

INFECTIOUS DISEASES:
Bird Flu Today Public Awareness Campaign
Overview for Teachers

This webquest explores the science behind infectious diseases and how they spread. Using the devastating 1918 flu pandemic as a basis, students will examine how flu epidemics originate, how they spread, and how they might be controlled.

Overview

Scientists, policy makers, and the public are all concerned about the potential of an influenza epidemic within this decade. Of particular concern is bird flu –or avian influenza. Although it currently cannot be transmitted from person to person, the virus that causes bird flu could potentially evolve into a form that people could pass to each other. If that happens, it could trigger a serious flu pandemic, much like the pandemic of 1918, which killed an estimated 50 million people worldwide. The activity allows students to take on the role of a policy advocate and make recommendations about how Americans should prepare for the potential arrival of an avian influenza epidemic.

Students

- Introduction and instructions
- Researcher 1 materials
- Researcher 2 materials
- Researcher 3 materials
- Researcher 4 materials
- Group project instructions and worksheet

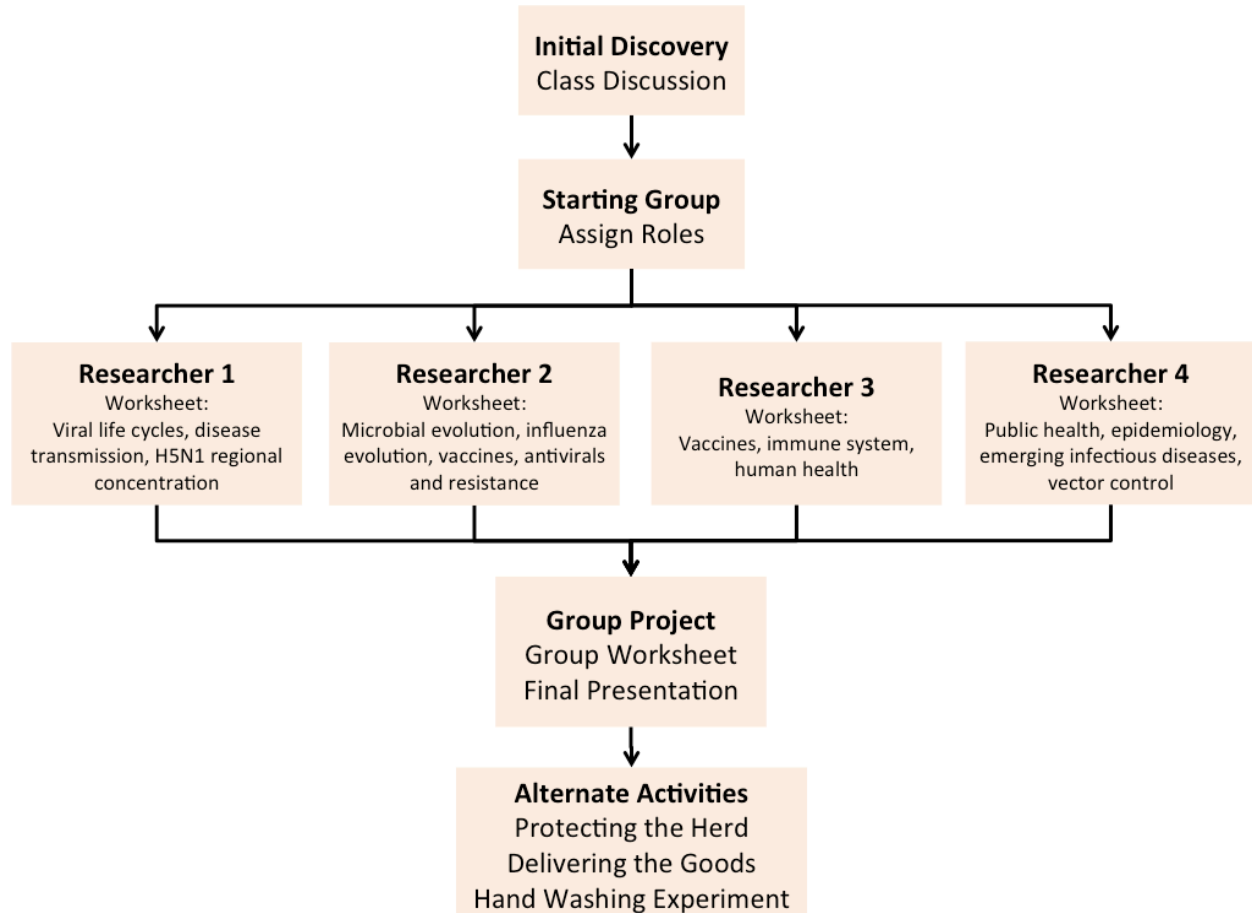
Teachers

- Teacher Introduction
- Background - Background information on H5N1 and suggested introductory activity
- Evaluation – Rubrics for evaluating student and group achievement
- Academic Standards – Relevant Next Generation Science Standards and Common Core State Standards
- Alternate Activities – Other activities you can do in your classroom related to this webquest

Introduction

This webquest is intended for high school and undergraduate science students as a web-based, stand-alone activity. The goal is to engage students in studying emerging infectious diseases, microbial evolution, public health, vaccines, and science policy. It is designed to take approximately one week.

Students should be divided up into groups of four, so that each student can assume the role of one of the investigative team members. This encourages cooperative learning and also gives students a chance to work as a team, just as real-world investigative teams work.



Alternatively, students can complete the webquest individually, investigating all four roles by themselves. Either way, students should be encouraged whenever possible to communicate their findings by creating a multimedia presentation.

Background Information for Teachers

In 1918, as World War I was coming to an end, a flu pandemic was beginning in the United States. The pandemic was caused by a shift in the H1N1 strain of the flu virus. [6] By the end of the epidemic, over 675,000 Americans and more than 50 million people worldwide were killed by the pandemic. Although the origin of the disease is still under dispute, one theory suggests that it started in humans, then transferred to swine and then back again. Symptoms experienced by the 1918 flu victims are quite similar to those of people who have contracted H5N1 today – including typical influenza symptoms, eye infections, pneumonia, and severe respiratory diseases, among others. The 1918 pandemic was not the only flu pandemic in the last century; there were also pandemics in 1957 and 1968. The flu virus continues to mutate and a number of new strains have become prominent.

Influenza viruses are categorized into A, B, and C groups based on their virulence, with A being the mildest and C being the most virulent. Most seasonal influenza viruses fall under the A category, but viruses are always evolving. These viruses are further classified into subgroups based on exterior proteins called hemagglutinin (H) and the neuraminidase (N). The 2007 subtypes currently circulating are both type A viruses: H1N1 and H3N2. Influenza type A viruses undergo two kinds of changes. One is a series of mutations that occur over time and cause a gradual evolution of the virus, called *antigenic drift*. The other kind of change is an abrupt change in the hemagglutinin and/or the neuraminidase proteins, called *antigenic shift*; in this case, a new subtype of the virus suddenly emerges. Type A viruses undergo both kinds of changes but influenza type B viruses change only by the more gradual process of antigenic drift.

Today's H5N1 virus has been transferred to humans mainly through human contact with the excretions or secretions of domesticated poultry. Currently, the virus cannot be easily transmitted from person to person. Scientists fear that if H5N1 did develop ability to be transmitted between human beings, it could lead to another global pandemic even worse than that of 1918, given today's global society. To evolve the ability to "jump" from human to human, the virus would probably require an intermediate host to facilitate the process. For example, an H5N1 virus would have to infect a pig that is also infected with a human influenza A virus. This would allow for mixing of the genetic material of both viruses, possibly resulting in a form that could be transmitted between humans.

Every year vaccines are developed to fight the currently pervading virus strains. Certain target groups such as young children or the elderly are encouraged to get the vaccine annually to develop immunity to current strains. There are also antiviral drugs available on the market that are used to treat and prevent influenza A viruses. However, just as bacteria develop antibiotic resistance, so too can viruses develop antiviral resistance.

References

http://www.flu.gov/about_the_flu/index.html
<http://www.cdc.gov/ncidod/EID/vol12no01/05-1254.htm>
<http://www.niaid.nih.gov/topics/flu/Pages/default.aspx>
<http://www.cdc.gov/flu/avian/gen-info/transmission.htm>

Introductory Activity

The purpose of this webquest is to engage students in thinking critically about how the American government should respond to a potential avian flu pandemic based on current knowledge about viruses, vaccines, microbial evolution, and public health measures. Participating students will partake in both individual and team components of the webquest. As teams, they will use individual and group research to develop a public awareness campaign advocating their perspective.

Before beginning the webquest, students should have a solid understanding of the basic differences between viruses and bacteria, as well as their respective treatment and control measures. We recommend that you use the following discussion questions before starting the webquest.

1. What are the differences between viruses and bacteria?

[Explore the *Where Are They?* section of the Koshland Science Museum's Infectious Disease exhibit](#)

2. What is the difference between an antibiotic, a vaccine, and an antiviral?

[Explore the *Vaccines & Human Immunity* and *Antibiotics & Emerging Drug Resistance* sections of the KSM's exhibit](#)

3. How many Americans die each year on average from the seasonal flu virus?

<http://www.facesofinfluenza.org/about.php>

If time permits students can explore additional resources:

- The National Academy of Sciences' online resource "What You Need to Know About Infectious Disease" <http://needtoknow.nas.edu/id/>
- PBS' DVD of "American Experience: Influenza 1918" <http://www.pbs.org/wgbh/americanexperience/films/influenza/>

Evaluation Rubric – Option 1

Points	6	4	2	1	Score
Timing and Presentation	Expertly timed and paced, held the audience's interest	Well-timed, kept audience interested most of the time	Timing had some gaps and rough spots, audience quickly tuned out	Dragged, had many gaps and did not fulfill time requirement	_____
Connection to Natural Selection (multiply by 1.5)	Clear, detailed explanation of how bird flu is impacted by natural selection	Somewhat clear explanation of how bird flu is impacted by natural selection	Explanation unclear, steps missing, few people understood link	Not clear what the link is, most did not understand the link	_____ x 1.5
Persuasiveness	Many persuasive arguments and information	Moderately persuasive	Few persuasive arguments or information	Little if any persuasive arguments or information	_____
Content	<i>Fully and effectively</i> incorporated research and information from individual researcher tasks	<i>Partially effectively</i> incorporated research and information from individual researcher tasks	<i>Partially or ineffectively</i> incorporated research and information from individual researcher tasks	<i>Failed to</i> incorporate research and information from individual researcher tasks	_____
Originality	Creative and thoughtful, displaying originality	Fairly creative and original, stood out from most other campaigns	Few creative elements or unique ideas, did not stand out	Got lost in the crowd, little evidence of forethought or creative ideas	_____
Overall Effort and Effectiveness	Campaign fully incorporated group's position statement throughout the entire presentation	Campaign incorporated group's position statement throughout the majority of presentation	Campaign partially incorporated group's position statement throughout the presentation	Little or no effort displayed, campaign poorly incorporated group's position statement throughout the presentation	_____
Sources Cited	All sources were trustworthy and cited properly	Most sources were trustworthy and cited properly	Some resources were not trustworthy or cited properly	Most sources were not trustworthy sources or cited properly	_____
				Total Points	____ / 45

Evaluation Rubric – Option 2

	Beginning	Developing	Accomplished	Exemplary	Total Possible Score	Score
Group Worksheet	Answers are incomplete or incorrect. Sub-questions not addressed well 3 Points	Answers are mostly correct and complete. Sub-questions adequately addressed 5 Points	Answers are correct and mostly complete. Most sub-questions addressed well 8 Points	Answers are thorough and thoughtful. Sub-questions all addressed well 10 Points	10	
Individual Worksheet	Incomplete and answers show minimal understanding of material 5 Points	Complete and answers show moderate understanding of material 8 Points	Complete and answers show mastery of material 12 Points	Complete and answers show the highest level of understanding 15 Points	15	
<i>Group Report Questions: Grammar, organization, formatting, logical arguments, and adequacy of elements considered</i>						
Group Report Question #1	Minimally acceptable 3 Points	Acceptable 5 Points	Shows mastery of subject 8 Points	Shows the highest level of performance 10 Points	10	
Group Report Question #2	Minimally acceptable 3 Points	Acceptable 5 Points	Shows mastery of subject 8 Points	Shows the highest level of performance 10 Points	10	
Group Report Question #3	Minimally acceptable 3 Points	Acceptable 5 Points	Shows mastery of subject 8 Points	Shows the highest level of performance 10 Points	10	
				Total Points	55	

This webquest addresses the following Next Generation Science Standards and Common Core State Standards for high school students.

Next Generation Science Standards

Standards

- [HS-LS1 From Molecules to Organisms: Structures and Processes](#): HS-LS1-1, HS-LS1-2
- [HS-LS2 Ecosystems: Interactions, Energy, and Dynamics](#): HS-LS2-2, HS-LS2-6
- [HS-LS3 Heredity: Inheritance and Variation of Traits](#): HS-LS3-2, HS-LS3-3
- [HS-LS4 Biological Evolution: Unity and Diversity](#): HS-LS4-5
- [HS-ETS1 Engineering Design](#): HS-ETS1-1

Science and Engineering Practices

- Asking questions (for science) and defining problems (for engineering)
- Developing and using models
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence

Crosscutting Concepts

- Cause and effect
- Scale, proportion, and quantity
- Systems and system models
- Structure and function
- Stability and change

Common Core State Standards

ELA/Literacy

- [Literacy in Science and Technical Subjects \(Grades 9 and 10\)](#): RST.9-10.8
- [Literacy in Science and Technical Subjects \(Grades 11 and 12\)](#): RST.11-12.1, RST.11-12.7, RST.11-12.8, RST.11-12.9
- [Writing \(History/Social Studies, Science, and Technical Subjects\)](#): WHST.9-12.1, WHST.9-12.2, WHST.9-12.9
- [Speaking and Listening \(Grades 11 and 12\)](#): SL.11-12.5

Mathematics

- [Standards for Mathematical Practice](#): MP.2, MP.4
- [Number and Quantity – Quantities](#): HSN.Q.A.1, HSN.Q.A.2, HSN.Q.A.3
- [Statistics & Probability – Interpreting Categorical & Quantitative Data](#): HSS.ID.A.1
- [Statistics & Probability – Making Inferences & Justifying Conclusions](#): HSS.IC.A.1, HSS.IC.B.6

Alternative Activities

There are several activities that can be used to extend the webquest:

1. **NIH Emerging and Re-Emerging Infectious Diseases; Activity 4: Protecting the Herd** – This activity could serve as a great introduction to the webquest. By using cards to represent immunity and lack thereof, students simulate the spread of a disease through a population that has no vaccinations and then through a population that has a 50% vaccination rate. They then discuss how vaccinations impact public health.

<http://science.education.nih.gov/supplements/nih1/Diseases/guide/activity4-1.htm>

2. **Rx for Survival: Delivering the Goods** – In this activity, students will be critically assessing their response to the spread of a possible flu and the impacts it has regionally and globally. This would be a great follow-up activity to the webquest to give students a practical global perspective about public health concerns in developing nations.

http://www.pbs.org/wgbh/rxforsurvival/series/teachers/pdf/rx_guide_deliveringgoods.pdf

3. **BAM! Hand Washing Experiment** – Students learn about the importance of maintaining proper hygiene in order to decrease the risk of getting ill. Students will test how effectively they wash their hands by testing for the presence of microbes. This activity can serve as a public health link for the webquest emphasizing the value of good hygiene.

http://www.bam.gov/teachers/epidemiology_hand_wash.html