ANSWER THE FOLLOWING THREE QUESTIONS (they are weighted equally)

1. Was the 2004-05 Flu crisis a case of market or government failure? Explain your argument.

2. The following is a list of policy options to ensure an adequate annual flu vaccine supply.
   a. The vaccine should be regulated and distributed by market forces of supply and demand.
   b. The federal government should guarantee, annually, the purchase of a large supply of vaccines to protect vaccine producers from the risky market.
   c. The US needs to develop a low risk, affordable method for producing vaccines. The federal government should invest in the research and development necessary to develop such techniques.
   d. The government should manufacture, manage, and distribute all flu vaccines and eliminate the private market altogether.

Assess each option in terms of its merit, stability, riskiness, reliability and robustness. Which option(s) should the federal government adopt? Explain.

3. The current swine flu pandemic, the recent international concern about avian flu, and threats of bioterrorism all underscore the urgency of public health planning and preparedness for emergency distribution of vaccines and medicines for treatment. During the vaccine shortage of 2004-05, the CDC recommended that healthcare providers ration the vaccine to high-risk patients, and several public officials made efforts to redirect supplies to high risk patients. But as the case noted, public officials knew very little about how flu vaccine supplies are shipped and to whom, making it difficult to intervene.

The State of Alaska Division of Homeland Security and Emergency Management, in conjunction with the Alaska Division of Public Health, Office of Health Preparedness, are presently working on a response plan for Alaska, and have issued an RFP to survey healthcare providers to identify their source and volume of supply for vaccines and numbers and locations of high risk patients.
   a. Sketch the approach you would take in the survey design.
   b. Discuss the method you would use to administer the survey and explain why you chose it.
   c. Consider the sampling frame and whether you would stratify the sample and why.
   d. Comment on sample size and the need for accuracy in planning for future public health emergencies.
FLU VACCINE CASE STUDY
General Overview

The 2004-2005 U.S. Influenza Vaccine Shortage

Influenza, or the flu, causes approximately 36,000 deaths and 200,000 hospitalizations annually in the United States and costs the American economy between $11 and $18 billion each year (General Accounting Office 2001b, page 1). The primary method for preventing influenza is the flu vaccine, which is generally available in a variety of settings including clinics, hospitals, schools, workplaces, and other convenient locations. The vaccine is typically distributed in October and November in anticipation of the winter flu season, which usually begins in late November and peaks in February. For the 2004-05 flu season, the Centers for Disease Control and Prevention (CDC) recommended that as many as 185 million Americans receive flu shots. Among those 185 million, almost half (90 million) are considered high-risk (CDC 2004, 2; GAO 2004). The high-risk population includes adults 65 and older, infants six to 23 months old, pregnant women, health care workers, those who care for children under six months old, and people with compromised immune systems or chronic illnesses such as asthma, lung cancer, and cystic fibrosis (CDC 2004; GAO 2004).

In recent years Americans have faced flu vaccine shortages on multiple occasions. For example, at the beginning of the 2000-01 flu season, demand for the vaccine outstripped supply, when problems developing a new viral strain and safety and quality control issues temporarily delayed vaccine delivery by 6-8 weeks (Cohen 2002, 1999; GAO 2001b). The reduced supply resulted in an uneven distribution of available vaccines and sharp price increases as the cost of flu shots more than doubled from the previous season (GAO 2001b, 2). In 2001-02, three manufacturers produced 87 million doses of which almost one-third were not available when demand for the vaccine peaked. The following year supply exceeded demand when only 87% of the 95 million doses produced were purchased. In 2003-04, demand exceeded supply when 4 million doses were discarded and 87 million doses were inappropriate for that year’s flu strain (Brown 2004; GAO, 2001b, 2004).

The Institute of Medicine (IOM) notes that these recent shortages have “highlighted the fragility of vaccine supply” which is further complicated by declining financial incentives
Flu Vaccine Case Study

to develop and produce vaccines (IOM 2003, 1). The high-risk market, long-term exorbitant production costs, and low profit margins have reduced the number of vaccine manufacturers in the US, from more than 25 companies 30 years ago to only five in 2003 (IOM 2003, 1).

The production of the flu vaccination is a risky and long-term venture for numerous reasons.

1. Opening new facilities can take five or more years due to high Federal Drug Administration (FDA) quality standards.

2. Producing the flu vaccine takes six to eight months and the formula cannot be altered once production has begun.

3. Manufacturers must reformulate the vaccine annually to address new influenza strains, preventing manufacturers from reusing excess supplies from the previous season.

4. There is extensive risk associated with predicting supply and demand for the flu vaccine because there is no mechanism for predicting the market.

5. Demand and supply in the flu vaccine market tend to be fickle, shifting from year to year or month to month based on the severity of the flu season, public health efforts to promote vaccination, and the timing of vaccine availability.

6. The profit margin for producing the flu vaccine is low because vaccines are sold at a low price relative to the high time, risk, and cost of producing safe and efficient vaccines.

7. Producing vaccines is particularly unprofitable in comparison to developing pharmaceutical drugs which patients purchase on a daily basis.

Precipitating Factors in the 2004-05 Flu Crisis

By 2004, two companies, Aventis and Chiron, produced all the flu vaccine for the US and hoped to provide 100 million dosages for the 2004-05 flu season. In August 2004, Chiron, a California-based company, announced to the FDA and the Medicines and Healthcare Products Regulatory Agency (MHRA) in Britain that the 48 million doses produced at Chiron’s plant in Liverpool, England, had been contaminated. Concerns about quality and safety at the Liverpool plant emerged as early as 2003 following an FDA inspection. At that time, however, the FDA allowed Chiron to voluntarily fix the problems and, based on reassurances from Chiron, the US government believed the bacterial contamination issue would be resolved. The FDA proceeded to communicate
with Chiron via letters, emails, and phone calls, while the MHRA took a more proactive approach including inspections of the plant (Brown 2004).

In October 2004, to the surprise of the US government, the MHRA suspended Chiron’s license and closed the Liverpool plant. Dr. Shaffner of the National Vaccine Advisory Committee stated, “we have been reassured on a regular basis” that the contamination at Chiron was not going to be a major problem (Pollack 2004, 3). Tommy Thompson, Secretary of Human and Health Services reported, “we had no idea” this suspension would occur (Pollack 2004b, 1). By mid-October the FDA confirmed that none of the Chiron vaccine could be salvaged.

Media frenzy and public outrage followed the announcement that Americans would not receive almost half of the expected 100 million dosages of the flu vaccine. Across the nation long lines formed outside health clinics while others rushed to Canada for the flu shot. As with the 2000-01 vaccine shortage, when demand surpassed supply, reports of price gauging immediately appeared. For example, a pharmacist was reportedly offered 10 doses that usually cost $67 for $700 (Altman 2004). Meanwhile Shore Memorial Hospital in New Jersey was offered 8,000 doses, which had been illegally smuggled into the US, at the price of $60 each (Associated Press 2004a). Besides price gauging, in a more extreme case, 620 vaccine dosages were stolen from a Colorado pediatrician’s office (Belluck 2004).

In addition to the rising cost of flu shots, distributing available vaccines quickly became a problem. The distribution issues came as no surprise to federal officials or health care workers who have long known about the fragility of the US vaccine market. Following the 2000-01 vaccine shortage the GAO published a report outlining the issues related to vaccine shortages and recommending policies to prevent future problems. The report’s primary concern was that there is “no system to ensure that high-risk people have priority when the supply of vaccine is short” (General Accounting Office 2001b, 3).

Because the production, sale, and distribution of the flu vaccine are private enterprises, the available 2004 vaccine supply was unevenly distributed throughout the nation. Those health facilities that ordered the vaccine from Chiron were left with no dosages, while others, supplied by Aventis, had their entire order filled immediately. Distribution is based on type of health care provider, not the level of risk among patients. Public officials know very little about how flu vaccine supplies are shipped and to whom, making it difficult to impossible for the government to intervene in the distribution of the available vaccine produced by Aventis.

The CDC responded to distribution concerns by recommending that health care providers ration the vaccine to high-risk patients. However, because the CDC lacks the authority to intervene in the distribution process or enforce guidelines, the recommendation left states, health care centers, county health departments, and doctors to determine how to distribute the vaccine. Many flu shot providers asked healthy adults to voluntarily pass up the vaccine, leaving available supplies for high-risk individuals. In Maryland, the state immunization center operated as a vaccine broker to ensure that public health agencies
received 100% of their orders. Meanwhile, in Virginia, the state divided available vaccines proportionately to census data (Levine 2004b). In rare cases, such as the District of Columbia, flu shots were strictly reserved for high-risk patients (Levine 2004a). However, in general, city and state officials did not deny the vaccine to healthy people who wanted it.

In response to price gouging and distribution issues the CDC created a panel to investigate the ethics of distributing the flu vaccine. In addition, a Federal task force, the Flu Action Task Force, was convened to manage the federal vaccine supply, coordinate efforts, and prevent price gouging (Harris 2004b). By mid-October, federal agencies began distributing their store of flu dosages to high-risk areas and within one week a total of 3.2 million doses had been sent to high priority groups. That same week many hospitals began sharing flu vaccine supplies. The federal government also diverted an additional 300,000 doses from federal employees and the military to the high-risk civilian population.

Once it was confirmed that the entire Chiron supply was unsalvageable, the federal government began to look overseas for additional doses. Tommy Thompson announced that Aventis would have 2.6 million more doses of the flu vaccine by January 2005. The US also began negotiating with an ID Biomedical plant in Canada and GlaxoSmithKline in Germany to purchase additional doses. Unfortunately, those purchases were delayed as they awaited FDA approval. By early December President Bush confirmed that the US would purchase 1.2 million doses from Germany (Connolly 2004b) (1). The FDA requires patients to sign a consent form for the more costly doses from Germany since they are not licensed in the US.

Many state officials also began looking for alternative methods to obtain the vaccine for their high-risk populations. Illinois Governor Rod Blagojevich (D) located 750,000 doses overseas and requested permission from the FDA to purchase them. In New York City, Mayor Michael Bloomberg (R) requested 500,000 dosages of the flu vaccine from federal health agencies for high-risk residents. When that request was denied, Bloomberg decided to spend $2 million to buy vaccines from manufacturers in Germany and Canada however that purchase too would require FDA approval (Connolly 2004a).

Unfortunately, previous experience indicates that people will not rush to purchase these delayed supplies. For example, during the 2000-01 flu season, the late shipments went unused or sold at very low prices. According to Rod Watson, president of Prevention MD, an immunization and medical screening company in Seattle, he cancelled numerous flu-shot clinics in October, and by December 2004 had excess shots he could barely give away let alone sell (Associated Press 2004b). The same lack of demand occurred in states such as California, Colorado, and Texas despite the fact that December vaccinations would still protect many people during the peak flu month, February.

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Attachment 1 - Influenza Facts and Figures

- Influenza causes approximately 36,000 deaths and 200,000 hospitalizations annually in the US.
- Nearly 90 million Americans are at high risk for getting the flu.
- Estimated annual costs of the flu to the US economy are $11 - $18 billion.
- As of 2004-05, two companies, Aventis and Chiron, produce all flu vaccines for the US and deliver that vaccine in October and November.
- In 2003-04 the US had 80 million doses of flu vaccine (ironically, they were not appropriate for that year’s flu strain).
- In 2000-01 delivery of the flu vaccine was delayed until December because of a vaccine production problem.
- Health officials have warned about the fragile vaccine situation in the US for decades (Cowley, 2005).
- The “Flu vaccine marketplace has been withering for years” (Thompson, 2005).
**Attachment 2 - Flu Time Line 2004**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
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<tbody>
<tr>
<td>Aug 26, 2004</td>
<td>Bush administration announces first national plan for how US can prepare for and respond to an influenza pandemic. Tommy Thompson, secretary of health and human services said, “A pandemic virus will likely be unaffected by currently available flu vaccines”</td>
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<tr>
<td>Aug 27, 2004</td>
<td>Chiron announces contamination of 50 million doses (nearly half the US supply) of flu vaccine. Chiron is based in California, but manufactures the vaccine in Liverpool, England. About 90% of the vaccines produced at Chiron go to the US. US government and Chiron both contend that the flu vaccine problem would be resolved by Oct/Nov when Americans receive flu vaccinations.</td>
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<tr>
<td>Oct 5, 2004</td>
<td>UK suspends Chiron’s license. The Chiron license suspension came as a surprise to the US government. “We had no idea,” said Tommy Thompson. Dr. Schaffner of the National Vaccine Advisory Committee stated that “we have been reassured on a regular basis” that the contamination at Chiron was not going to be a major problem.</td>
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<td>Oct 7, 2004</td>
<td>CDC recommends rationing vaccine to high risk patients only</td>
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<td>Oct 8, 2004</td>
<td>CDC says that someone will investigate reports of price gauging, but does not specify what agency. AP reports charges against a Kansas distributor who tried to sell vaccine with 1,000% markup.</td>
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<tr>
<td>Oct 12, 2004</td>
<td>House Government Reform Committee opens investigation of FDA response to August reports of contamination problems at Chiron. CDC and FDA may have known about Chiron’s license suspension and shortage as early as Sept 13th.</td>
</tr>
<tr>
<td>Oct 13, 2004</td>
<td>620 vaccine doses stolen in Colorado</td>
</tr>
<tr>
<td>Oct 13, 2004</td>
<td>Feds begin to distribute flu dosages and divert vaccines to high risk areas</td>
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<tr>
<td>Oct 15, 2004</td>
<td>DC denies flu shots to non high-risk people</td>
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<tr>
<td>Oct 17, 2004</td>
<td>FDA confirms no vaccines from Chiron can be salvaged</td>
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<tr>
<td>Oct 18, 2004</td>
<td>Tommy Thompson announces Aventis will have 2.6 million more doses of flu vaccine in January 2005.</td>
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<tr>
<td>Oct 18, 2004</td>
<td>US negotiating with Canada to get 1.5 more vaccine dosages</td>
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<tr>
<td>Oct 20, 2004</td>
<td>Canadian doctors asking for Canadian ID before giving vaccine. Canadians argue Bush administration is hypocritical by not allowing Canadian drugs into US, but then asking for flu vaccines.</td>
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## Attachment 2 - Flu Time Line 2004 (cont.)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>Oct 22, 2004</td>
<td>Tommy Thompson says, “we are prepared” and claims Bush administration increased spending on flu from $39 million in 2001 to a <em>proposed</em> $283 million next year. Thompson argues that the US has a “healthy” supply of flu vaccine and 61 million doses will be available to the 90 million high risk Americans (you do the math).</td>
</tr>
<tr>
<td>Oct 22, 2004</td>
<td>3.2 million doses sent to high priority groups</td>
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<tr>
<td>Oct 22, 2004</td>
<td>Many Americans go to Canada for vaccination</td>
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<tr>
<td>Oct 22, 2004</td>
<td>US looking to Europe for vaccines (France!)</td>
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<tr>
<td>Oct 28, 2004</td>
<td>CDC creates panel on ethics of vaccine distribution</td>
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<tr>
<td>Oct 28, 2004</td>
<td>Feds divert 300,000 doses from federal employees and military to high risk civilian population.</td>
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<tr>
<td>Oct 28, 2004</td>
<td>United States identifies 5 million flu vaccine doses at Canadian and German plants, but awaits FDA approval, which should come in December.</td>
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<td>Oct 30, 2004</td>
<td>Vancouver offers special flu vaccination clinic for Americans, $40 per dose.</td>
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<tr>
<td>Nov 1, 2004</td>
<td>WHO plans a Nov 11th summit of flu makers and nations</td>
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Attachment 3- Flu Time Line 2005

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tr>
<td>Aug 12, 2005</td>
<td>ID Biomedical Corporation’s influenza virus vaccine (Fluviral) receives the FDA approval for a fast track designation. Fast track designation, a result of the FDA Modernization Act of 1997, facilitates and expedites the review of new drugs to treat serious or life-threatening diseases and address unmet medical needs.</td>
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<td>Oct 6, 2005</td>
<td>Senators Clinton (D-NY) and Roberts (R-KS) introduce legislation to ensure an adequate flu vaccine supply. &quot;Despite three shortages of seasonal flu vaccine since 2000, we still don't have the flu vaccine production and distribution infrastructure we need to ensure a stable supply and demand for seasonal flu vaccine, raising serious concerns about our ability to respond to a flu pandemic or an outbreak of avian flu,&quot; said Senator Clinton.</td>
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<tr>
<td>Oct 11, 2005</td>
<td>Indiana State Medical Association used their private stock to vaccinate high risk children. The Indiana State Department of Health uses funds from the federal program, Vaccines for Children, to stockpile doses for uninsured and underinsured children.</td>
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Attachment 4 - References


