Hospital Surge Capacity Strategies to Prepare for an Epidemic

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Second National Emergency Management Summit

February 3, 2008

Overview

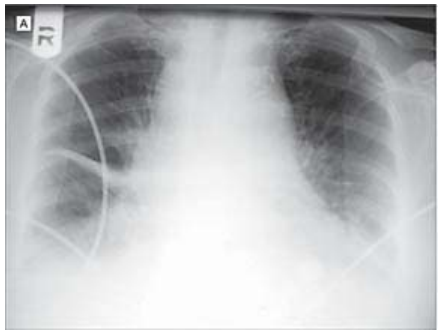
- What an epidemic is.
- How epidemics are different from other surge events.
- Specific epidemic issues.
- What hospitals should do.

What is an Epidemic?

- Outbreak of new cases of human disease substantially beyond expected
- Not all epidemics are the same
  - Infectious or not
    - Epidemiology- rate and mechanism of spread
  - Contagious or not
    - Route, degree of herd immunity
  - Scale: 1918 vs SARS
  - Severity of illness: 1968 vs H5N1

Examples of Epidemics

- Anthrax 2001: Old disease but little modern experience–optimal diagnostics and treatment uncertain; not contagious; few cases–all severe; 3 cities



- SARS: New disease; range of severity; moderately contagious but a few superspreaders—mostly nosocomial; 22 countries

- H5N1: New disease, minimally contagious; very severe; awesome potential; 14 countries

Epidemics are Different from other Surge Events

- Gradual onset → delayed recognition of event
- Situational awareness is problematic:
  - Who has it?
    - Incubation period
    - Variable symptoms
    - Slow diagnostic results
  - How big is it?
    - Uncertain geographic range
    - Uncertain number of cases
    - Uncertain epidemiology

Epidemics are Different

- Medical issues may be uncertain:
  - Who to suspect?-clinical case definition
  - How best to make diagnosis?- diagnostic criteria
  - How best to treat?
  - Is prevention possible?- vaccine, prophylaxis
  - Infection control measures?- PPE, isolation
- May be public health issues:
  - Quarantine, social distancing, travel restrictions
  - Mass vaccination/ prophylaxis
- May be prolonged:
  - New cases for weeks to years
  - Prolonged hospitalizations

Prolonged Length-of-Stay May Accentuate Surge

- Hospital census is a function of admission volume and length of stay (LOS)
- Average LOS is 4-5 days
- Most epidemic scenarios involve LOS > 4-5 days
  - Doubling LOS (e.g. 4 days→ 8days) results in doubling of census with no increase in patient volume.
  - Even a 1 day increase in average LOS can increase hospital census by 20-25%.

In most epidemics, prolonged LOS will accentuate surge demands

Contagious "Surge"

- What precautions are needed?
  - Do precautions vary with setting or procedures?
- What PPE is needed?
  - Are staff well trained in proper use of PPE?
  - Back-up plan if not enough PPE?
- How to prioritize limited negative pressure isolation rooms and PPE?
-

Cohorting

- Segregated unit with dedicated staff
- Purposes:
  - Reduce nosocomial spread if normal isolation capacity is exceeded
  - Reduce number of staff exposed
  - Limit changes of PPE
  - Concentrate limited resources in one area

Cohorting

- Who gets cohorted?
  - Suspect cases or confirmed cases?
  - What if diagnostics not available?
- How many cohorts?
  - Confirmed, likely, unlikely, ruled-out?

Cohorting

- Degree of isolation needed?
  - Among patients in unit and between unit and rest of hospital?
  - Neg pressure? What rate of flow? Each room? Entire unit?
  - Decontamination procedure? Between patients in unit and upon exiting unit?

Pandemic Influenza

HHS Pandemic Planning Assumptions

	Moderate (1968-like)	Severe (1918-like)
Illness	**90 million (30%)**	**90 million (30%)**
Outpatient medical care	**45 million (50%)**	**45 million (50%)**
Hospitalization	**865,000**	**9, 900,000**
ICU care	**128,750**	**1,485,000**
Mechanical ventilation	**64,875**	**745,500**
Deaths	**209,000**	**1,903,000**

Assumptions vs. Total US Capacity

	Moderate (1968-like)	Severe (1918-like)	Total U.S. Hospital Capacity
Illness	**90 million**	**90 million**	
Outpatient	**45 million**	**45 million**	
Hospitalization	**865,000**	**9, 900,000**	**946,997 beds**
ICU care	**128,750**	**1,485,000**	**87,400 ICU beds**
Mechanical ventilation	**64,875**	**745,500**	**53,000- 105,000 ventilators (5000→7500 in SNS)**
Deaths	**209,000**	**1,903,000**	

Pandemic Influenza
Impact on Average U.S. Hospital

- FluSurge model (CDC)
- HHS planning assumptions
- At peak (week 5 of 8) with 25% attack rate

Moderate Scenario (1968-like)	Severe Scenario (1918-like)
19% of non-ICU beds	191% of non-ICU beds
46% of ICU beds	461% of ICU beds
20% of ventilators	198% of ventilators

Problems in Hospital Response to a Severe Influenza Pandemic

- High absenteeism among HCW
  - illness, family care, fear
- All regions affected
  - no outside help
- Prolonged event
  - Supplies/ medications/ staffing/ deferred services
- Many critical patients
  - Limited ICU/vent capacity
- Risk of contagion
  - Need for infection control and cohorting

How Hospitals "Surge"

- Surge in place
  - Increase beds
    - Use hallways
    - Double up patients
    - Convert "flat space"
    - Commandeer outpatient space for inpatient use
  - Free up beds
    - Early discharge
    - Cancel electives
  - Increase staff
    - Staff overtime
    - Shift staff
    - Volunteer staff
  - Mutual aid
- Surge beyond the walls
  - Transfer patients out
  - Use of alternative care facilities

“Surge” is Not Just Space

- **Stuff**
  - Basic supplies, meds, PPE
  - Equipment (ventilators)
- **Staff**
  - Particularly with special skills (ICU, x-ray, lab, respiratory therapy)

Stuff

- Just-in-time supply chains
  - Most hospitals maintain only a few day's supply of:
    - basic supplies
    - Routine medications
    - PPE
- Re-supply is doubtful in a pandemic
- SNS:
  - N95s: 105 million in-stock and on-order
  - Surgical masks: 51 million in-stock and on-order
  - Estimated need for minimal number of N95s for hospital workers with direct contact with flu patients in in one wave of a severe pandemic is ~ 200 M

Staff

- Existing staffing shortages (~10%)
- High absenteeism in pandemic due to:
  - illness (HCW at higher risk of infection)
  - family care (most HCW are women and the primary family caretakers)
  - other employment (many work at multiple healthcare organizations)
  - Fear of contagion (~50% may refuse to work)

The most difficult issue

What Hospitals Should Do to Prepare for a Severe Epidemic

- **Prioritize and triage inpatient care**
  - Cancel non-urgent admissions
  - Accelerate discharges
  - Out-of-hospital triage of patients (flu/SARS screening clinics)-only the very sick get into hospitals

What Hospitals Should Do

- **Maintain, augment and stretch the hospital workforce**
  - Limit absenteeism
    - Prevent current staff from getting ill
    - Facilitate family care
    - Allay fear
  - Shift clinical staff to areas of highest need
  - Augment clinical staff with nontraditional personnel
  - Coordinate recruitment and use of volunteers with other hospitals in the region

What Hospitals Should Do

- **Use alternative care sites**
  - Limited capabilities
    - Cannot do hospital- like care
    - limited O2, equipment, trained staff, supplies
  - What they can do:
    - Screen, hydrate, limited meds for “flu-like” patients
    - Minor care for non-flu patients
    - Step-down care for early discharge of non-flu patients

What Hospitals Should Do

- **Allocate limited resources**
  - in a rational, ethical and organized way
  - "*do the greatest good for the greatest number*"
  - Institute alternative patient care routines
    - Not all patients in need of intensive care will be able to be accommodated in the ICU
    - Normal staffing ratios and standard operating procedures will not be able to be maintained
  - Plan for alternative sites to provide ICU-like care within the hospital
  - Create criteria/clinical guidelines and a decision-making process for triage and use (or denial thereof) of limited resource intensive services

What Hospitals Should Do

- **Engage in regional collaboration**
  - Sharing limited assets, volunteers
  - Aligned approach to allocation of scare resources
  - Organization and operation of alternative care sites

What Policy Makers Should Do

- High level “call-to-service” to hospital executives to fully engage in preparedness
- Expand and integrate programs to recruit and deploy volunteers (ESAR-VHP, MRC)
  - Licensing, credentialing and liability issues
- Promote regional healthcare collaboration
- Facilitate a national discussion of the allocation of scarce medical resources
- Increase funding for hospital preparedness

Estimate of What it Will Cost

- The average hospital (164 beds) will require an initial infusion of **$1 million** for *minimal* preparedness for a severe pandemic
- Component costs to achieve minimal preparedness
  - 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
  - *Excludes antiviral stockpiles and ventilators*
- National cost for initial preparedness: **$ 5 billion**
- Recurring annual costs - $ 200K / year per hospital
- Current funding: Hospital Preparedness Program (ASPR)

  ~ $ 500M / year nationally since 2002 and decreasing

  > $ 100K / year per hospital

Acknowledgments

Hospital Preparedness Project:

- Richard Waldhorn, MD
- Beth Maldin, MPH
- Jennifer Nuzzo, SM
- Luciana Borio, MD
- Crystal Franco
- Clarence Lam
- David Press, MD
- Jason Matheny, MPH, MBA
- Thomas Inglesby, MD
- Tara O'Toole, MD, MPH
- D.A. Henderson, MD, MPH

Michelle Cantu, MPH

Kunal Rambhia

Further information

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- **Roundtable: Promoting Partnerships for Regional Healthcare Preparedness and Response** Maldin-Morgenthau B, Toner E, Waldhorn R, Nuzzo JB, Franco C, Press D, O'Toole T, and Inglesby TV. *Biosecurity and Bioterrorism*. 2007;5(2).
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CBN Weekly Bulletin for April 12, 2005

(also see current CBN Monthly Topics: Avian Influenza: The Next Pandemic?)

The CBN Weekly Bulletin presents the editors' analysis of important current events in clinical biosecurity.

Marburg Situation Worsens

While it is known that the number of Marburg cases and deaths continues to rise, at this point the true extent of the outbreak remains unclear. The WHO's April 11 update indicates that 214 cases have been reported from 7 of 15 provinces in Angola, with 194 deaths. There are unconfirmed reports of cases in neighboring Congo, and reports of secondary transmission in Luanda, a city of several million. Whether the apparent increase in cases over the last few days represents rapid spread of the epidemic or improved surveillance has yet to be determined. The outbreak is likely to be larger than it now appears due to the difficulty of tracking down cases. Unfortunately, the WHO suspended efforts to find new cases in Uige following an attack on its workers.

The mortality rate is also unclear. To calculate mortality one must know how many infected people ultimately die, but at this point it is only possible to know how many people have died to date. The number of non-lethal cases cannot be determined until spread of the infection has been halted. What is clear is that this is a terrible disease, and as yet there have been no reports of survivors.

The WHO reports that hospitals are a primary vector for spreading the illness and have recommended closure of some hospitals. Due to lack of even rudimentary supplies, hospitals are unable to protect healthcare workers or prevent nosocomial spread of the disease. In addition, news reports indicate that some victims are avoiding hospitals and are dying at home or in the community.

As international aid organizations respond to the outbreak, the possibility of spread to remote counties may increase as relief workers return home. It would be prudent for clinicians who might be charged with the care of such returning health care workers to review the clinical features of the disease and infection control recommendations, both of which can be found posted on the CDC's website. Recommendations include adherence to strict contact and fluid precautions and negative pressure airborne precautions. While Marburg virus has been spread by contact with skin, blood, and bodily fluids in Africa, the potential does exist for aerosol spread in a modern ICU where invasive and heroic procedures are performed.

By Eric Toner, M.D.

Physicians Fail to Diagnose Boston University Tularemia Cases

In November 2004, Boston University reported three cases of tularemia to the Boston Public Health Commission. All three cases c
believed they were working with the avirulent live vaccine strain of *Francisella tularensis*. They did not realize that the material th
highly virulent Type A *F. tularensis*. A report released on March 28 by the Boston Public Health Commission provided an overview
among other findings that all three of the infected researchers were seen by physicians, treated with antibiotics, and recovered,
diagnosed by any of the treating physicians." Details on the nature of the physician visits were not included in the report, but on
occupational history from the first two workers in May, 2004 might have identified the causative agent and source of exposure, th
September.

The failure to diagnose tularemia in these researchers highlights the important role that clinical astuteness and careful history tak
lab accident or bioterrorism event. Furthermore, it points out that, as was seen with both incidences of SARS lab infections, labor
underestimate their risk of occupational infection and thus may not volunteer critical exposure information. Physicians should take
every patient with a febrile illness. If a patient's occupation involves work with microbes, follow up to identify specific organisms h
even if the patient is reluctant.

BPHC Report on Pneumonic Tularemia in Three Boston University Researchers

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- WHO Releases Working Group Report on Influenza Research
- FDA Halts VaxGen Anthrax Vaccine Trials, HHS Threatens to Cancel BioShield Contract
- Dr. Margaret Chan Selected as Top WHO Official
- Turkey Awarded Funding for Avian Flu Preparedness

Pandemic Flu UPDATE

NEW: Disease mitigation in the control of pandemic influenza. Inglesby TV, Nuzzo JB, O'Toole T, Henderson DA. *Biosecurity and Bioterrorism* 2006;4(4). [pdf]

Now Available on the Web: Hospitals "Full-Up": The 1918 Influenza Pandemic — a short documentary produced by the Center.

ATLANTIC STORM interactive

NEW: *Atlantic Storm Interactive* is Now Available
How would leaders manage the catastrophe of a fast-moving, global epidemic of deadly disease? *Atlantic Storm Interactive* brings this table top exercise to life. Watch the presentation

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Clinicians' Biosecurity Network — clinical information for healthcare providers interested in biosecurity. [CBN Report]

Disease, Disaster, & Democracy U.S.-Canada Summit

Disease, Disaster, & Democracy — Summit on the public's stake in health emergency planning. Washington, DC. May 23, 2006.

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