Influenza Inquiry Lab
Malukiewicz

Keywords: Epidemic, Influenza, Virus, Epidemiology, Infectious Disease
Grade Level: 9-12
Arizona Standards: Strand 1 - Inquiry Concept 1; Strand 4 - Life Sciences
National Science Education Standards: Science in Personal and Social Perspectives
Content Standard F - Personal and community health

Overview: This activity allows students to explore and study realistic scientific data based on seasonal influenza activity. Students come to understand the occurrence of epidemics, vaccine design, and the surveillance of infectious diseases. Additionally, students develop skills in data interpretation and analysis, model design, and basic statistics. This lesson can also be used or modified to introduce other topics such as public health, pathogens, and host-parasite interactions.

Links:
http://www.cdc.gov/flu/ (general information)
http://www.cdc.gov/flu/weekly/fluactivity.htm (maps showing geographical spread of flu for various yearly seasons, data on circulating flu types, info on patients seen for ILI, as well as other influenza data available at this link)

Activity

Background:
The reports on flu activity from national flu surveillance agencies were extremely alarming in recent years. Despite getting vaccinated, many US citizens were displaying high levels of influenza-like illness (ILI) symptoms. Doctors’ offices were reporting higher percentages of patients seeking treatment for ILI. Schools were noticing a higher amount of student absences attributed to the flu.

Fearing a worsening national flu epidemic, Congress summoned top officials from the CDC and WHO to a national flu summit. After much discussion and debate about the problem, the solution was clear. The Influenza Unit of the CDC, responsible for analyzing surveillance data, did not do its job correctly. The flu unit suggested the wrong type of flu vaccine, predicted an incorrect start to the flu season, and did not properly monitor geographical data. Congress mandated that the entire staff of the CDC Influenza Unit be dismissed for such bad form. Congress also ordered the entire Influenza Unit to be newly staffed with elite scientists and epidemiologists who are up to the task of correctly monitoring flu activity and public health.

You have been hired as part of this elite scientific team. Are you up to the task?
Part I Individual Observation:

For 10 minutes, preview the three pieces of CDC flu surveillance data you have been given.

What types of patterns do you observe in the data? For example, what is the data telling you about circulating flu types or what can you derive about the geographical spread of the flu?

Make at least 3 observations.

We will discuss your observations and formulate questions for further inquiry.

Expectation: Make insightful observations about flu activity and discuss why something intrigued you or why you thought it was important.

Part II Group Investigation

Get in a group with three other students (note: each student will be responsible for her/his own lab report).

Your objectives are to:
1. Determine if a national flu epidemic occurred during the 2006-2007 flu season (using ILI and geographic data).
   1.1. Define criteria for a national flu epidemic to guide your decision.
   1.2. Using your defined criteria, provide evidence either for or against a 2006-2007 US flu epidemic.
   1.3. Support your argument with graphs, text, tables, and statistics (and logic!).

2. Design a flu vaccine for the upcoming flu season based on the available CDC data (using ILI and flu composition data).
   2.1. Determine the proper composition for the future vaccine (H and N antigens).
   2.2. Discuss why you chose this composition.
   2.3. Determine when you predict the next flu season will begin, when production of flu vaccine should start, and when the flu vaccine should be implemented.
   2.4. Support your decision with graphs, text, tables, and statistics.

3. Pick 2 class generated questions from the board to investigate using the available CDC data.
   3.1. You may also use other primary or secondary sources to investigate your question.
   3.2. Support your investigation with graphs, text, tables, and statistics.

Part III Class Discussion

Observations, arguments, and discoveries regarding the data will be discussed during the last 10-15 minutes of class.
Part IV Lab Report
每位组员需提交一份个人实验报告。
实验报告将包含以下6部分:
- 标题页：标题、姓名、数据、班级、班级时间
- 引言：描述其性质
- 部分 II 目标 1
- 部分 II 目标 2
- 部分 II 目标 3
- 闭幕

实验报告将根据以下评分标准进行评分：

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<thead>
<tr>
<th>Criteria</th>
<th>Expectation</th>
<th>Full Value</th>
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<tbody>
<tr>
<td>语法和校对</td>
<td>表述中无拼写错误；语法使用正确；没有并列句；每一段至少3句。句子结构和词语使用要合理。</td>
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<tr>
<td>风格</td>
<td>引言部分须针对适当对象，并介绍实验报告；段落包含主题句和结论句。每部分须组织良好，段与段之间有明确的联系。写作风格要保持一致。闭幕部分须总结实验报告的主要发现，并将实验报告内容整合在一起。</td>
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<td>论证分析</td>
<td>论证须逻辑清晰。支持或反驳论点需有充分证据。</td>
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<tr>
<td>数据图、表和统计</td>
<td>数据通过这三种元素恰当表示。所选图、表或统计类型须适合表示特定数据类型。作者须解释为何选择使用特定类型的图、表或统计。</td>
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Supplementary Information on Chart Data

A. Isolated Influenza Virus Types
   a. A nation-wide network of laboratories analyzes patient samples for influenza types. Typing is conducted on a weekly basis and obtained information is submitted to the CDC. The CDC uses this information to compile weekly reports on virus types circulating in the US from October to May of each year. Influenza is typed by H and N surface antigens. Data in the “Isolated Influenza Virus Types” lab chart simulates CDC data, and represent raw numbers of typed virus surface antigens. This chart is broken down week by week.

B. Influenza-Like Illness Surveillance Chart Data
   a. Several medical facilities are part of a nation-wide network that reports data to the CDC on frequency of patients seen for influenza-like illness (ILI). These reports are sent out by participating medical facilities to the CDC on a weekly basis. The CDC compiles the submitted data into a chart which represents the percentage of patients seen for (ILI) out of total patient visits for all reporting facilities. The ILI lab chart simulates data complied by the CDC. The chart indicates, for example, that during week 40 of 2006 1.4% of patients seen by health professions were seen for ILI.