Biosecurity and Bioterrorism in Public Health

American Industrial Hygiene Conference

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Concerns about terrorism –pre 1995

- Little concern about terrorism of any type
- Control of nuclear arms development deemed to be generally effective
- Limited attention to use of chemical weapons
- Unwarranted confidence in the Biological Weapons Convention of 1972
- Intelligence capabilities limited

Biological Weapons

- A threat, largely ignored
  - Too difficult to grow
  - Technologically difficult to disseminate
  - An inherent moral barrier unlikely to be transgressed

Watershed events
Iraq -- 1995

- Papers of Iraqi bioweapons program become available
- Production and testing of anthrax
  - Aerosol studies
  - Use of drone aircraft

Concern: Deliberate development of anthrax as a weapon by a nation-state

Watershed events
Aum Shinrikyo -- Japan

- Religious cult released Sarin gas in Tokyo subway (1995)
- Cult - previously unknown to intelligence
  - Thousands of members, well-funded
  - Tried to aerosolize anthrax and botulinum toxin throughout Tokyo at least 8 times
- *Concern – unknown, non-state sponsored organization, acting without concern for moral deterrents*

Watershed events
USSR Bioweapons Program

- Secret program – not suspected until 1989
- 1992 – Ken Alibek, Deputy Director of bioweapons program, deserts
- 1995 – Full scope of program apparent
  - 60,000+ persons in 50 different labs
  - 30 metric tons of anthrax spores in storage
  - Large capacity to produce smallpox virus
- *Concern – Expertise and possibly specimens now dispersed world-wide. Still a secret program*

"On May 8, 1980, WHO announced that smallpox had been eradicated..Soon after, smallpox was included in a list of biological weapons targeted for improvement in the 1981-85 Five -Year Plan...

Where other governments saw a medical victory, the Kremlin perceived a military opportunity...the military command issued an order to maintain an annual stockpile of 20 tons (of smallpox virus)."

Alibek, 1998

Civilian initiatives in national security

1995-99

- Presidential Decision Directive #39 –1995
- For terrorist threats, the solution is entirely encompassed by emergency response measures
  - Police, fire, emergency staff for rescue and to deal with chemical leaks, spills, etc
  - DoD to do the training
  - FBI to find the bad guys
  - FEMA to deal with recovery
  - Public health and medical problems – all but ignored
- Chemical and biologic weapons require the same response– hence, a new word "CHEMBIO"

Changes in capabilities

- Rapidly growing numbers and sophistication of laboratories in many countries
- Growing numbers of trained biologists
- Information access – internet
- Growth of independent terrorist groups

Biological weapons

"the poor man's nuclear weapon"

- Necessary ingredients available
- Can be produced in small facilities
- Inexpensive
- Few technical staff required
- Small quantities produce a major effect
- Easily transported from place to place

New World Coming

"While conventional conflicts will still be possible, the most serious threat to our security may consist of unannounced attacks on American cities by sub-national groups using genetically engineered pathogens."

U.S. Commission on National Security/21st Century
15 September 1999

New World Coming

- Besides nuclear weapons, biological weapons are the only other weapon class with the capacity to take the nation past the "point of non-recovery"

Admiral Stansfield Turner, former CIA Director

A reassessment of strategies – 1998-2001

- Center for Civilian Biodefense Strategies
  - Working group on priority (Class A) agents
  - Two national symposia for medical and public health professionals
  - Meaningful funding of HHS – FY 2000
  - The Dark Winter exercise (June 2001)
  - The anthrax attacks (October 2001)

DHHS --Office of Public Health Emergency Preparedness

- Emergency appropriation – January 2002 $3 billion
  - State directors for preparedness and planning
  - Surveillance and epidemiology
  - Laboratory capacity
  - IT systems
  - Training and education
  - Research on principal agents

Biological Agents of Greatest Concern

- Smallpox
- Anthrax
- Plague
- Tularemia
- Botulinum Toxin
- Hemorrhagic fevers

Agents that if released, could threaten the integrity of government

Smallpox – a diminished concern

- Risk is small but a potential for global catastrophe if not contained
- Stockpile is > 300 million vaccine doses
- Network of >100 diagnostic labs
- Educational materials readily available
- Acquisition of virus – not easy
- Production of weaponized smallpox – moderately difficult

Anthrax – the frightening gorilla

- B. anthracis – easy to obtain
  - Former Soviet laboratories
  - Natural infections occur around the world
    - Cases in man and animals in U.S. every year
  - Until 2003 – 46 labs offered specimens
- Demonstrable intent and capability to use
  - Aum Shinrikyo
  - Iraq
  - Russia
  - The U.S. terrorist "x" of 2002

Production and dispersal of anthrax

- Methods of production widely known
  - Only a small, modestly equipped lab needed
- Aerosols – either from powder or slurry
  - Crop dusters
  - Ambient sprayers-- easily obtained
  - Ventilation systems
  - Mail

Prevention and detection measures

- Prevention
  - Interdiction of terrorists – unlikely
  - Large scale vaccination – vaccine supply limited
- Detection
  - Biowatch – forget it
    - Launched on false premise that technology is available and that incubation period is 2-6 days
  - Biosense -- forget it
  - Early, rapid diagnosis – difficult

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Response

- Vaccination and antibiotic distribution
  - A logistics nightmare
  - Available vaccine – reactogenic, limited supply
  - Limited tolerance of antibiotic for 60 days
  - Is there a risk beyond 60 days?
  - Possibly antibiotic resistant engineered strain
- Clean-up of environment
  - How much is really needed?
  - Cumbersome, expensive and uncertain at best
- Patient treatment
  - Available therapies require early treatment
  - Longer-term after-effects appear to be a problem whatever the treatment

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Aerosols and filtration

- Most likely means for dissemination of spores
  - Indoor aerosol easiest -- requires small amount of material and little equipment. A few attacks could result in panic on a national scale
  - Outdoor aerosol release via crop duster is possible but logistically complicated, esp.wind
  - Outdoor release from a point source, vehicle or back pack subject to similar disadvantages
- Reduction of number of spores is important
  - Dose to infect 50% of exposed is ~2000 – 10,000 spores

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Working Group on indoor aerosols
Center for Biosecurity

Practical recommendations regarding currently available technologies that are not prohibitively costly nor require major renovations or retrofit.

"Improving performance of HVAC systems to reduce exposure to aerosolized infectious agents in buildings"

Hitchcock, Mair, Inglesby, et al

Biosecurity and Bioterrorism 4:41-53, 2006

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Recommendations

1. Replace existing filters with the highest Minimum Efficiency Reporting Value (MERV) filters that do not cause excessive pressure drops
2. Seal, caulk, and replace gaskets to minimize air leakage between filter and filter housing

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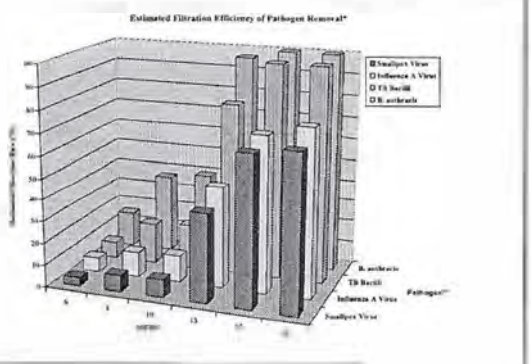

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Recommendations

3. Install filters in the outdoor air intake.
4. Change filters regularly
5. Require training programs for those maintaining HVAC systems.
6. Commission buildings.

- *Affordable, more efficient filtration systems could play a major role in reducing mortality where ever a release might take place. At present, the only other foreseeable approach toward providing a measure of greater security against an anthrax attack is routine preventive vaccination – a possible option but still a long way off.*

Pandemic Flu –a major concern
but is this exaggerated?

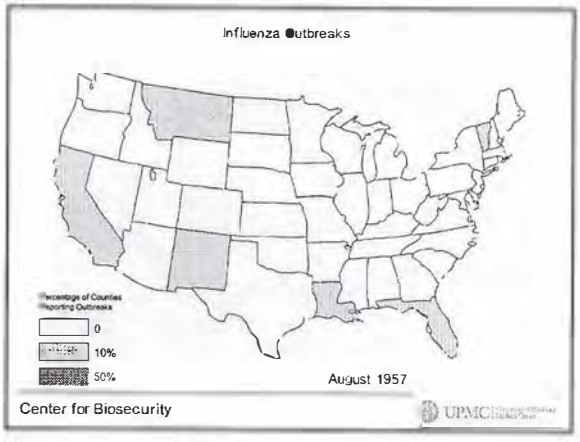
- Unprecedented behavior of a flu strain with massive deaths in poultry and 50% death rate in humans
- Influenza – 1918 – H1N1
  - Case fatality rate – about 2%
  - Deaths U.S. 675,000
    World > 50,000,000
- H5N1 influenza – 2004-2006
  - >200 cases, about 100 deaths

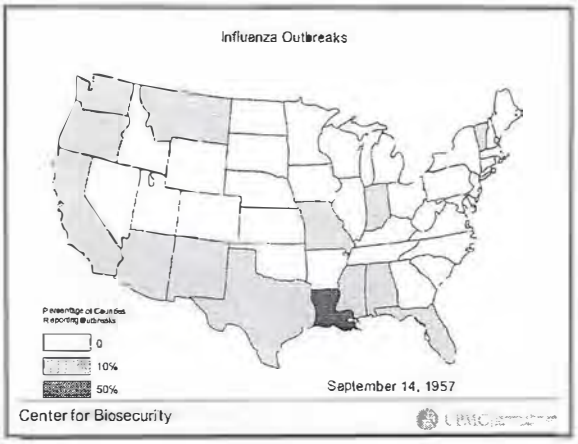
Status – May 2006

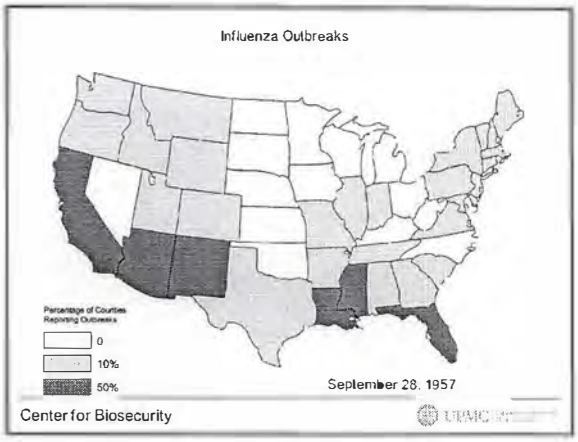
- Infected wild fowl, chickens, ducks, turkeys
  - Asia
  - Most of Europe
  - Africa
- Human cases – contacts of birds (a few patients)
  - Asia and Africa
- Massive slaughter of fowl in infected areas
- Embargo on fowl from infected areas
- Flu season – November (? September) to April

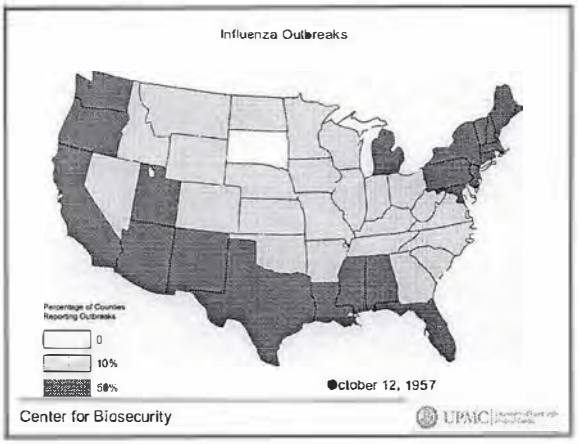
Prospects for the U.S.

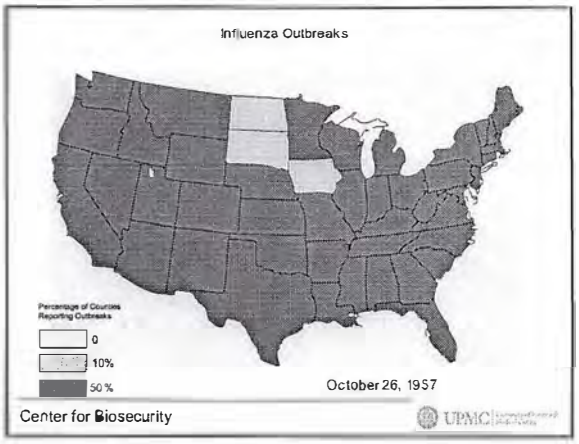
- Avian H5N1 – a virtual certainty
  - Migratory birds
  - Bird smugglers
- Pet animals – probable but limited
  - Cats
- Human pandemic flu
  - Will it occur?
  - Can it be slowed or stopped?











Key facts in planning responses

- No quarantine measure has done anything to stop or slow the spread of pandemic flu
- Expected attack rate is about 25 %
  - 25 of 100 people develop illness; 75% do not
- Patients with flu begin spreading virus one to two days before symptoms
- Duration of outbreak in a city – 10-12 weeks
- Illness lasts ~10 days; therefore, peak absentee rate because of illness = <15%

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A principal tenet in any epidemic

- Alleviate anxiety; avoid panic
  - Continuing informed communication to public
  - Change the normal social activities of the city as little as possible
  - Provide care for those who are ill

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Actions to deal with pandemic flu
constructive steps

- Vaccine – at least 3 years away
  - Necessary delay until specific strain identified. Once identified, 6 months until vaccine is available
  - Problems in production
    - Antigenicity of experimental H5N1 vaccines
    - Use of adjuvants
- Antiviral agents
  - Tamiflu
- Isolate sick patients
- Provide for care of large numbers of patients

A litany of suggested preparations
Do they make sense?

- Close borders and/or screen arriving air passengers
  - 317 ports of entry into the U.S.
  - 1.1 million passengers and pedestrians daily
  - 365,000 vehicles
- Dealing with a passenger with cough and fever
- Screening in Asia for SARS
  - 3.5 million screened for temperature- 0 cases

A litany of suggested preparations
Do they make sense?

- Reduce contact among individuals
  - Quarantine families or neighborhoods
  - Advise "sheltering in place" – for 3 months?
  - Close churches, schools, malls, events – for 3 months ?
  - Station workers 3 feet apart
- Implications for paralyzing commerce
  - Just-in-time delivery issues – food, drugs
  - Hourly workers

The principal tenets for dealing with pandemic flu -- 2006-2007

- Alleviate anxiety; avoid panic
- Provide for continuing informed communication to public
- Change the normal social activities of the city as little as possible
- Provide care for those who are ill
  - Major efforts needed to plan for a flood of patients
  - Tamiflu for treatment if available

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