Pandemic: Comparing Influenza to COVID-19

Teacher Resources for Grades 9-12

These resources from the National Museum of Health and Medicine will help you create a virtual experience for your students.

The mission of the National Museum of Health and Medicine is to preserve and explore the impact of military medicine. Through the use of the museum's archival collections, public programs, and resources, students will learn about the military's involvement and history of combatting pandemics. This document is designed to provide resources to engage students in a virtual setting. Here you will find documents, images, and activities investigating the 1918 "Spanish" Influenza to the current COVID-19 pandemic.

At the conclusion of this experience, students should be able to:

- Identify the viral strains that caused the 1918, 1957, 2005, and COVID-19 pandemics
- Using primary resources, analyze images to identify the tools that were used to treat patients in 1918, 1957, 2005, and today along with describing similarities and differences between pandemics
- Describe how public health response has changed since 1918
- Describe how a pandemic can impact the military
- Investigate and analyze public health responses for COVID-19
- Identify and describe how technology has impacted or improved the public health response to the 1918 influenza versus COVID-19
- Using primary resources, identify and collect trends in data for the 1918 influenza pandemic
- Describe the importance of identifying the 1918 influenza genome
- Create info-graphics, graphs, or charts using information and data from the current COVID-19 pandemic

Supplies

- NMHM Flu Content for Download PowerPoint presentation
- Internet
- Copies of documents and images listed in appendices

Activities

Lessons From the Past and Planning for the Future:

This activity is designed for students to analyze and evaluate an oral presentation, analyze a current scientific or news article, and research information related to public health responses.

- Watch the October 2018 Medical Museum Science Café: On the Centenary of the 1918 Influenza: Lessons from the Past and Planning for the Future (42 minutes).
- Have students evaluate the presentation using the Guiding Questions worksheet in appendix 1
- Following the evaluation of the presentation, have students research one current article on COVID-19. Have students write an evaluative response to the article that reflects the similarities and differences to the science café presentation. Students should pay attention to similar information, graphics, projections, and accuracy of the article.
- Ask students to review appendix 4: "The Bird Flu and You" and to complete the following:
    - Who is the author(s) of the document?
    - What is the document about?
    - When was the document created?
    - List three things you learned from the document.
    - Do you think the information presented is accurate and why or why not?
    - What are the differences between the information presented in "The Bird Flu and You" and current COVID-19 guidance?
    - Create a COVID-19 poster using the format in the "The Bird Flu and You."
- Ask students to research local (county), state, national, and/or international public health response plans to the COVID-19 pandemic. Students should compare and evaluate the usability of the information, effectiveness, and implementation of the plans.
- After reviewing response plans, ask students to create a response plan to a future influenza epidemic. Students should include a budget, communication, infographics, resources, and data collection.

A Picture is Worth a Thousand Words:

NMHM has captured information, documents and images related to various epidemics and pandemics since its founding and has become a repository for pandemics, such as the 1918 influenza. A key aspect of this documentation is medical illustration and clinical photography. This activity will have students analyze primary sources through illustrations and images, as well as explore the career path of medical/scientific illustration.

- Read "What the Coronavirus image you've seen a million times really shows you," by Robert Roy Britt. https://elemental.medium.com/what-the-coronavirus-image-youve-seen-a-million-times-really-shows-3d8de7e3eb1f
- Compare images of the generic influenza virus to the coronavirus. Students should look for similarities and differences in the construction of the virus. After comparing the images, ask students:
    - Do the viruses have a similar, basic structure? Why is that?

    - How does the design of virus structures make them more virulent? What challenges would this pose to scientists or researchers?
    - Why are images like these important and useful to scientists, doctors, and the public?
    - How would you use the images to teach the public about the disease and disease prevention?
    - Why are medical illustration important to the scientific community?
- Using the NMHM Flu PowerPoint presentation, have students choose an image from slides 2 to 8.
- Ask students to analyze the image using the Photo Analysis Worksheet in appendix 3.
- Ask students to find a picture from today's COVID-19 pandemic and complete the Photo Analysis Worksheet. After the students have completed both photo analyses, ask them to compare and contrast the photos.

More Than Just a Number:

During the 1918 influenza pandemic, museum staff collected data related to epidemiological trends in U.S. cities, Army camps, and in Europe. This activity will ask students to analyze, synthesize, and describe epidemiological information collected during the 1918 influenza pandemic.

- Ask students to review the charts and graphs on slides 11 to 26 of the PowerPoint presentation. You may also choose a selection of charts for the students.
- Ask students to complete the Document Analysis Worksheet in appendix 5.
  For question 19, have students reference the following CDC and WHO websites to collect data on the current COVID-19 pandemic. Students should be looking for number of confirmed cases by city or region and number of deaths by city or region.

  https://www.cdc.gov/coronavirus/2019-ncov/index.html

  https://www.who.int/emergencies/diseases/novel-coronavirus-2019

Vocabulary

Antibody: a protective, blood protein produced by the immune system in response to and counteracting a specific antigen or foreign substance. Also known as an immunoglobulin

Asymptomatic: showing no symptoms of a disease or illness

Autopsy: examination of the body after death

Biomarker: a measurable substance or molecules in the blood that represents an underlying condition, such as disease, infection, or environmental exposure

Causative agent: also known as disease causative agent; refers to the biological pathogen that causes a disease

DNA (deoxyribonucleic acid): a self-replicating material that is present in nearly all living organisms as the main constituent of chromosomes. It is the carrier of genetic information

Disease: an impairment of the normal state of the living animal or plant body that interrupts or modifies the performance of the vital functions and is a response to environmental factors, to specific infective agents, to inherent defects of the organism, or to a combination of these factors

Epidemic: a widespread occurrence of an infectious disease in a community at a particular time

Epidemiology: is the study (scientific, systematic, and data-driven) of the distribution (frequency and pattern) and determinants (causes and risk factors) of health-related states and events (not just diseases) in specified populations (neighborhood, school, city, state, country, and global)

Flatten the curve: is a public health term that refers to staggering the number of new cases over a longer period to improve access to care and reduce the transmission of a disease

Genome: the haploid set of chromosomes in a gamete or microorganism in each cell of a multicellular organism

Genotype: the genetic constitution of an individual organism

Gel electrophoresis: a laboratory method used to separate mixtures of DNA, RNA, or proteins according to molecular size. The molecules are separated using an electrical field to push them through a gel that contains small pores. An image can be produced on an X-ray film

Heliotrope-cyanosis: a bluish coloration of the skin that is a symptom of the 1918 influenza

Incubation: the time from the moment of exposure to an infectious agent until signs and symptoms of the disease appear

Influenza: a highly contagious viral infection of the respiratory passages causing fever, severe aching, and catarrh and often occurring in epidemics

Medical illustration: a form of biological illustration that helps to record and disseminate medical, anatomical, and related scientific knowledge in a visual format

Mutation: the changing of the structure of a gene resulting in a variant form that may be transmitted to subsequent generations caused by the alteration of single base units in DNA or the deletion, insertion, or rearrangement of larger sections of genes or chromosomes

Pandemic: a disease that becomes prevalent over the world

Pathogenesis: the manner of development of a disease

Pathology: the study of the nature of disease and its causes, processes, development, and consequences

PCR (polymerase chain reaction): a technique used to make numerous copies of a specific segment of DNA quickly and accurately

Pneumonia: lung inflammation caused by bacterial or viral infection in which the air sacs fill with pus and may become solid

Public health: the art and science dealing with the protection and improvement of community health by organized community effort, including preventive medicine and sanitary and social science

RNA (ribonucleic acid): a nucleic acid present in all living cells. Its principal role is to act as a messenger carrying instructions from DNA for controlling the synthesis of proteins, although in some viruses RNA rather than DNA carries the genetic information

Shedding: also known as viral shedding, refers to the expulsion and release of the virus following successful reproduction during a host-cell infection. The presence of the virus can be in body secretions, in excretions, or in body surface lesions with the potential for disease transmission and infection

Symptomatology: a set of symptoms of a medical condition or exhibited by a patient

Transmission: the act or process of transmitting a virus

Virology: the branch of science that deals with the study of viruses

Virus: small living particles that can infect cells and change how the cells function. A causative agent of an infectious disease

Resources

The appearance of hyperlinks does not constitute endorsement by NMHM or any other agency of the U.S. government of the destination website or the information, products, or services contained therein.

Websites:

- **National Museum of Health and Medicine**
  https://www.medicalmuseum.mil
- **National Library of Medicine**
  https://www.nlm.nih.gov/
- **Center for Disease Control**
  https://www.cdc.gov/flu/about/index.html
  https://www.cdc.gov/flu/pandemic-resources/pandemic-timeline-1930-and-beyond.htm
- **National Institutes of Health**
  https://www.nih.gov/

- **Walter Reed Army Institute of Research**
  https://www.wrair.army.mil/
- **Defense Health Agency**
  https://health.mil/Military-Health-Topics/Combat-Support/Public-Health/Coronavirus
- **Health and Human Services**
  https://hhs.gov
- **Coronavirus**
  https://www.coronavirus.gov/
- **The Deadly Virus: The Influenza Epidemic of 1918**https://www.archives.gov/exhibits/influenza-epidemic/
- **Coronavirus Is Very Different From the Spanish Flu of 1918. Here's How**https://www.nytimes.com/2020/03/09/health/coronavirus-is-very-different-from-the-spanish-flu-of-1918-heres-how.html, March 16, 2020
- **A Historian's View of the Coronavirus Pandemic and the Influenza Of 1918**https://www.newyorker.com/culture/video-dept/a-historians-view-of-the-coronavirus-pandemic-and-the-influenza-of-1918 March 25, 2020
- **Mutter Museum, Spit Spreads Death: The Influenza Pandemic of 1918-19 in Philadelphia**http://muttermuseum.org/exhibitions/going-viral-behind-the-scenes-at-a-medical-museum/

Publications:

- *The Great Influenza: The Story of the Deadliest Pandemic in History* (Barry, 2005)
- *Pale Rider: The Spanish Flu of 1918 and How It Changed the World*, (Spinney, 2017)
- *America' Forgotten Pandemic: The Influenza of 1918*, (Crosby, 2003)
- *Viruses, Plagues, and History: Past, Present, and Futures*, (Oldstone et al., 2018)
- *Virus: An Illustrated Guide to 101 Incredible Microbes*, (Roossinck and Zimmer, 2016)
- *Animal Viruses and Humans, a Narrow Divide: How Lethal Zoonotic Viruses Spill Over and Threaten Us*, (Andiman, 2018)
- *The Greatest Benefit to Mankind: A Medical History of Humanity*, (Porter, 1999)

Bibliography and Links:

National Governors Associations Center for Best Practices, & Council of Chief State School Officers. (2020). *Common Core State Standards*. Retrieved from www.corestandards.org

National Research Council. (1996). *National Science Education Standards*. Washington, D.C.: The National Academies Press.

National Research Council. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press.

NGSS Lead States. (2020). *Next Generation Science Standards: For States, By States.* Retrieved from www.nextgenscience.org

Maryland State Department of Education. (2020). *Maryland State Curriculum*. Retrieved from https://mdk12.msde.maryland.gov/INSTRUCTION/StandardsandFrameworks/sciences/Pages/sciences.aspx

Virginia State Department of Education. (2020). Virginia State Standards of Learning. Retrieved from http://www.doe.virginia.gov/testing/sol/blueprints/science_blueprints/2010/2010_blueprint_biology.pdf

Educational Standards

Maryland

Students will:

Recognize that real problems have more than one solution and decisions to accept one solution over another are made on the basis of many issues.

Critique arguments that are based on faulty, misleading data or incomplete use of the numbers.

Recognize data that are biased.

Explain factors that produce biased data (incomplete data, using data inappropriately, conflicts of interest, etc.).

Describe trends revealed by data.

Explain scientific concepts and processes through drawing, writing, and/or oral communication.

Create and/or interpret graphics (scale drawings, photographs, digital images, field of view, etc.).

Apply the skills, processes, and concepts of biology, chemistry, physics, or earth science to societal issues.

Identify and evaluate the impact of scientific ideas and/or advancements in technology or society.

Investigate a biological issue and be able to defend their position on topics, such as animal rights, drug and alcohol abuse, viral disease (such as AIDS), genetic engineering, bioethics, biodiversity, population growth, global sustainability, or origin of life.

Virginia

Students will:

Investigate and understand the life function of Archaea, Bacteria, and Eukarya as it relates to human health issues, human anatomy, and body systems.

Investigate and understand the life function of Archaea, Bacteria and Eukarya as it relates to how viruses compare with organisms and evidence supporting the germ theory of infectious disease.

Investigate and understand common mechanisms of inheritance and protein synthesis as it relates to the exploration of the impact of DNA technologies.

Investigate and understand that organisms reproduce and transmit genetic information to new generations and the historical contributions and significance of discoveries related to genetics.

Demonstrate skills for historical and geographical analysis and responsible citizenship, including the ability to evaluate and debate issues orally and in writing; the ability to analyze and interpret primary and secondary source documents to increase understanding of events and life in the United States history from 1865 to the present; and to make connections between the past and the present.

Identify, analyze, and interpret primary and secondary source documents, records, and data, including artifacts, diaries, letters, photographs, journals, newspapers, historical accounts, and art to increase understanding of events and life in the United States. Students will also evaluate the authenticity, authority, and credibility of sources.

Common Core

Students will:

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9 to 12 texts and topics. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence. Cite specific textual evidence to support analysis of science and technical text, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

Write arguments focused on discipline-specific content. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical process. Write information/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

Gather relevant information from multiple print and digital sources, access the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

Synthesize information from a range of sources (e.g., texts, experiments, and simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

Appendix 1: Guiding Questions

Name: Date:

Guiding Questions for Medical Museum Science Cafes

Title of Café:

Speaker(s):

Airdate of Café:

Length of Café:

1) **List three talking points you think will be covered during the café.**
   -
   -
   -

2) **Does the presenter provide an introduction to the topic with key points that will be covered during the lecture? If yes, list the points.**

3) **What is the speaker(s) argument or message?**

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4) **Do you feel that the speaker(s) are qualified to speak on this topic, yes or no? Explain your answer.**

5) **Did the speaker provide appropriate and accurate information to support of the argument? List two examples. (Hint, this could be images, graphs, or statistics)**

6) **How successfully did the presentation meet your expectations?**

Name: Date:

7) **Did the speaker provide a biased or unbiased argument on the subject? Provide at least two examples supporting either answer.**

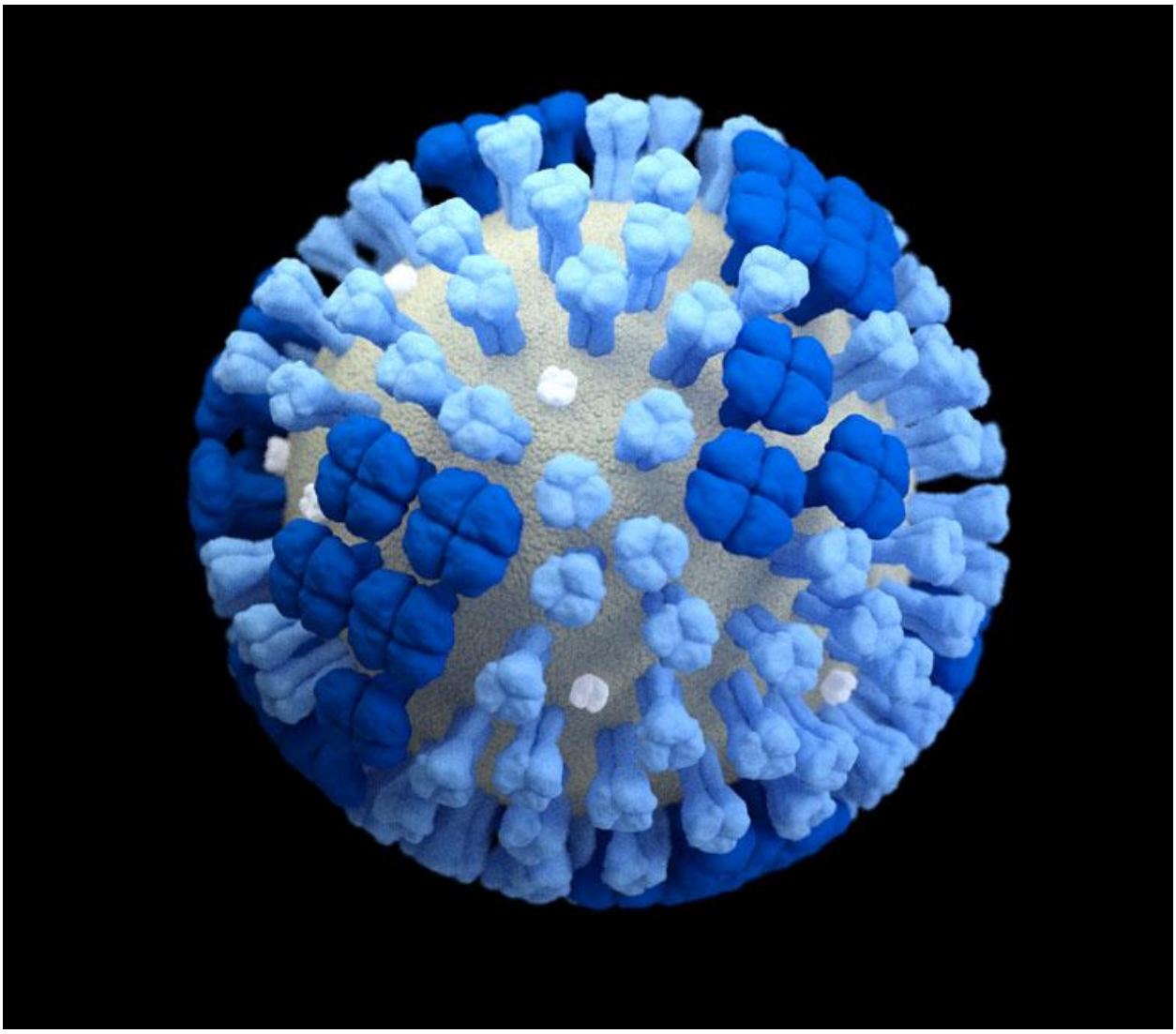
8) **Did you find the speaker engaging and knowledgeable? If not, why? (include ways to make the presentation more engaging)**

9) **List three things you learned from the Café.**

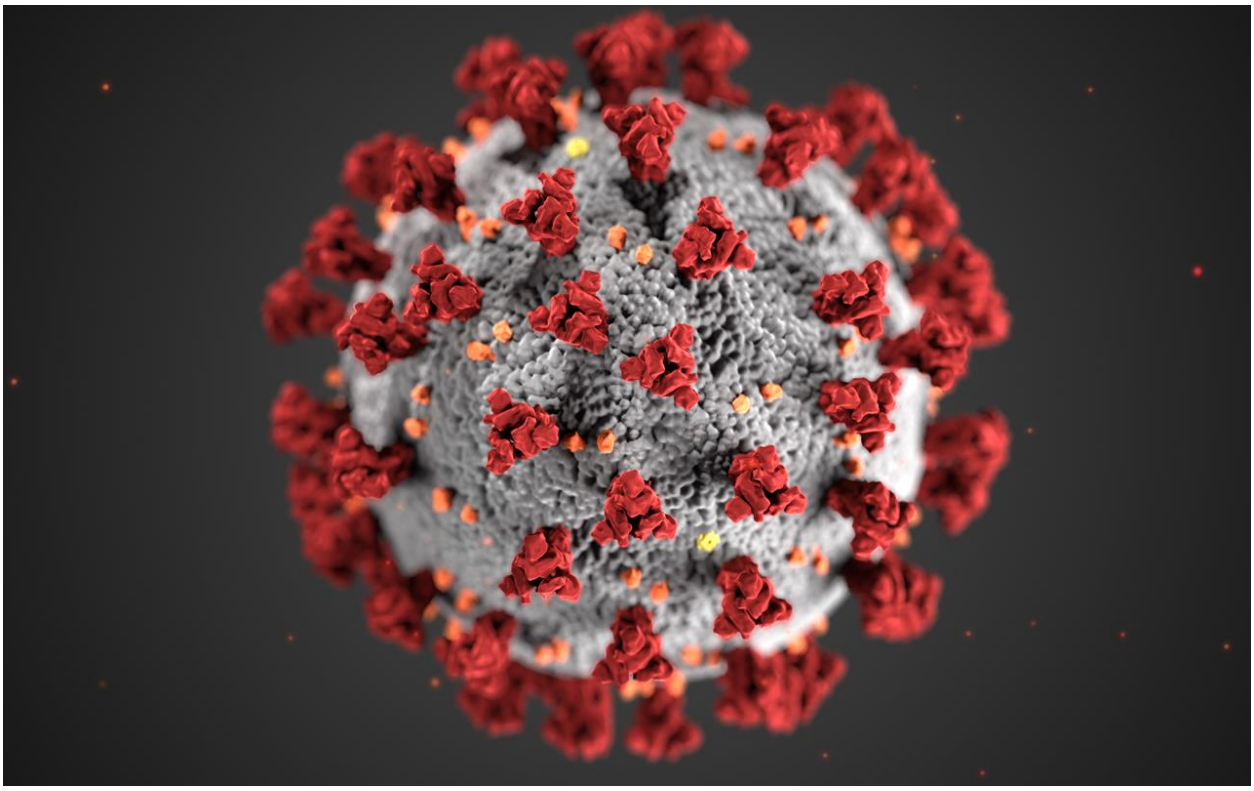
-
-
-

10) **Did the presentation meet your expectations, if not why?**

Appendix 2: Virus images



A 3D computer-generated rendering of a whole influenza (flu) virus with a light grey surface membrane set against a black background. The virus' surface proteins–hemagglutinin (HA) and neuraminidase (NA)–are depicted in light and dark blue, respectively. HA is a trimer (which is comprised of three subunits), while NA is a tetramer (which is comprised of four subunits and its head region resembles a 4-leaf clover). Retrieved from https://www.cdc.gov/flu/resource-center/freeresources/graphics/images.htm?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fflu%2Fimages.htm.



This illustration, created at the Centers for Disease Control and Prevention (CDC), reveals ultrastructural morphology exhibited by coronaviruses. Note the spikes that adorn the outer surface of the virus, which impart the look of a corona surrounding the virion, when viewed electron microscopically. A novel coronavirus, named Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2), was identified as the cause of an outbreak of respiratory illness first detected in Wuhan, China in 2019. The illness caused by this virus has been named coronavirus disease 2019 (COVID-19)

Coronavirus Disease 2019 (COVID-19). Courtesy of the CDC/Alissa Eckert and Dan Higgins. Retrieved from https://phil.cdc.gov/Details.aspx?pid=2871

Appendix 3: Image Analysis Worksheet

Name: Date:

Image Analysis Worksheet

1) Study the image for 2 minutes. Form an overall impression of the image and then examine individual parts. Next, divide the photo into quadrants and study each section to see what new details become visible.

2) Use the chart below to list what you observe in the image. This should include people, objects, activities, technology, and structures.

Quadrant 1	Quadrant 2
Quadrant 3	**Quadrant 4**

1

The Image Analysis Worksheet is based on the National Archives and Records Administration Photo Analysis Worksheet

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3) Based on what you have observed above, list three things you might infer from this image.

4) What questions does this image raise in your mind?

5) Where could you find answers to them?

6) How does this image compare to similar images of the past or the present?

7) Why are images like this important to understanding public health and disease?

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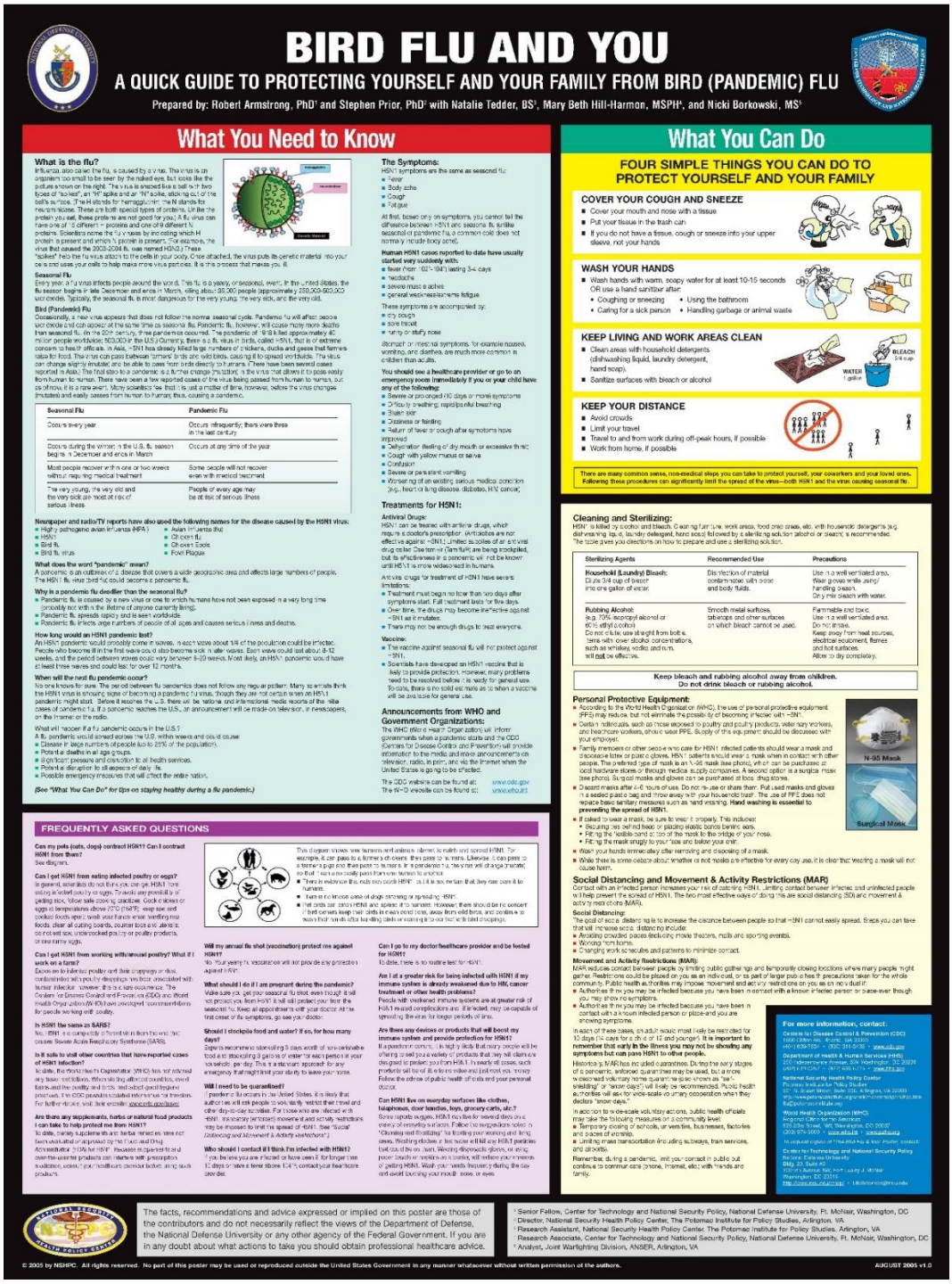
Appendix 4: Bird Flu and You



Bird Flu and you: a quick guide to protecting yourself and your family from bird (pandemic) flu. National Defense University, National Security Health Policy Center. 2005. In the collections of the National Library of Medicine. Retrieved from: https://collections.nlm.nih.gov/catalog/nlm:nlmuid-101581804-img

Appendix 5: Document Analysis Worksheet

Name: Date:

Document Analysis Worksheet

1) What do these documents depict?

2) Who is the author(s) of the documents?

3) When were the documents created?

4) What conclusion can be made from the data in the charts?

5) Are there advantages to different charts or graph styles on the same topic? Explain.

6) What is the most common age impacted by influenza shown in the charts?

7) Which length of service has the highest mortality rate associated with it?

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Name: Date:

8) What are the most common symptoms associated with influenza based on the chart(s)?

9) Are there any trends or patterns across the charts? Describe the trend or pattern.

10) Why did the author(s)/scientist(s) compare the rate of measles infections to the rate of influenza infections?

11) What do these infection rates tell you about life in 1918-1919?

12) What do these infection rates tell you about military life and camp conditions in 1918-1919?

13) Comparing the charts, is there a mortality rate based on location? Explain your answer.

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Name: Date:

14) Do you notice any differences in the information reported on the different charts? Why do you think there are differences?

15) Is there any information that is missing from the charts?

16) What information would have been useful in capturing during this period? Explain why this information would be helpful.

17) Summarize the information you have learned from the charts. This should include demographics (age, race), symptoms, and locality.

18) Did these documents provide information you previously didn't know on the topic?

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Name: Date:

19) Using available information from the Centers for Disease Control (CDC) and World Health Organization, create two similar charts or graphs for COVID-19.

20) Compare your charts with the charts from the slideshow. What are the similarities or differences between the two?

21) Explain how information collected from past pandemics can help predict and manage pandemics today.

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