

Meeting Report

Hospital Preparedness for Pandemic Influenza

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ON MARCH 1, 2006, the Center for Biosecurity of the University of Pittsburgh Medical Center convened a meeting of senior government officials, hospital leaders, clinicians, and public health officials on *Hospital Preparedness for Pandemic Influenza* in Baltimore, Maryland. A list of meeting participants is provided in Appendix 1. Individual comments were not for attribution so as to foster a frank and open discussion.

The purpose of the meeting was to examine ways the U.S. healthcare community, and especially hospitals, can prepare to care for the large number of patients that would be expected during an influenza pandemic. At the meeting, the group was asked to discuss the serious challenges hospitals and communities will confront, to try to reach accord on what high-level solutions should be pursued, and to examine actions and next steps that the group or others might take to bring about such changes.

To structure the meeting conversation, the staff of the Center for Biosecurity presented its initial assessment of the issues. The assessment was informed by analyzing pre-meeting discussions with the group and other government and clinical leaders and by reviewing information from a broad range of government and industry reports and peer-reviewed literature. This meeting report synthesizes the presentations given at the meeting and the group's discussions.

Initially, a vision of success in hospital preparedness was proposed:

U.S. hospitals, individually and jointly, will be able to provide medical care for flu victims while maintaining other essential medical services in the community during and after a pandemic.

BACKGROUND BRIEFING

The staff of the Center for Biosecurity presented a briefing on the current state of avian influenza, hospital preparedness, and the threat of pandemic influenza.

- According to Robert Webster of St. Jude Children's Research Hospital, H5N1 "is the most lethal influenza virus we have ever seen."¹
- As of March 1, 2006, outbreaks of the disease in birds had been detected in 30 countries over a 25-month period, representing the first known highly pathogenic avian influenza (HPAI) panzootic (a global disease outbreak in animals). Eighteen of the 30 countries had begun experiencing outbreaks in the preceding month alone;² 173 human cases had been confirmed by WHO, with a case fatality rate of approximately 50%.³
- There are several uncertainties related to the potential of an H5N1 pandemic if it should become easily transmissible from person to person:
 - Currently, the case fatality rate of human H5N1 infection is approximately 20 times that of the 1918 H1N1 virus (2.5%), but it is unclear whether increased transmissibility would be associated with a significant reduction in mortality.
 - It is not known if increased transmissibility would occur suddenly (through reassortment) or gradually (through accumulation of mutations), or whether this would happen in one location or many.
 - Historically, flu is transmitted, at least in part, by asymptomatic individuals. It is unclear if the transmission pattern of a completely novel pandemic flu would be the same.

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- There are a number of serious concerns:
 - Vaccine production capacity is still extremely limited.⁴
 - The current human H5N1 trial vaccine is poorly immunogenic and not well matched to the dominant circulating strain.⁵
 - The supply of oseltamivir is very limited, and there is a recognized potential for antiviral resistance to evolve.^{4,6}
 - Surveillance for H5N1 infection in both birds and people is imperfect.
- Whether or not H5N1 causes the next pandemic, pandemics do occur with some regularity.
- Thirty recognized influenza pandemics have occurred in the 426 years since the first one was described in 1580. Three occurred in the last century, varying in lethality from 1 million deaths worldwide in 1968 to 50 million deaths worldwide in 1918.⁷
- According to Secretary of Health and Human Services (HHS) Michael Leavitt, pandemic planning should be based on a 1918-like pandemic.⁸
- Pandemics spread quickly; in both 1918 and 1957, the outbreak spread across the U.S. in a matter of weeks.⁹
- For example, during a 10-day period in October 1918 in Philadelphia, daily influenza deaths increased from 1 per day to 759 per day. In the peak week of October 1918, 4,597 Philadelphians died of flu, and a total of 15,000 people died during that month.¹⁰
- In 1918, there were no antiviral medications, antibiotics, mechanical ventilators, IV fluids, oxygen, or intensive care units.
- While it is unclear to what extent modern medical care would improve chances of survival, it is clear that people would expect the full spectrum of medical care to be available to them.
- For planning purposes, we must assume that neither vaccine nor antivirals will be available to help deal with a pandemic during the first wave, and that the federal government will not be able to provide special resources to all or even many of the local communities served by the 5,000 U.S. hospitals.
- The impact of a 1918-like pandemic on U.S. hospitals may be estimated using the HHS planning assumptions for a severe pandemic¹¹ and CDC's FluSurge 2.0 software,¹² middle of the road variables for duration of the local outbreak and attack rate (8 weeks and 25%, respectively), and default values for all other assumptions (length of stay, percent of patients needing ventilators, etc.). This modeling projects that at the peak of the outbreak (week 5), the following percentages of available hospital resources would be needed for influenza patients alone:
 - 191% of non-ICU beds
 - 461% of ICU beds
 - 198% of ventilators
- The current status of U.S. hospitals and, by implication, their ability to handle such a load can be illustrated by the following:
 - 30% of U.S. hospitals are currently losing money; of those that are profitable, the operating margins average 1.9%.
 - 45 million Americans are uninsured; \$25 billion per year in uncompensated care is provided by U.S. hospitals.
 - There are shortages of healthcare workers of all kinds—for example, 100,000 additional RNs (8% of workforce) are needed.
 - 48% of emergency departments report being at or over capacity.
 - 46% of emergency departments had spent time “on diversion” (i.e., they needed to divert patients to other hospitals) for some period of time during a calendar year, due primarily to lack of inpatient beds.
 - The numbers of hospitals, hospital beds, and ERs have all decreased in recent years.¹³

KEY CHALLENGES AND POSSIBLE SOLUTIONS

The Center for Biosecurity staff presented an analysis of key challenges in hospital preparedness and some possible solutions or paths forward, which the group discussed. The key themes of the discussion are summarized below.

Key Challenge #1: Hospital “preparedness” is not clearly defined.

- HHS has promulgated a comprehensive checklist of pandemic preparedness tasks that hospitals should undertake, but implementation of the items on the checklist is hampered by a lack of specificity, priorities, and metrics.
- The HHS checklist is not harmonized with existing HRSA (Health Resources and Services Administration) bioterrorism benchmarks or JCAHO (Joint Commission on Accreditation of Healthcare Organizations) standards.

Proposed Solution #1: A revised, prioritized hospital pandemic preparedness plan

- HHS, with advice from hospitals, outside experts, and JCAHO, should revise its pandemic plan for hospitals to define specific, nationally sanctioned preparedness goals, priorities, and metrics.
 - The revised plan should distinguish responsibilities of individual hospitals from regional responsibilities.
 - The revised plan should be aligned with existing HRSA benchmarks and JCAHO standards.

- Priorities for hospital preparedness should be clearly stated; for example:
 - Establish a plan to achieve specific surge capacity targets, based on FluSurge projections using standardized assumptions.
 - Enumerate tasks essential for hospital operations, such as limiting the spread of disease within the hospital in order to prevent hospitals from becoming amplifiers of the epidemic and to protect hospital staff who are essential to maintaining hospital services.
 - Identify tasks that require significant advanced planning, such as establishing protocols for the use of antivirals and creating protocols for the deferral and limitation of medical services.
- The plan should set *specific* and *measurable* goals. The items below are meant to be illustrative only; a process for proposing metrics will be developed after the meeting:
 - Every hospital should be prepared, with 1 week's notice, to accommodate numbers of influenza patients equivalent to 30% of listed bed capacity ("surge").
 - Every hospital should participate in a regional plan for the medical care of flu patients in numbers up to 200% of existing regional hospital capacity ("supersurge").
 - Every hospital should stockpile, or assure access to a stockpile of, personal protective equipment (PPE) sufficient for 8 weeks.

Group Discussion of Challenge #1

- A lack of specific targets and a lack of a generally accepted, defined, and transparent methodology for planning are paramount obstacles at present to hospital preparedness planning. HHS should provide leadership in developing a nationally sanctioned, specific, and prioritized pandemic planning list that includes clear metrics for measuring hospital pandemic preparedness.
- HHS should coordinate efforts and seek endorsement of an acceptable planning framework from major organizations and government bodies such as HRSA, JCAHO, the American College of Emergency Physicians, the Association of Academic Health Centers, etc. This process should be done in coordination with regional hospitals (and associations) and health departments.
- The methodology for developing specificity and priorities needs to be transparent. Pandemic preparedness mandates should be harmonized with existing hospital preparedness requirements (i.e., HRSA, JCAHO) with the goal of creating a synchronized and jointly prioritized list.
- Implementing the list will require a marked increase in the level of federal funding. Funding to meet the objectives of the nationally sanctioned list will need to be distributed in a timely manner (commensurate with the desired rate of progress). The group agreed that, to ensure institutional ownership of hospital preparedness planning, special efforts should be made to capture the attention of hospital leaders.

Key Challenge #2: Some key preparedness tasks cannot be accomplished by hospitals individually.

- Regional resource allocation, patient redistribution, and use of alternative care sites all require collaboration among hospitals, and among hospitals and public health and emergency management agencies, both in planning and in response.
- Effective recruitment, training, credentialing, and deployment of volunteer health and hospital workers require cooperation among hospitals, which might otherwise be competing for the same volunteers.
- The scientific, ethical, and legal frameworks for decisions regarding the allocation of limited healthcare resources and the need for possible alterations in standards of care under epidemic circumstances must be considered collectively to be deemed legitimate.
- There are significant barriers to collaboration among hospitals. The U.S. has a highly fragmented, private, and competitive hospital sector with inherent disincentives for collaboration.
- In most communities there are no administrative or legal mechanisms to coordinate these functions, and there is limited operational coordination among hospitals, public health agencies, and emergency management agencies.

Proposed Solution #2: "Regional" Hospital Planning and Response Groups (RHPRGs)

- Local groups should be established across the country to involve every general hospital. The essential functions of such groups would be to:
 - Standardize planning and preparedness among the participating hospitals;
 - Expand the role of hospitals in traditional emergency operation centers;
 - Enable the sharing of assets, staff, and patients among the hospitals;
 - Share situational awareness in disasters among the hospitals and between hospitals and other agencies;
 - Coordinate the implementation of the surge process (the expansion of patient capacity within individual hospitals while retaining near-normal practice standards) and the supersurge process (the further expansion of patient capacity involving use of alternative care sites and/or significant alteration in practice standards);
 - Facilitate a communitywide approach to ethical and political challenges (e.g., altered standards of care);

- Serve as an advisory body to public health and elected officials on medical issues;
- Communicate with the public and the media; and
- Establish systems for jointly recruiting and coordinating volunteers.
- A number of important questions remain regarding the regional planning groups:
 - Who should be responsible for creating RHPRGs? Is membership mandated or voluntary? Who should chair the meetings? Is it the state health commissioner or his/her designee or someone else? What legal authorities are needed?
 - Who are the participants? Do they include public health, Red Cross, HMOs, the Veterans' Administration and military hospitals, etc.?
 - What is the scope of responsibilities (intrahospital medical care vs. communitywide provision of medical care)?
 - What is the process for resolving these issues?

Group Discussion of Challenge #2

- Regional coordinating groups are critical for hospital preparedness and response, but getting hospitals to accept and join in the effort may be difficult. Therefore, incentives for regionalization need to be created.
- Regional coordinating groups must include medical and nonmedical stakeholders (in all disciplines) and must be organized in coordination with public health and emergency management agencies.
- These groups should function for all hazards. Some group members pointed out that the regional command structure is foreign to hospitals, but they will need to be educated and integrated into the unified command within the region.
- Regional hospital organizations should coordinate information flow, serve as information clearinghouses, coordinate regional alterations in standards of care, and represent hospital operations by integrating into the larger incident command structure as well as serve as a joint decision-making body.
- Some group members pointed out that regional coordinating groups will be essential in providing consistent public messages during a pandemic.
- It will be important to clarify who “owns” the responsibility for organizing regional coordinating groups. One group member pointed out that while public health needs to make sure that there is a plan to respond, this does not mean that public health has to be the one to carry out the response.
- Some group members felt that membership in these regional coordinating groups should be mandatory for hospitals and should include outpatient care facilities.

Key Challenge #3: The demand for health care will exceed capacity.

- In a severe pandemic, it will not be possible to provide traditional hospital care to all who need it. There will not be enough beds, supplies, or trained staff to take care of all the sick people, using normal practice standards.
- Hospital care will have to be reorganized through deferral of some services, rationing, and altered standards of care in order to do the “greatest good for the greatest number.”
- Hospitals will need to defer nonurgent services, but few hospitals have any processes in place to decide what services can be delayed and for how long.
- While many experts recognize the need to ration care in a severe pandemic, there are no nationally sanctioned scientific, ethical, or legal frameworks for the optimal allocation of scarce medical resources. The creation of such frameworks—even the discussion of them—is potentially politically charged; therefore, transparency, fairness, and consistency are critical to public acceptance.

Proposed Solution #3: A framework for optimal allocation of limited medical resources

- A three-tiered framework of guidelines for decision making should be created. This would consist of:
 - National: A national blue ribbon commission appointed by the Secretary of HHS to develop consensus guidelines based on evidence, ethics, and law;
 - Regional: Regional joint decision-making bodies to apply national guidelines to local conditions; and
 - Hospitals: A team of senior clinicians to implement the guidelines as they apply to individual patients.
- Among the issues that would need to be examined are:
 - Deferral of services
 - Admission/discharge criteria
 - Criteria for use of resource-intensive care
 - Alteration of practice standards
 - Alternative care sites

Group Discussion of Challenge #3

- There is an urgent need for a decision-making process for altering standards of care, because such complex decisions will need to be made in advance of a crisis.
- It will be important that plans to modify standards of care be developed transparently, with public input.
- Ways of modifying patient care to make it more efficient in times of crisis (e.g., limiting the number of times the pharmacist must check medications) must be evaluated. The group also suggested that crisis condi-

tions may necessitate modifying the types of duties particular professionals are able to perform and providing “just-in-time” training to support these modifications.

- The group discussed the need to establish thresholds for setting up alternative sites of care, to identify the roles and services to be provided at these facilities, and to determine how they will integrate with the hospitals.
- Group members felt that, while HHS’s role is not to dispense clinical advice, it is unclear who does have the responsibility to coordinate decisions regarding degradation of care. In particular, hospitals will need guidance so that local decisions can be made under the security of a national umbrella.
- The group strongly supported development of a communications plan for altering standards of care. In particular, they underscored the importance of education campaigns to inform Americans that usual standards of care may not be possible during a pandemic.
- It will also be important to make sure that all practitioners are involved (including MDs, PAs, RNs, etc.) to ensure that those delivering care fully understand and comply with developed standards.
- The group encouraged more research so that providers have data to support decisions with regard to diminishing or withdrawing care.

Key Challenge #4: A critical shortage of hospital workers will occur.

- In a pandemic there will be high absenteeism of all hospital staff (not just clinical staff) due to illness, family responsibilities, or fear of contagion.
- Mutual aid agreements for sharing personnel will be of limited use in a pandemic that affects all hospitals, because there will be no personnel to share.
- Deployable federal medical assets (such as DMAT teams) and fixed federal assets (such as Veterans’ Administration and Department of Defense facilities) are unlikely to be available or of much use, since they also will be affected by the pandemic.
- There will be many demands on the few volunteers who are available.

Proposed Solution #4: Volunteers to maintain medical services

- In addition to protecting the existing healthcare workers, every effort should be made to develop efficient and consistent local systems for volunteer enlistment, credentialing, and call-up.
- For licensed healthcare volunteers (e.g., retired healthcare workers, trained clinicians working in other fields,

etc.), there should be enhanced funding and development of the state-based Emergency System for Advanced Registration of Volunteer Health Professionals (ESAR-VHP).

- Credentialing guidelines should be uniform from state to state, and liability protection in emergencies should be made national in scope.
- For lay volunteers there is a need to organize the many existing nonintegrated local volunteer systems. The Citizen Corps Council may provide a platform for such state-based registration and coordination.

Group Discussion of Challenge #4

- A national system (such as ESAR-VHP) is needed that can register medical and nonmedical emergency volunteers in advance and verify their licenses and credentials.
- Recruiting volunteers may present challenges. Some members of the group pointed out that healthcare workers may not see themselves as part of public health or emergency response actions, and, therefore, work must be done to encourage active participation in disaster preparedness and response. One member also pointed out that ESAR-VHP is scary to some healthcare professionals because they don’t understand the program requirements; some have wondered whether signing on would mean they could be involuntarily drafted in a health emergency.
- In order to make volunteer programs more functional, there is a need to collect more information regarding individual competencies, to establish more uniformity among states, and to set standard requirements for training. One participant suggested that volunteers should be given some form of identification, such as a SMART card, that could readily verify skills and credentials in an emergency.
- To improve the pool of ready volunteers, it may be necessary to plan for “just-in-time” training for family caregivers and to encourage participation by medical professionals who will not be working because elective procedures are cancelled.
- One participant cautioned that during a crisis it may not always be feasible to provide optimal personal protection for staff members, particularly in light of the expected supply problems.
- It would be useful to determine the immune status of volunteers so that recovered individuals can help out during a pandemic.
- Some working group members urged consideration of “paid volunteers” and targeted incentives to encourage participation of medical staff who will be most in demand, such as respiratory therapists and nurses.

Key Challenge #5: Federal funding levels for hospital preparedness are inadequate.

- The National Bioterrorism Hospital Preparedness Program (under HRSA) has provided funding to hospitals of approximately \$500 million per year nationally since 2002, and the FY07 request is \$487 million. This comes to about \$100,000 per year per hospital. In December 2005, Congress appropriated \$350 million for state and local public health departments for pandemic preparedness; however, none of this appropriation is specifically identified for hospitals.
- The Center for Biosecurity's rough calculation of the minimum costs of realistic readiness for a severe (1918-like) pandemic indicates a need for at least \$1 million for the average size hospital (164 beds). The component costs to achieve minimal preparedness include:

Develop specific pandemic plan	\$200,000
Staff education/training	\$160,000
Stockpile minimal PPE	\$400,000
Stockpile basic supplies	\$240,000
	\$1 million per hospital

- With approximately 5,000 general hospitals in the U.S., the national cost for initial preparedness would be \$5 billion. In addition, there would be recurring annual costs to maintain preparedness, estimated to be approximately \$200,000 per year per hospital.
- Note that these figures exclude stockpiling antivirals, since there is a separate national plan to acquire these drugs. In addition, no monies are included for purchases of expensive equipment such as mechanical ventilators, since it is not clear that extra ventilators would be useful if there were no trained personnel to operate them. A rough estimate of the cost to double the number of ventilators in the country, using safe but inexpensive equipment, is \$1 billion.

Proposed Solution #5: Increase funding for preparedness

- HHS should urgently designate a working group to calculate more precisely the cost of hospital preparedness based on consensus planning assumptions.
- Based on the conclusions of this group, Congress should appropriate the required funds in an emergency supplemental appropriation to be distributed to hospitals using the existing HRSA funding mechanism with some modifications.
- HRSA should limit the amount of money that state health departments can retain for overhead.

- The funding to hospitals should be tied to achievement of clearly defined goals, using metrics built into the pandemic plans for hospitals and with a mechanism for holding hospitals accountable.

Group Discussion of Challenge #5

- Regional planning should be funded through the RHPGs. At this point it is impossible to estimate this cost until these organizations are more clearly defined.
- Federal funding for hospital preparedness must be significantly increased and must be made sustainable to allow for long-range planning.
- Healthcare should be integrated into homeland security and funded over the time span that hospitals will need to meet these requirements.
- The group emphasized the need for an officially sanctioned analysis of what it will cost to get hospitals prepared.
- The group cited the failure of national leaders to recognize or pay for the full cost to hospitals for training and educating staff and the lack of funding designated for research.

Key Challenge #6: A severe pandemic may threaten hospitals' solvency.

- Under current healthcare reimbursement schemes, hospitals lose money on nearly every illness-related hospital admission—especially those, like pneumonia, that are likely to result from flu. Normally, hospitals offset these losses with profitable elective procedures, but these elective cases will be among the first services to be cancelled or deferred in an attempt to respond to the demands of flu patient care during an epidemic.
- Hospitals' revenue flow can be expected to decrease significantly during a pandemic, even though they will be experiencing record-high patient volumes. In addition, hospitals will undoubtedly need to provide care to many more patients who are uninsured and/or unable to pay. At the same time, operating costs in a pandemic will be extraordinarily high. Hospitals will have to pay a premium for staff and materiel that are in short supply. According to the AHA, the average hospital has only 41 days of cash on hand; thus, many hospitals may have insufficient cash reserves to survive a severe pandemic that significantly interrupts operations for weeks.

Proposed Solution #6: Federal emergency financial aid to hospitals severely affected by a pandemic

- HHS should develop, and Congress should fund, a program to reimburse hospitals for uncompensated care and extraordinary costs as a result of a pandemic.

This could be done by amending the existing Stafford Act.

- In addition, the government should provide loan guarantees to offset transient negative cash flow due to deferral of profitable elective services (with the presumption that the deferred services will be provided later).
- Whatever the mechanism of financial relief for hospitals, it is essential that they have advance notice of qualifications for reimbursement (e.g., data collection requirements).

Group Discussion of Challenge #6

- Hospitals would become insolvent if they faced a 1918-like flu pandemic. One participant noted that according to a survey of NYC hospitals (pre- and post-9/11), hospitals are spending on average \$2.5 million per year on preparedness (not including pandemic preparations).
- Collaborative planning is needed for the best application of funding.
- The group strongly supported the need to take into account the liability of the individual and the institution in calculating the costs of preparedness.
- With respect to possible federal reimbursements, it is critical that hospitals know in advance what information they need to collect to get reimbursed. Data collection reimbursement forms and requirements should be harmonized with activities that hospitals routinely perform (i.e., this data collection should not be an additional burden to hospitals).
- Individual providers will need compensation for lost services.

THE PATH FORWARD AND NEXT STEPS

The Center for Biosecurity presented a series of considerations and options for next steps and the path forward toward hospital preparedness. Group discussion followed.

What Congress Can Do:

- Direct funding for hospital pandemic preparedness
 - \$5 billion emergency funding
 - \$1 billion per year thereafter
- Legislation to ensure hospital solvency
- Legislation to support the use of volunteers to maintain medical services
 - Funding and development of state-based volunteer systems
 - National liability protection for professionals, volunteers, and institutions in emergency service across state lines

What the Administration Can Do:

- Issue a presidential “call to service” for hospital preparedness.
- Revise the pandemic plan for hospitals with metrics and accountability, including mandatory participation of hospitals in RHPRGs.
- Convene a national expert commission to develop guidelines for allocating limited medical resources.
- Build on ESAR-VHP to include nonmedical volunteers, and integrate it with other existing volunteer programs.

Other Things that Might Be Considered:

- Pandemic simulation exercise
- Educational conferences for hospital leaders and clinicians
- Media campaign to raise public awareness
- Targeted appeals to political leaders (e.g., governors)

Group Discussion:

- The Center for Biosecurity agreed to finalize a meeting report and to brief HHS leadership on the outcome of the group meeting.
- A series of additional initiatives were discussed and considered by the group, including:
 - Briefing Congressional members or staff
 - Developing specific metrics and priorities for hospitals
 - Calling for an expert bipartisan commission (9/11 style) to define, prioritize, and measure hospital preparedness. The commission should have a short time frame (3–4 months).
 - Creating a clearinghouse for ideas, protocols, and best practices—perhaps a role for the Center for Biosecurity
 - Calling for a national pandemic “czar” or at least further clarification of federal roles and responsibilities
- The group resolved to consider these and other initiatives related to hospital preparedness in the time ahead, with priorities for action dictated in part by near-term steps taken by the Administration and Congress.

REFERENCES

1. Maldin B, Inglesby TV, Nuzzo JB, et al. Bulls, bears, and birds: preparing the financial industry for an avian influenza pandemic. *Biosecur Bioterror* 2005;3(4):363–367.
2. OIE [World Organization for Animal Health]. *Update on Avian Influenza in Animals (Type H5)*. Paris: OIE; March 1, 2006. Available at: http://www.oie.int/download/AVIAN%20INFLUENZA/A_AI-Asia.htm. Accessed March 1, 2006.
3. World Health Organization. *Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1) Re-*

- ported to WHO. Geneva: World Health Organization; 2006. Available at: http://www.who.int/csr/disease/avian_influenza/country/cases_table_2006_04_04/en/index.html. Accessed March 1, 2006.
4. U.S. Department of Health and Human Services. *Pandemic Planning Update*. Washington, DC: U.S. Department of Health and Human Services; March 13, 2006. Available at: <http://www.pandemicflu.gov/plan/pdf/panflu20060313.pdf>. Accessed April 12, 2006.
 5. Treanor JJ, Campbell JD, Zangwill KM, Rowe T, Wolff M. Safety and immunogenicity of an inactivated subvirion influenza A (H5N1) vaccine. *N Engl J Med* 2006 Mar 30;354(13):1343–1351.
 6. de Jong MD, Tran TT, Truong HK, et al. Oseltamivir resistance during treatment of influenza A (H5N1) infection. *N Engl J Med* 2005 Dec 22;353(25):2667–2672.
 7. Lazzari S, Stohr K. Avian influenza and influenza pandemics. *Bull World Health Organ* 2004 Apr;82(4):242.
 8. U.S. Department of Health and Human Services/State of Maryland Summit on Influenza Pandemic; Baltimore, Md, February 26, 2006.
 9. Crosby AW. *America's Forgotten Pandemic: The Influenza of 1918*. New York: Cambridge University Press; 1989.
 10. Barry JM. *The Great Influenza: The Epic Story of the Deadliest Plague in History*. New York: Viking Penguin USA; 2004.
 11. U.S. Department of Health and Human Services. *Pandemic Influenza Plan*. Washington, DC: U.S. Department of Health and Human Services; November 2005. Available at: <http://www.hhs.gov/pandemicflu/plan/pdf/HHSPandemicInfluenzaPlan.pdf>. Accessed April 12, 2006.
 12. U.S. Centers for Disease Control and Prevention. *FluSurge 2.0 Software*. Available at: <http://www.cdc.gov/flu/flusurge.htm>. Accessed April 12, 2006.
 13. American Hospital Association. *Taking the Pulse 2005: The State of America's Hospitals*. Chicago: American Hospital Association; 2005. Available at: <http://www.aha.org/ahapolicyforum/resources/content/TakingthePulse.pdf>. Accessed April 12, 2006.

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