

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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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

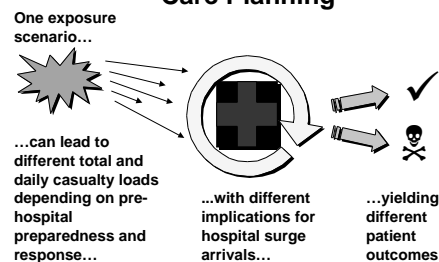
Critical Capacity #2: To conduct integrated assessments of public health system capacities related to bioterrorism, other infectious disease outbreaks, and other public health threats and emergencies to aid and improve planning, coordination and implementation.

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/smallpox/vaccination/maxivac/index.asp>
- Proprietary models (e.g., Hartford, CT)
- Weill Cornell Models

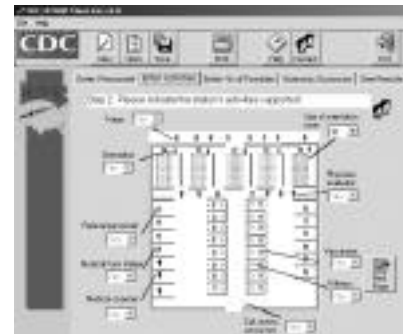


<http://www.bt.cdc.gov/agent/smallpox/vaccination/maxi-vac/index.asp>

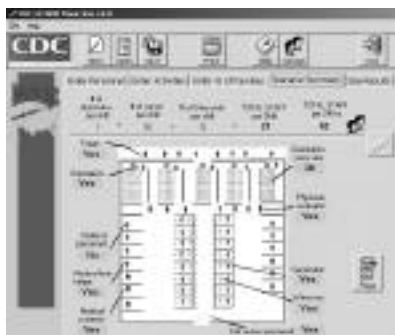
CDC Maxi-Vac



CDC Maxi-Vac



CDC Maxi-Vac



CDC Maxi-Vac



CDC Maxi-Vac

Staff description	Physicians	Nurses	Other staff
Physician	1	100	0
Registered nurse	0	0	100
Medical assistant	0	0	100
Pharmacy technician	10	0	0
Pharmacist	0	0	0
Medical aide	0	0	0
Medical assistant	0	0	0

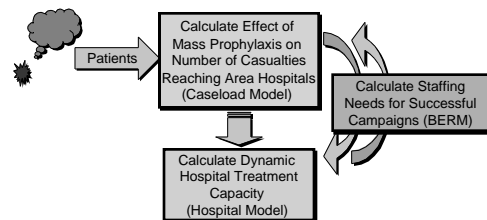
Limitations of Maxi-Vac

- 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.

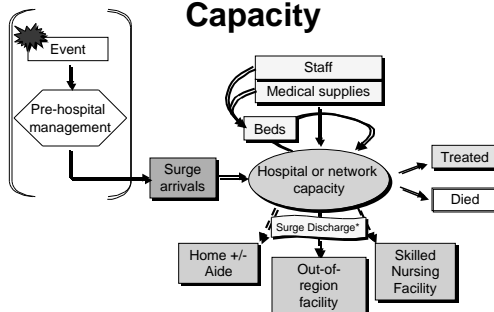
Limitations of Maxi-Vac

- 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”

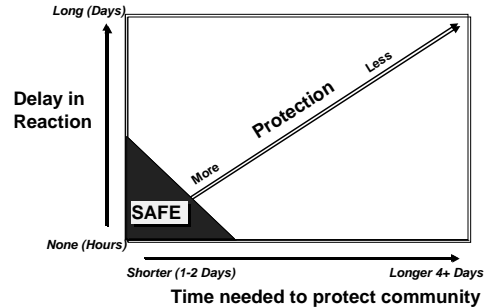
Regional Hospital Caseload Calculator Model

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

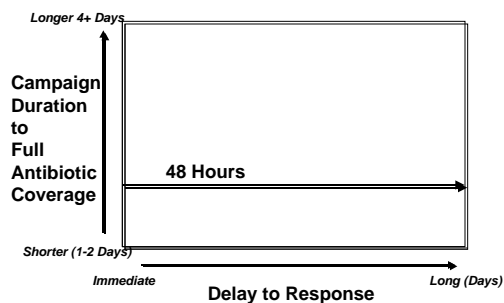
Regional Hospital Caseload Calculator Model

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

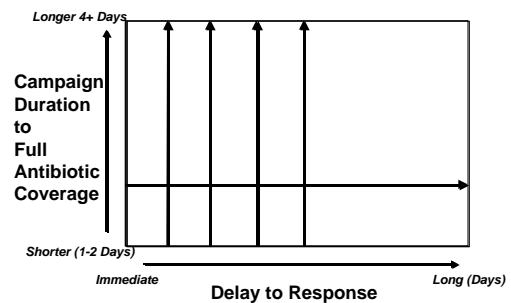
Caseload Calculator Schematic



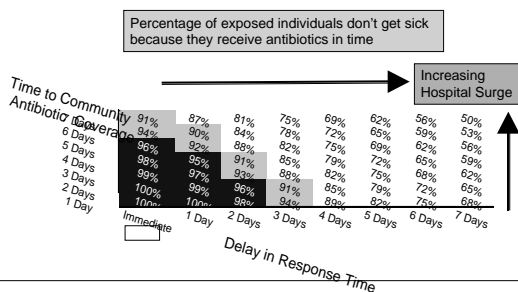
Cities Readiness Initiative Cutoff



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



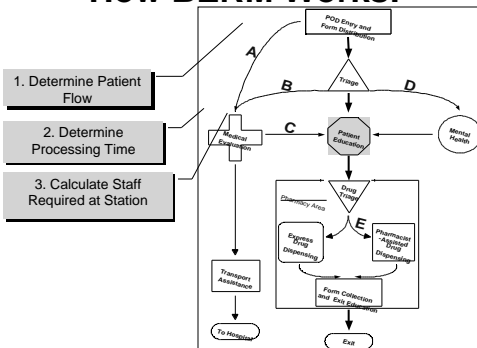
Bioterrorism and Epidemic Outbreak Response Model (BERM):

- 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).

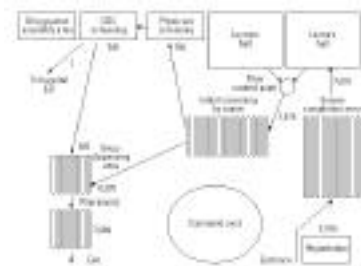
Bioterrorism and Epidemic Outbreak Response Model (BERM):

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

How BERM Works:



New York City Postal Service Prophylaxis



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 Characteristic	Hours of Clinic Operation	24 hrs
	Shifts per Day	2 shifts
	Downtime	15%
	Per-Clinic Flow Rate	5.00 pts/min/clinic
	Crisis / Isolation Counselor	N
Scenario	Process Time Scenario	Fast Process Times
	Event Scenario	Small-Scale Event
	Biological Agent	Non-communicable (e.g., Anthrax)

To change any of this information, enter your new values as before in the appropriate cells.

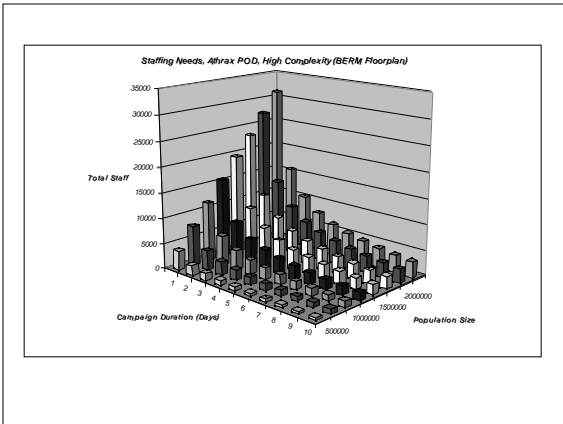
3. OVERALL MODEL OUTPUTS This page tracks your through the main outputs produced by BERM, including the estimated number of clinics and core staff needed to successfully carry out the mass prophylaxis campaign described below. These initial calculations assume unlimited available staff. To see the effect of limited available staff, go to Page 1, STAFF LIMITS, CALCULATOR. To modify the estimates provided here, simply return to DATA INPUTS and change your inputs. For information on the calculation of your input or comparison of various people processing during a campaign of 3 days, (assuming clinics are operating under Top-Off/Fixed) in a Small-Scale Event scenario involving a Non-communicable (e.g., Anthrax) biological agent, see:	
PART 1: CAMPAIGN ORGANIZATION & REQUIREMENTS, US CLAMP User's Guide Your responses give rise to the following essential features:	
A) Patient flow rate for the entire prophylaxis campaign (patients processed per unit time):	300,000 People per day 10,000 People per hour 200 People per minute
B) Number of clinics required to carry out campaign in stated time frame:	6000 Clinics (assuming that all clinics have identical layout and rates of patient flow)
C) Total core staff for campaign (Note: Core staff refers to all personnel involved in direct patient interaction, in contrast to support staff, see Sec 5C-4.0)	1,000 Core Staff (assuming an 8-hour shift and 10% downtime)

1. ESTIMATED CORE STAFF PER STATION AT EACH CLINIC			
The following staff per station calculations are per shift and do not include overtime.			
	Greeters		1 per shift
	Room Disinfection and Collection		3 per shift
	Triage		3 per shift
	Medical Receptionist		1 per shift
	Exam Counterline		1 per shift
	Waiting Separators		8 per shift
	Drop Triage		3 per shift
	Express Drop Receptionist		1 per shift
	Pharmacist		1 per shift
	Transportation Worker		1 per shift

2. Output: Inventory of Estimated Support Staff Needed for Clinic Operations	
These calculations show the number of support staff needed per site, per shift. These estimates are not adjusted for staff overtime hours, although they are adjusted later in Section 5: Summary.	
Shifts To	4 (Nightly Rotations)
Station Managers	3 Station Managers
Exam Entry	1 Exam Entry Personnel
Registration	1 RT Staff
Emergency Staff	2 Emergency Staff
SWO	1 PMA Personnel
Clinic Managers	1 Clinic Manager
Security Management	2 Facility Staff
Exam Services	2 Field Station Staff
Lab/Pharm	2 Lab/Pharm Staff
Administrative	4 Administrative

3. SUMMARY OF CLINIC STAFFING REQUIREMENTS		
This summarizes the core and support staffing requirements per clinic. "Operational staff" is defined as those staff working at any given time. "Assigned staff" include waiting staff, those staff on-call to cover operational staff absence, and staff for additional shifts.		
Operational Staff (8 per shift, on average)	Total Operational Core Staff per Clinic Total Operational Support Staff per Clinic	15 per Clinic 50 per Clinic
	Total Operational Staff per Clinic	65 per Clinic
Assigned Staff (2 shifts x 10% average)	Total Assigned Core Staff per Clinic Total Assigned Support Staff per Clinic	34 per Clinic 100 per Clinic
	Total Assigned Staff per Clinic	134 per Clinic

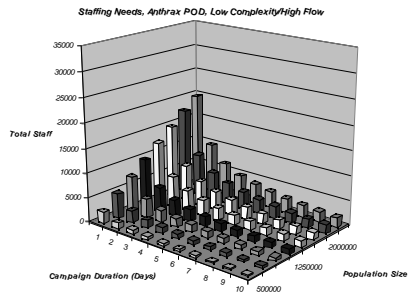
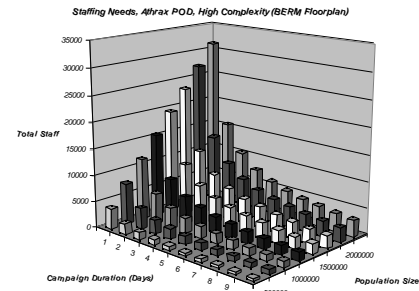
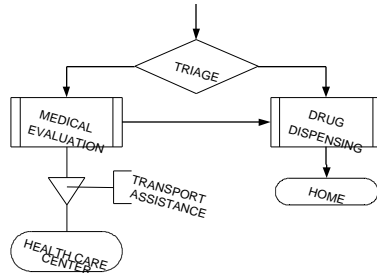
4. SUMMARY OF CAMPAIGN STAFFING REQUIREMENTS		
This summarizes the core and support staffing requirements for your entire campaign, assuming that all the clinics set up to receive the population are identical in terms of number and kind of stations, station process times, and patient flow rate. (Note: If the model recommends three or fewer clinics, there may be some inconsistency between the recommended clinic and campaign total staff numbers due to rounding. If this occurs, adjust the staffing recommendations from Page 3: Station Details, staffing to get the most accurate estimates.)		
Operational Staff (8 per shift, on average)	Total Operational Core Staff Total Operational Support Staff	750 per Campaign 1,410 per Campaign
	Total Operational Staff	2,160 per Campaign
Assigned Staff (2 shifts x 10% average)	Total Assigned Core Staff Total Assigned Support Staff	1,700 per Campaign 4,700 per Campaign
	Total Assigned Staff	6,400 per Campaign



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





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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Health & Medical Coordinator

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- 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**