Computer-Aided Bioterrorism Response Planning

Satellite Conference
Tuesday, November 16, 2004
12:00-1:30 p.m. (Central Time)

Produced by the Alabama Department of Public Health
Video Communications Division

Faculty

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Funding: Department of Health and Human Services, Agency for Healthcare Research and Quality (AHRQ)

Objectives

- To survey currently available computer modeling tools for bioterrorism response planning.
- To describe and demonstrate two models developed at Weill Cornell Medical College: the Bioterrorism and epidemic Outbreak Response Model, and the Regional Hospital Caseload Calculator Model.

Objectives

- To preview new directions in modeling that are currently being undertaken to link resource assessments for both pre-hospital and hospital-based care in responding to bioterrorism and other public health emergencies.

Research Team & Funding

- Division of Outcomes and Effectiveness Research, Weill Medical College of Cornell University
  - Jason Cuomo, MPH (RAND)
  - Mary Koshy, MPA
  - Christopher Neukermans
  - Mark A. Callahan, MD (Division Chief)
  - Alvin I. Mushlin, MD, ScM (Chairman)

Research Team & Funding

- Agency for Healthcare Research and Quality (AHRQ), Department of Health and Human Services
  - Sally Phillips, RN, PhD
    Program Director, Bioterrorism Response
  - Carole Dillard, MA
    Task Order Officer

Value of Computer Modeling

- Modeling can challenge basic assumptions about surge capacity—its causes and cures
- Models can provide numerical estimates of casualties resulting from different attack or exposure scenarios and from different response strategies (e.g, from service lines in a single hospital to emergency planning functions in a region)
- Models address Continuation Guidance goals

Continuation Guidance
Budget Year Five - Attachment A
Focus Area A: Preparedness Planning and Readiness Assessment
June 14, 2004

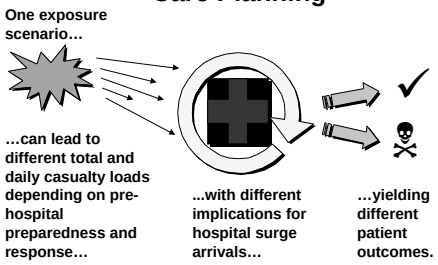
Critical Capacity #2: To conduct integrated assessments of public health system capacities related to bioterrorism, other infectious disease outbreaks, and other public health threats and emergencies to aid and improve planning, coordination and implementation.

Critical Capacity #3: To respond to emergencies caused by bioterrorism, other infectious disease outbreaks, and other public health threats and emergencies through the development, exercise, and evaluation of a comprehensive public health emergency preparedness and response plan.

Critical Benchmark #2: Develop or enhance scalable plans that support local, statewide, and regional response to incidents of bioterrorism, catastrophic infectious disease, such as pandemic influenza, other infectious disease outbreaks, and other public health threats and emergencies. Plans must include detailed preparations to rapidly administer vaccines and other pharmaceuticals, and to perform healthcare facility based triage and provide short-term acute psychosocial interventions as well as longer-term.

Critical Capacity #4: To effectively manage the Strategic National Stockpile (SNS), should it be deployed-translating SNS plans into firm preparations, periodic testing of SNS preparedness, and periodic training for entities and individuals that are part of SNS preparedness.

Modeling Improves Community-Wide Surge Capacity Planning by Linking Pre-hospital and Hospital-based Care Planning



Computer-Based Models

- **Centers for Disease Control and Prevention (CDC) Maxi-Vac**

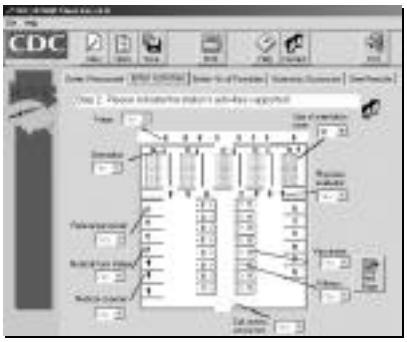
http://www.bt.cdc.gov/agent/smallpoxvaccination/maxivac/index.asp

- **Proprietary models (e.g., Hartford, CT)**
- **Weill Cornell Models**

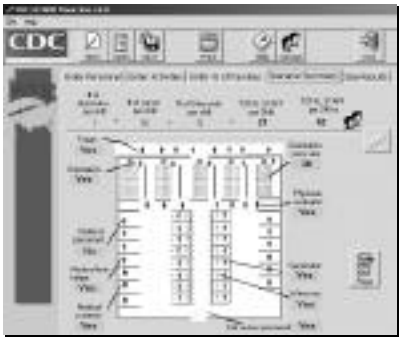
http://www.bt.cdc.gov/agent/smallpox/vaccination/ maxi-vac/index.asp

CDC Maxi-Vac

CDC Maxi-Vac



CDC Maxi-Vac



CDC Maxi-Vac

CDC Maxi-Vac

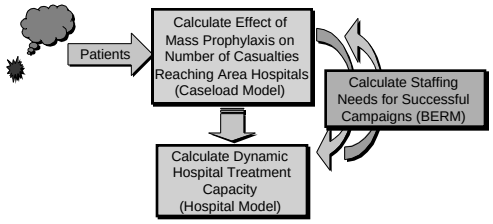
Limitations of Maxi-Vac

- **Staff determines treatment capacity vs. time requirement (e.g., CRI) determines staff needs.**
- **Addresses single clinic plan vs. community-wide planning.**
- **Staffed by MDs and RNs vs. just-in-time trained staff.**
- **Only one available clinic layout.**

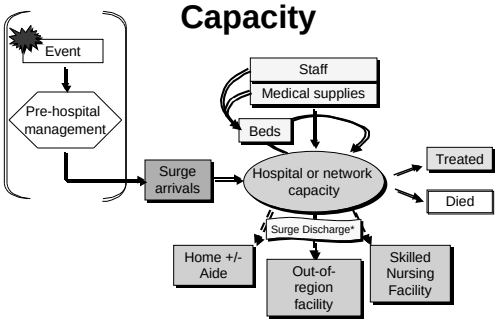
Limitations of Maxi-Vac

- **Single "hard-wired" set of processing times.**
- **Engineering orientation (confusing).**
- **No support staff calculations.**

The Weill/Cornell Models



Determinants of Surge Capacity



*Note: I am indebted to Sam Benson, EMT-P, New York City Office of Emergency Management for the notion of "surge discharge"

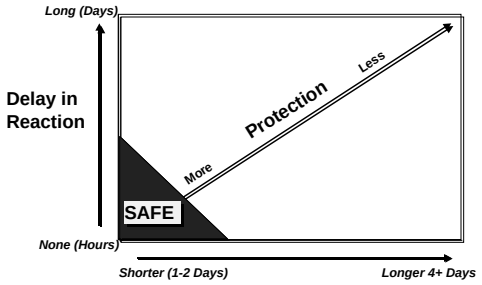
Regional Hospital Caseload Calculator Model

- **Two key policy/tactical variables:**
  - **DELAY in INITIATION**
  - **CAMPAIGN DURATION (COVERAGE)**
- **Daily counting of who gets prophylaxed and who becomes symptomatic**

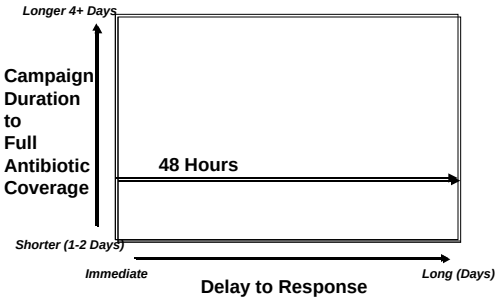
Regional Hospital Caseload Calculator Model

- **Assumes:**
  - **You don't know "who's who": RANDOM MIXING**
  - **You have drugs that can halt the disease process**

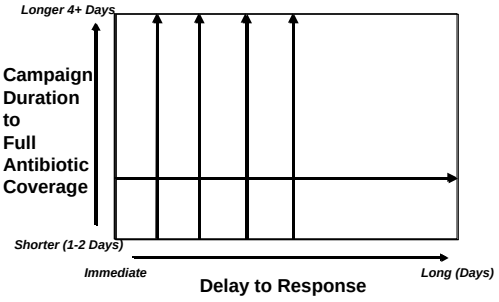
Caseload Calculator Schematic



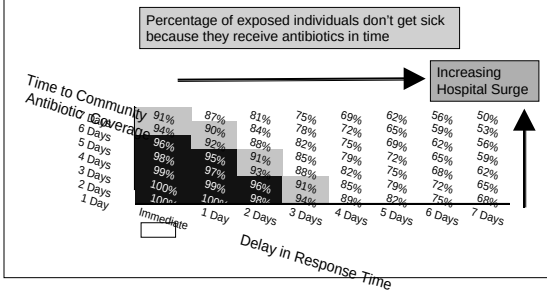
Cities Readiness Initiative Cutoff



Variability from Response Times



Example: Modeled Outcomes of Pre-hospital Anthrax Prophylaxis



Example: 100,000 People Were Exposed to Anthrax and Your Prophylaxis Campaign…

- **Could cover all in 2 days after a 1 day delay**
  - → **~1,000 sick**
- **Could cover all in 2 days after a 2 day delay**
  - → **~4,000 sick**

Next Question: Can You Do It?

- **Regional Caseload Calculator indicates optimal response parameters**
- **Next, need a way to calculate staff and resources needed to accomplish that task**
- **→ Weill Cornell Bioterrorism and Epidemic Outbreak Response Model or BERM**

Bioterrorism and Epidemic Outbreak Response Model (BERM):

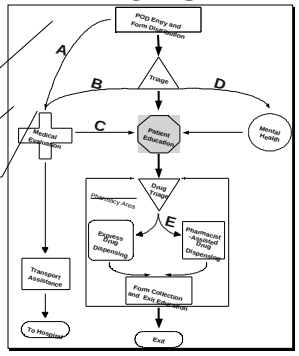
- **Models a mass prophylaxis campaign for a POPULATION AT RISK.**
- **Network of identical clinics.**
- **Pill dispensing or vaccination options.**
- **Calculations performed at steady-state operation (controlled entry, no "lag" time, queues stable).**

Bioterrorism and Epidemic Outbreak Response Model (BERM):

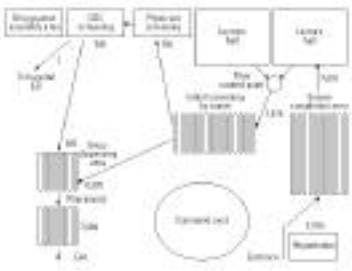
- **Estimates minimum staff needed to operate clinics at a given set of PROCESS TIMES and PATIENT FLOW (i.e., acuity) ASSUMPTIONS**

How BERM Works:

1. Determine Patient Flow
2. Determine Processing Time
3. Calculate Staff Required at Station



New York City Postal Service Prophylaxis



Partridge, et al. *Ann Emerg Med.* 2003;41:441-446

Using BERM

- With SIZE of population-at-risk and TIME FRAME for action, you can start detailing your prophylaxis campaign
- Key additional assumption:
  - How fast is each dispensing site going to run?
  - Options: 150 pph (TOPOFF), 250 (San Francisco) all the way up to 1,400 pph (TriPOD as reported in the New York Times last week).

Key Inputs to the Model

- Type of Event
  - Non-communicable, antibiotics (Anthrax-type)
  - Communicable, vaccination (Smallpox-type)
- Timing of Event (= number sick)
  - Pre-event
  - Post-event (small-scale or large-scale)
- Speed of patient processing
  - Baseline, fast or slow

Modeled Staff Functions

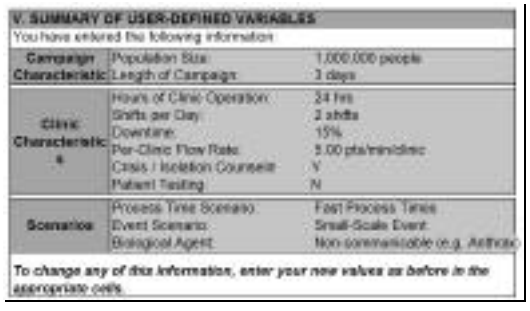
Core Patient Interaction Staff:

- Greeting/Screening
- Form Distribution
- Briefing
- Triage
- Medical Evaluation
- Dispensing/Vaccination
- Testing
- Crisis Counseling
- Form Collection
- Exit/Isolation Counseling

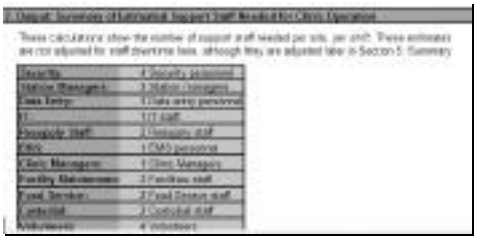
Modeled Staff Functions

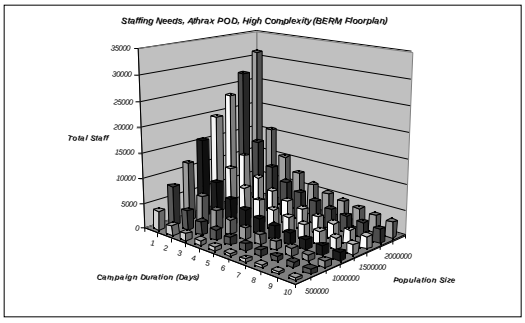
Support Staff:

- Security
- Station Managers
- Medication/Vaccine Resupply
- Data Entry Personnel
- Information Technology
- Other: Custodial, Food Service, Special Assistance, Translation



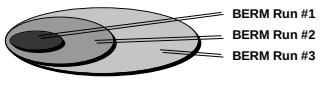
V. SUMMARY OF USER-DEFINED VARIABLES		
You have entered the following information		
Campaign Characteristic	Population Size	1,000,000 people
	Length of Campaign	3 days
Clinic Characteristics	Hours of Clinic Operation	24 hrs
	Shifts per Day	2 shifts
	Downtime	15%
	Per-Clinic Flow Rate	5.00 pts/min/clinic
	Crisis / Isolation Counselir	Y
	Patient Testing	N
Scenarios	Process Time Scenario	Fast Process Times
	Event Scenario	Small-Scale Event
	Biological Agent	Non-communicable on g. Anthrax
To change any of this information, enter your new values as before in the appropriate cells.		

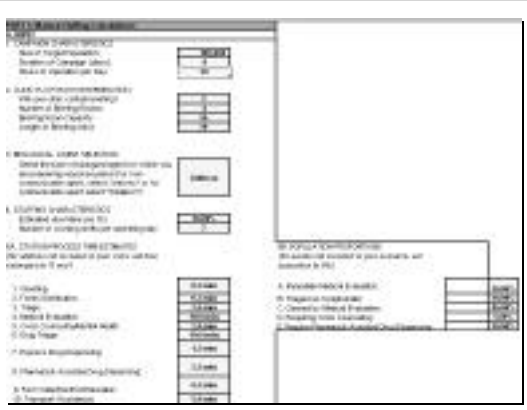




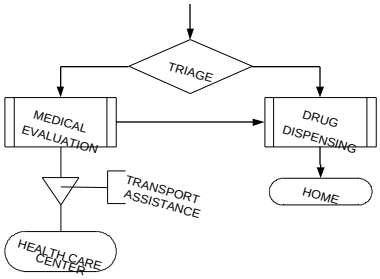
Ways to Customize BERM

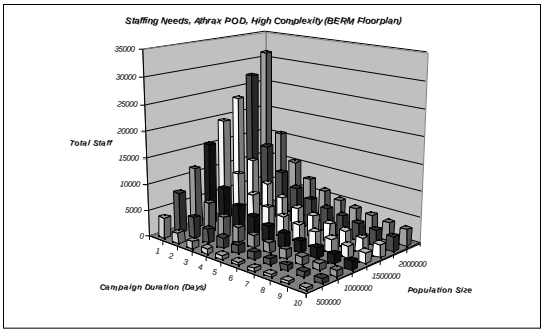
- **Community size**
- **Time “window” for response**
- **Limitations in the size of sites and staff**
- **Change time estimates for processing**
- **Use multiple runs for multiple affected areas:**

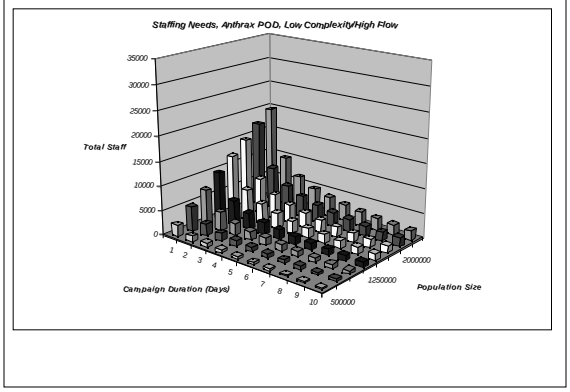




Low Complexity, High Flow







Getting BERM and Planning Guide

- **DHHS Agency for Healthcare Research and Quality (AHRQ)**

  http://www.ahrq.gov/research/biomodel.htm

  http://www.ahrq.gov/research/cbmprophyl/cbmpro.htm

Getting BERM and Planning Guide

- **American Hospital Association website "Disaster Preparedness" page (Registration requested for survey)**

  http://www.hospitalconnect.com/aha/ key_issues/disaster_readiness/resources/vaccination.html

A Successful Campaign: NYC 1947


The New York Times

FRIDAY, APRIL 15, 1955

HALF MILLION HERE VACCINATED IN DAY

Summary

- Federally-funded efforts to develop and implement computer-based tools for improved bioterrorism planning are starting to reach their intended audiences.
- Modeling may assist in maximizing "return on investment" for community preparedness planning.
- More work needs to be done to bridge the model-reality gap.

Our Next Steps:

- Ready Caseload Calculator for web
- Improve BERM
  - "Stochasticize" – variability in arrivals, etc.
  - Realistic lines/queues
  - Web-playable in government approved format

Our Next Steps:

- Link to a hospital component to create "end-to-end" simulation model

  → Smarter tabletops/exercises, better response

BERM Version 3

Acknowledgments

- NYC Office of Emergency Management
  - Edward Gabriel, MPA, AEMT-P
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  - Sam Benson, AEMT-P
    Director, Health & Medical Preparedness
  - Anita Sher, MIA
    Health & Medical Coordinator

Acknowledgments

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  - Capt. Ann Knebel, RN, DNSc
    Senior Program Mgmt. Officer
- NY Presbyterian Healthcare System
  - Neal Flomenbaum, MD
    Director of Emergency Services

Upcoming Programs

Crisis and Emergency Risk Communication:
by Leaders for Leaders (Part 1)
Tuesday, December 7, 2004
1:00-3:30 p.m. (Central Time)

Abnormal Pap Smears
Wednesday, December 8, 2004
2:00-4:00 p.m. (Central Time)

Upcoming Programs

Crisis and Emergency Risk Communication: by Leaders for Leaders (Part 2)
Tuesday, December 14, 2004
1:00-3:30 p.m. (Central Time)

For a complete listing of all upcoming programs, visit our website: www.adph.org/alphtn