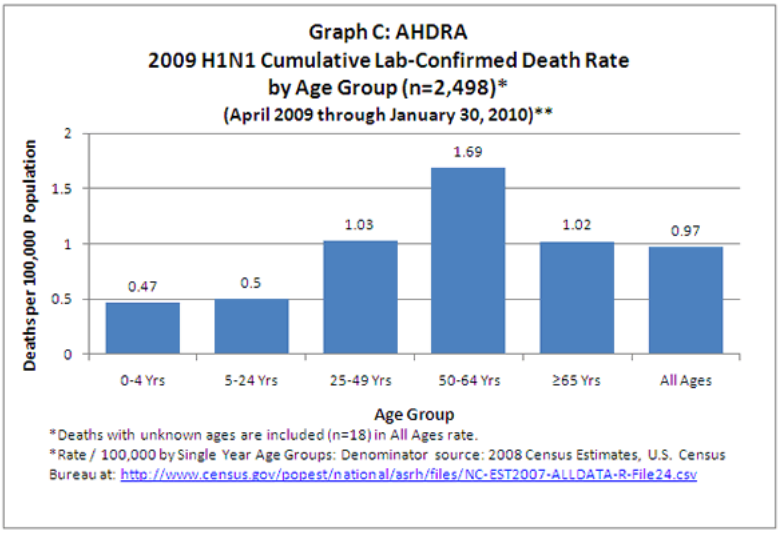


*Figure 2. Deaths per 100,000 persons from H1N1 in 2009 from April 2009–January 30, 2010 reported by the Aggregate Hospitalizations and Deaths Reporting Activity (AHDRA).*

6. On the basis of the data provided, which age group had the greatest number of deaths?

7. How many deaths per 100,000 persons occurred among the group aged 5–24 years?

8. List the greatest risk for death from highest to the lowest risk for death, rank the age groups.

**Severity & Transmissibility**

Two important characteristic of an epidemic or pandemic is the severity of infection and transmissibility of the virus. Severity refers to how pathogenic a virus is (or how likely it is to cause disease and death). Transmissibility refers to the virus' ability to be passed from person-to-person.

In 2007, the Pandemic Severity Index was introduced as a tool to define the severity of a future influenza outbreak. The index had five categories similar to the hurricane severity scale, ranging in severity from category 1 (moderate severity) to category 5 (most severe) and was based on a hypothetical 30% attack rate (percentage of persons with the illness) and ranges of case-fatality ratios (number of deaths/number of persons with the illness) associated with a particular novel influenza virus.

Use Figure 3 to answer the following questions regarding the Pandemic Severity Index:

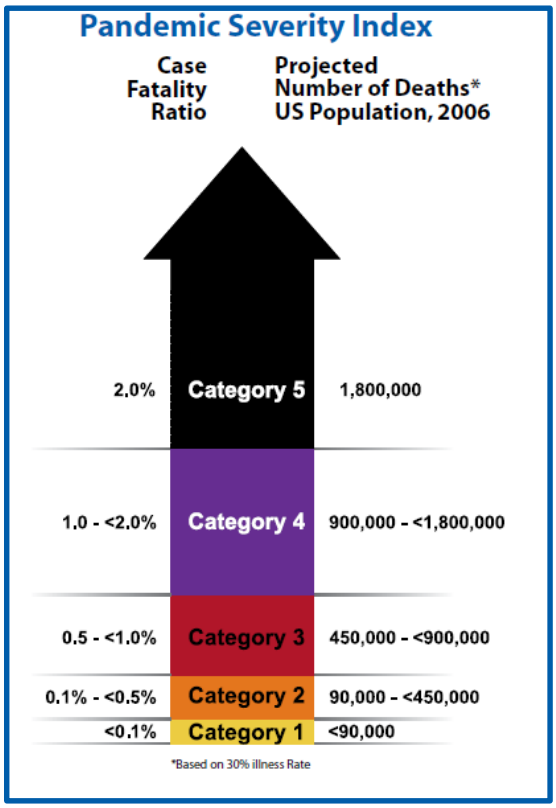


Figure 3. Pandemic severity index with case fatality ratio and projected number of deaths among the U.S. population during 2006 for each severity level. (Source: US Department of Health and Human Services (DHHS) and U.S. Department of Homeland Security (DHS). Guidance on Allocating and Targeting Pandemic Influenza Vaccine. Washington, DC: DHHS and DHS; 2008, p 16.)

9. In the PSI, which category was considered the most severe?

10. CDC has estimated that from April 12, 2009 to April 10, 2010 approximately 60.8 million cases and 12,469 deaths occurred in the United States due to the 2009 A/H1N1 Pandemic.(Source: CDC: http://www.cdc.gov/h1n1flu/estimates_2009_h1n1.htm)

    a. What was the case fatality ratio?

    b. According to PSI, which category would this pandemic be classified as?

    c. How would you describe this situation with respect to transmissibility?

11. H5N1 is a highly pathogenic avian (bird) flu virus that has caused serious outbreaks in domestic poultry in parts of Asia and the Middle East. Highly pathogenic refers to the virus's ability to produce disease. Although H5N1 does not usually infect humans, nearly 650 cases of human cases of H5N1 have been reported from 15 countries since 2003. About 60% of people infected with the virus died from their illness. (Source: FLU.gov)

    a. If 60% of those infected died, calculate the case fatality ratio.

    b. According to PSI, which category would this pandemic be classified as?

    c. How would you describe this situation with respect to transmissibility?

**Pandemic Severity Assessment Framework**

In 2014, a newer assessment called Pandemic Severity Assessment Framework (PSAF) was introduced to take the place of PSI. The PSAF incorporates both transmissibility and severity.

12. Using 2009 A/H1N1 and H5N1 as examples, explain why it is important to account for transmissibility and severity of a virus when classifying pandemics.

## Appendix 4B: Worksheet 3: Two Deadly Pandemics, Answer Key

# Two Deadly Pandemics

Name: _____ Date: _____

Directions: Analyze the following 3 graphs and answer the following questions.

**1918 Spanish Flu**
During 1918, approximately 20%–40% of the world's population became ill, and an estimated 50 million persons died, from the Spanish Flu. This accounted for 3-5% of the world's population at the time making this among the most serious flu pandemics in history.

Using Figure 1, answer the following questions regarding the 1918 Spanish flu.

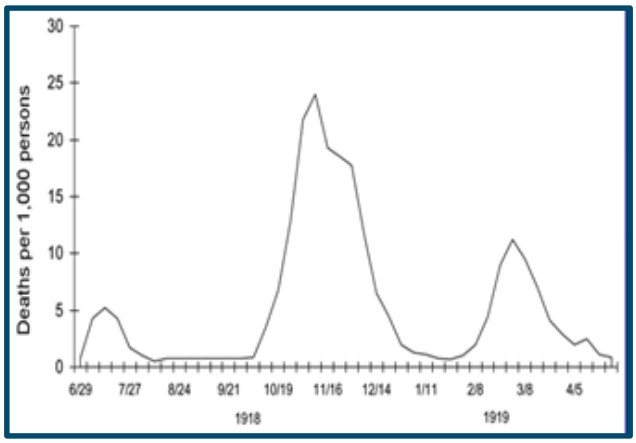


Figure 1. Three pandemic waves: weekly combined influenza and pneumonia mortality, United Kingdom, 1918–1919.(Taubenberger JK, Morens DM. 1918 influenza: the motherof all pandemics. Emerg Infect Dis 2006:12;15–22.)

1. On the basis of the data displayed in Figure 1, when was the highest death rate from Spanish flu?
   **Answer:** During October–November 1918.

2. Approximately, how many deaths occurred during the week ending November 16?
   **Answer:** Approximately 24 deaths/1,000 persons.

3. During which seasons was the pandemic at its worst?
   **Answer:** During late fall/early winter of 1918 (Note that this occurred in the Northern Hemisphere).

4. What happened to the death rate during July–September 1918?
   **Answer:** The death rate was low.

5. Based on your answers to questions 3 and 4, what could you hypothesize about the seasonality of the flu? **Answer:** The flu can be seasonal, occurring at higher rates in the late fall/winter and lower rates during the summer months.

**2009 A/H1N1 Pandemic (initially called "Swine Flu")**

During 2009, a substantially different strain of the H1N1 influenza virus was transmitted to humans. It was thought that some older populations were thought to have some immunity directly or via cross-protection from earlier flus. However, since most humans did not have immunity to the virus, the result was pandemic. In the initial stages of the pandemic, it was sometimes referred to as Swine Flu.

Using Figure 2, answer the following questions regarding the 2009 A/H1N1 Pandemic.

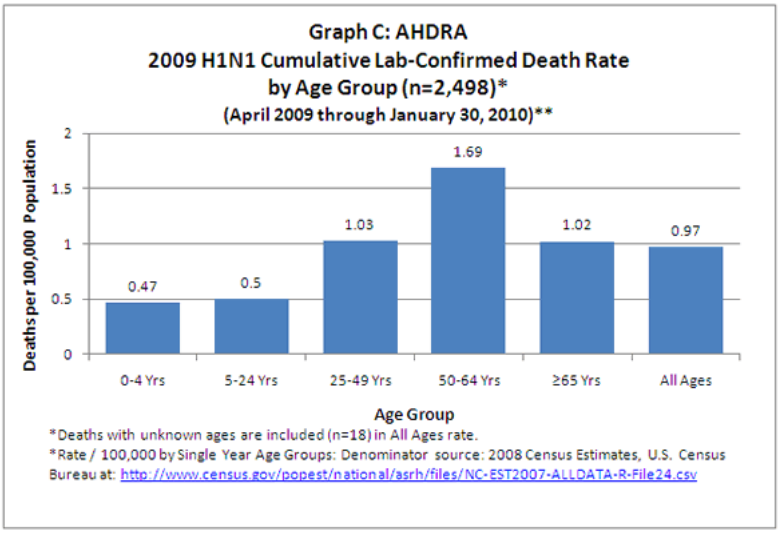


Figure 2. Deaths per 100,000 persons from H1N1 in 2009 from April 2009–January 30, 2010 reported by the Aggregate Hospitalizations and Deaths Reporting Activity (AHDRA).

6. On the basis of the data provided, which age group had the greatest number of deaths?
   **Answer:** Persons aged 50–64 years.

7. How many deaths per 100,000 persons occurred among the group aged 5–24 years?
   **Answer:** 0.5/100,000 persons.

8. List the greatest risk for death from highest to the lowest risk for death, rank the age groups.
   **Answer:** Persons aged 50–64 years; persons aged 25–49 years; persons aged >65 years; persons aged 5–24 years; and persons aged 0–4 years.

**Severity & Transmissibility**

Two important characteristic of an epidemic or pandemic is the severity of infection and transmissibility of the virus. Severity refers to how pathogenic a virus is (or how likely it is to cause disease and death). Transmissibility refers to the virus' ability to be passed from person-to-person.

In 2007, the Pandemic Severity Index was introduced as a tool to define the severity of a future influenza outbreak. The index had five categories similar to the hurricane severity scale, ranging in severity from category 1 (moderate severity) to category 5 (most severe) and was based on a hypothetical 30% attack rate (percentage of persons with the illness) and ranges of case-fatality ratios (number of deaths/number of persons with the illness) associated with a particular novel influenza virus.

Use Figure 3 to answer the following questions regarding the Pandemic Severity Index:

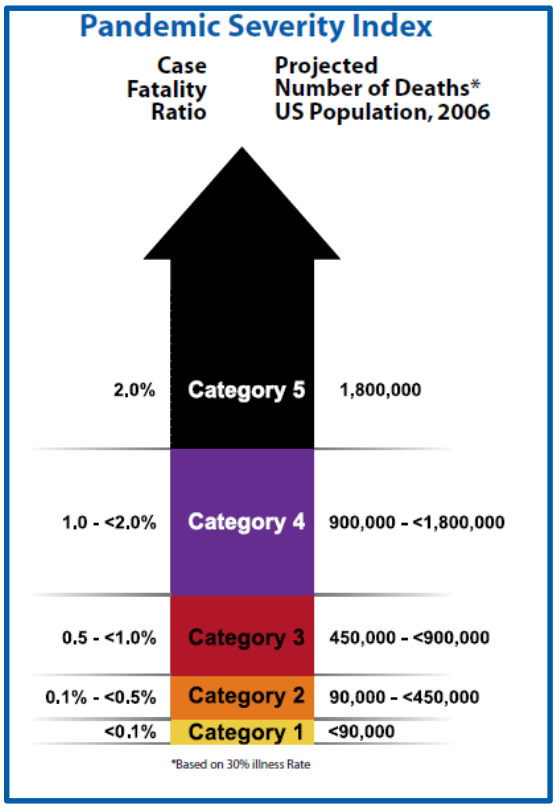


Figure 3. Pandemic severity index with case fatality ratio and projected number of deaths among the U.S. population during 2006 for each severity level. (Source: US Department of Health and Human Services (DHHS) and U.S. Department of Homeland Security (DHS). Guidance on Allocating and Targeting Pandemic Influenza Vaccine. Washington, DC: DHHS and DHS; 2008, p 16.)

9. In the PSI, which category was considered the most severe?
   **Answer:** Category 5.

10. CDC has estimated that from April 12, 2009 to April 10, 2010 approximately 60.8 million cases and 12,469 deaths occurred in the United States due to the 2009 A/H1N1 Pandemic.(Source: CDC: http://www.cdc.gov/h1n1flu/estimates_2009_h1n1.htm)

    a. What was the case fatality ratio?
    **Answer:** 0.02%

    b. According to PSI, which category would this pandemic be classified as?
    **Answer:** Category 1.

    c. How would you describe this situation with respect to transmissibility?
    **Answer:** The risk appears to be high in terms of transmissibility.

11. H5N1 is a highly pathogenic avian (bird) flu virus that has caused serious outbreaks in domestic poultry in parts of Asia and the Middle East. Highly pathogenic refers to the virus's ability to produce disease. Although H5N1 does not usually infect humans, nearly 650 cases of human cases of H5N1 have been reported from 15 countries since 2003. About 60% of people infected with the virus died from their illness. (Source: FLU.gov)

    a. If 60% of those infected died, calculate the case fatality ratio.
    **Answer:** 60.0%

    b. According to PSI, which category would this pandemic be classified as?
    **Answer:** Category 5.

    c. How would you describe this situation with respect to transmissibility?
    **Answer:** The risk is low in terms or transmissibility.

**Pandemic Severity Assessment Framework**

In 2014, a newer assessment called Pandemic Severity Assessment Framework (PSAF) was introduced to take the place of PSI. The PSAF incorporates both transmissibility and severity.

12. Using 2009 A/H1N1 and H5N1 as examples, explain why it is important to account for transmissibility and severity of a virus when classifying pandemics.
    **Answer:** For H5N1, although the case fatality ratio is much greater than the threshold for a Category 5 severity index, the risk is low in terms or transmissibility, and thus, this would not be considered a pandemic. Although not a pandemic, it is important to monitor viruses like this because an increase in transmissibility would vastly increase their pandemic potential.

    For 2009 A/H1N1, although the case fatality suggests that it is a Category 1 severity index, the transmissibility appears to be very high, and thus, this would be considered a pandemic.

## Appendix 5A: Worksheet 4: Influenza Webquest

# Influenza Webquest

Name: _____ Date: _____

Directions: Use **FLU.gov** to answer the following questions.

**Seasonal flu**

1. Seasonal flu is a _____ _____ _____ caused by viruses.
2. Approximately _____ of U.S. residents get the flu each year.
3. Getting a _____ is your best protection against the flu.
4. What groups are likely to experience complications from the seasonal flu?

**How the Flu Virus Changes**

5. Flu viruses constantly _____ and _____.
6. Antigenic drift refers to changes to the flu virus that happen _____.

   This can cause changes to the _____ flu that require us to be vaccinated yearly.
7. Antigenic shift results when _____ different flu strains _____ and infect the same cell. This happens suddenly. This mutation is what allows flu viruses to move from animals to _____.
8. Which type of change can result in a severe flu epidemic or pandemic?

**About Pandemics**

9. A pandemic is a _____ disease outbreak. It is determined by the _____ of countries and continents involved, not how many deaths it causes.

**About Pandemics, con't.**

10. There are many differences between a pandemic flu and the seasonal flu. Create a table to show at least 5 differences.

**Vaccination and Vaccine Safety**

11. The flu vaccination is available by _____ or _____ _____.

12. Getting a flu vaccination is especially important if you, someone you live with, or

    _____at _____ _____ of complications from the flu.

13. If you get the flu vaccination, you are _____% less likely to need treatment for the flu by a healthcare provider.

14. You _____ get the flu from the flu shot or nasal spray.

**2009 A/H1N1 (Swine flu)**

15. The 2009 H1N1 flu virus caused a worldwide _____ during 2009. It is now a human _____ flu virus.
16. Although the H1N1 viruses have continued to circulate since the pandemic, 2013-2014 was the first_____ since 2009 that H1N1 was so predominant in the United States.
17. Getting the _____ is your best protection against 2009 H1N1 flu.

## Appendix 5B: Worksheet 4: Influenza Webquest, Answer Key

# Influenza Webquest

Name: _____ Date: _____

Directions: Use **FLU.gov** to answer the following questions.

**Seasonal flu**

1. Seasonal flu is a **contagious respiratory disease (Answer)** caused by flu viruses.

2. Approximately **5%–20% (Answer)** of U.S. residents get the flu each year.

3. Getting a **vaccination (Answer)** is your best protection against the flu.

4. What groups are likely to experience complications from the seasonal flu?
   **Answer:** Seniors, children, persons with chronic health conditions, and pregnant women.

**How the Flu Virus Changes**

5. Flu viruses constantly **change (Answer)** and **mutate (Answer).**

6. Antigenic drift refers to changes to the flu virus that happen **slowly** over time. This can cause changes to the **seasonal (Answer)** flu that require us to be vaccinated yearly.

7. Antigenic shift results when **multiple (Answer)** different flu strains **combine (Answer)** and infect the same cell. This happens suddenly. This recombination is what allows flu viruses to move from animals to **humans (Answer)**.

8. Which type of change can result in a pandemic?
   **Answer:** Antigenic shift.

**About Pandemics**

9. A pandemic is a **global (Answer)** disease outbreak. It is determined by the **number (Answer)** of countries and continents involved, and not how many deaths it causes.

**About Pandemics, con't.**

10. There are many differences between a pandemic flue and the seasonal flu. Name at least 5 differences.
    **Answer:** Answers may vary, but could include:

| **Pandemic Flu** | **Seasonal Flu** |
|---|---|
| Rarely happens (three times in 20th century) | Happens annually and usually peaks in January or February |
| People have little or no immunity because they have no previous exposure to the virus | Usually some immunity built up from previous exposure |
| Healthy people may be at increased risk for serious complications | Usually only people at high risk, not healthy adults, are at risk of serious complications |
| Health care providers and hospitals may be overwhelmed | Health care providers and hospitals can usually meet public and patient needs |
| Vaccine probably would not be available in the early stages of a pandemic | Vaccine available for annual flu season |
| Effective antivirals may be in limited supply | Adequate supplies of antivirals are usually available |
| Number of deaths could be high (The U.S. death toll during the 1918 pandemic was approximately 675,000) | Seasonal flu-associated deaths in the United States over 30 years ending in 2007 have ranged from about 3,000 per season to about 49,000 per season. |
| Symptoms may be more severe | Symptoms include fever, cough, runny nose, and muscle pain |
| May cause major impact on the general public, such as widespread travel restrictions and school or business closings | Usually causes minor impact on the general public, some schools may close and sick people are encouraged to stay home |
| Potential for severe impact on domestic and world economy | Manageable impact on domestic and world economy |

**Vaccination and Vaccine Safety**

11. The flu vaccination is available by **injection (Answer)** or **nasal spray (Answer)**.

12. Getting a flu vaccination is especially important if you, someone you live with, or **someone for whom you provide care for (Answer)** is at **high risk (Answer)** of complications from the flu.

13. If you get the flu vaccination in a year when it is well matched to the circulating strains, you are **60% (Answer)** less likely to need treatment for the flu by a health care provider.

14. You **cannot** get the flu from the flu shot or nasal spray.

**H1N1 (Swine flu)**

15. The H1N1 flu virus caused a worldwide **pandemic (Answer)** during 2009. It is now a human **seasonal (Answer)** flu virus.

16. Although the H1N1 viruses have continued to circulate since the pandemic, 2013-2014 is the first **flu season (Answer)** since 2009 that H1N1 has been so predominant in the United States.

17. Getting the **flu vaccination (Answer)** is your best protection against H1N1.

## Appendix 6A: Assessment: Keep Calm and Get Vaccinated Quiz

# Keep Calm and Get Vaccinated Quiz

Name: _____ Date: _____

Directions: Answer the following questions.

1. List 3 ways that disease can be spread.

2. What number tells us how many persons that someone is likely to infect if no immunity to the disease exists and no interventions to stop disease transmission are used?

3. Which strain of flu caused a pandemic during 2009?

4. What is your best protection against getting the flu?

5. Which type of change in a flu virus happens slowly?

6. Which type of change in a flu virus causes a pandemic?

7. What percentage of the U.S. population typically gets the flu each year?

8. What is 1 group that is at increased risk for complications from the flu?

9. Can you get the flu from a flu vaccination?

10. Name 2 animals that have been the source of novel influenza strains for humans.

11. Certain persons, such as very young infants, are unable to be vaccinated against the flu. How can vaccinating family members and others around these persons protect them against the flu?

## Appendix 6B: Assessment: Keep Calm and Get Vaccinated Quiz, Answer Key

# Keep Calm and Get Vaccinated Quiz

Name: _____ Date: _____

Directions: Answer the following questions.

1. List 3 ways that disease can be spread.
   **Answer:** Blood, direct contact, droplets, air, sexual contact, and vectors.

2. What number tells us how many persons that someone is likely to infect if no immunity to the disease exists?
   **Answer:** $R_0$.

3. Which strain of flu caused a pandemic in 2009?
   **Answer:** H1N1, which early on was sometimes known as swine flu, now called "2009 H1N1" or "pandemic H1N1".

4. What is your best protection against getting the flu?
   **Answer:** Getting vaccinated.

5. Which type of change in a flu virus happens slowly?
   **Answer:** Antigenic drift.

6. Which type of change in a flu virus can cause a pandemic?
   **Answer:** Antigenic shift.

7. What percentage of the U.S. gets the flu each year?
   **Answer:** 5%–20%.

8. What is 1 group that is at high risk from the flu complications?
   **Answer:** Seniors, children, and persons with chronic health conditions.

9. Can you get the flu from a flu vaccination?
   **Answer:** No.

10. Name 2 animals that have been the source of novel influenza strains for humans.
    **Answer:** Swine or pigs and birds.

11. Certain persons, such as very young infants, are unable to be vaccinated against the flu. How can vaccinating family members and others around these persons protect them against the flu?
    **Answer:** Vaccination reduces infections in family members and therefore reduces the risk of transmission to the susceptible person.

## Appendix 7: Extension: Public Service Announcement

# Public Service Announcement (PSA) Project

Name: _____ Date: _____

Directions: The goal of a PSA is to create awareness, educate, demonstrate the importance of a problem, and persuade the audience to take the desired action. Review some of the PSAs for the flu on CDC's website and answer the following questions. Then, design your own PSA. Consider elements that include ways to prevent transmission, why vaccination is important, the likely effect of vaccination, the likely effect of no vaccination, as well as the ideas given to you below.

Part 1. Review some of the PSA for the flu on CDC's website, available at: http://www.cdc.gov/flu/freeresources/media-psa.htm and FLU.gov Videos on Influenza, available at: http://www.flu.gov/video/.

1. What were some of the strategies used to grab the audience's attention? Name at least 5.

2. What did you like about some of the strategies used in the PSAs and videos?

3. What did you dislike about some of the strategies used in the PSAs and videos?

4. What about the content of the PSAs or videos that you liked was able to grab your attention?

5. What statistics and data did the PSAs or videos provide? What statistics and data did you think the PSAs and videos were missing?

6. What were some of the goals of the PSAs and videos?

Part 2. Design a PSA for the flu

Consider the following elements.

- Have one main idea, such as ways to prevent transmission.
- Get the most current information available; you want to be convincing and accurate. For example, the following site might be good for a PSA dealing with vaccination (http://www.flu.gov/prevention-vaccination/prevention/index.html).
- Who is your target audience? Make sure your message is clear to that specific audience. Check out other examples of PSAs for ideas (http://www.adcouncil.org/).
- Grab your audience's attention. (Caution: do not use scare tactics. It is a common misconception that these tactics work when; in fact, they have limited effectiveness.)
- Create a script that includes a limited number of simple statements. A 30-second PSA typically includes 5–7 concise statements.
- Storyboard your script. (Storyboard is making a graphic outline for your video.)
- Videotape your footage and edit your PSA.
- Show your PSA to the class. Did they respond in the way you expected?