Hospital Surge Capacity Strategies to Prepare for an Epidemic

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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 → 8 days) 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?
Cohortting

• 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

<table>
<thead>
<tr>
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<th>Moderate (1968-like)</th>
<th>Severe (1918-like)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Illness</strong></td>
<td>90 million (30%)</td>
<td>90 million (30%)</td>
</tr>
<tr>
<td><strong>Outpatient medical care</strong></td>
<td>45 million (50%)</td>
<td>45 million (50%)</td>
</tr>
<tr>
<td><strong>Hospitalization</strong></td>
<td>865,000</td>
<td>9,900,000</td>
</tr>
<tr>
<td><strong>ICU care</strong></td>
<td>128,750</td>
<td>1,485,000</td>
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<td><strong>Mechanical ventilation</strong></td>
<td>64,875</td>
<td>745,500</td>
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<tr>
<td><strong>Deaths</strong></td>
<td>209,000</td>
<td>1,903,000</td>
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# Assumptions vs. Total US Capacity

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<th>Total U.S. Hospital Capacity</th>
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</tr>
<tr>
<td>Hospitalization</td>
<td>865,000</td>
<td>9,900,000</td>
<td>946,997 beds</td>
</tr>
<tr>
<td>ICU care</td>
<td>128,750</td>
<td>1,485,000</td>
<td>87,400 ICU beds</td>
</tr>
<tr>
<td>Mechanical ventilation</td>
<td>64,875</td>
<td>745,500</td>
<td>53,000-105,000 ventilators (5000→7500 in SNS)</td>
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<td>Deaths</td>
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## Pandemic Influenza Impact on Average U.S. Hospital

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

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<th>Moderate Scenario (1968-like)</th>
<th>Severe Scenario (1918-like)</th>
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<tr>
<td>19% of non-ICU beds</td>
<td>191% of non-ICU beds</td>
</tr>
<tr>
<td>46% of ICU beds</td>
<td>461% of ICU beds</td>
</tr>
<tr>
<td>20% of ventilators</td>
<td>198% of ventilators</td>
</tr>
</tbody>
</table>
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 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 scarce 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

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Further information


- **The Prospect of Using Alternative Medical Care Facilities in an Influenza Pandemic.** Lam C, Waldhorn R, Toner E, Inglesby TV, O'Toole T. *Biosecurity and Bioterrorism* 2006; 4(4).

- **What Hospitals Should Do to Prepare for an Influenza Pandemic.** Toner E, Waldhorn R. *Biosecurity and Bioterrorism* 2006; 4(4).


Physicians Fail to Diagnose Boston University Tuberculosis Cases

In November 2009, Boston University reported three cases of tuberculosis to the Boston Public Health Commission. At that time, the university's Internal Medicine Division was guardians of the school's health. But when the second case was reported, the university failed to report it, and it was several months before the outbreak was recognized. The university's failure to recognize the problem led to a delay in the investigation, which resulted in a public health crisis.

The university's failure to diagnose tuberculosis cases highlights the importance of early detection and thorough investigation. It also raises questions about the university's commitment to public health and the well-being of its students.

The university's response to the outbreak included a number of measures to prevent the spread of tuberculosis. The university also provided counseling and support to affected students and faculty. The university has committed to improving its response to public health emergencies in the future.

By Erin Stanley, PhD