



Pandemic Influenza Modeling: Improving preparedness and operational readiness

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Models?

- ▶ Model Airplanes
- ▶ Business Models
- ▶ Model Homes
- ▶ Swimsuit Models
- ▶ Model Behavior





Outline

- ▶ Why Use Modeling?
 - Pros v. Cons
- ▶ LA County Models
 - Community Mitigation:
 - Questions, Objectives and Description
 - Hospital Supply:
 - Questions, Objectives and Description
- ▶ Integration and Use
 - So What?



Why Use Modeling?

PROS

- “Lab” for large and complex problems
- Customized Focus-Can evaluate efficacy of multiple interventions
- Large # of runs→ Robust sample size
- Visual and spatial representation of disease spread
- Provides planners and decision makers with reality based data

CONS

Uncertainty & Imprecision:

- Epidemiology of disease
- Target “population” characteristics
- Effectiveness of interventions

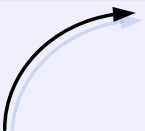
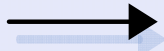




LA County Models -Demand and Supply

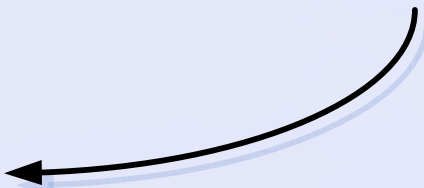
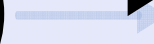
How will a pandemic affect LA County?

“Demand”



“Supply”

How will a pandemic affect LA County hospitals?





Community Mitigation Model

Driving Questions

- ▶ How will a pandemic affect LA County?
- ▶ Can we contain an outbreak in LA?
- ▶ How can we slow down, mitigate spread?
- ▶ Best interventions-Role of:
 - Vaccines
 - Anti-virals?
 - School dismissal?
 - Community isolation?



Community Mitigation Model

Objectives

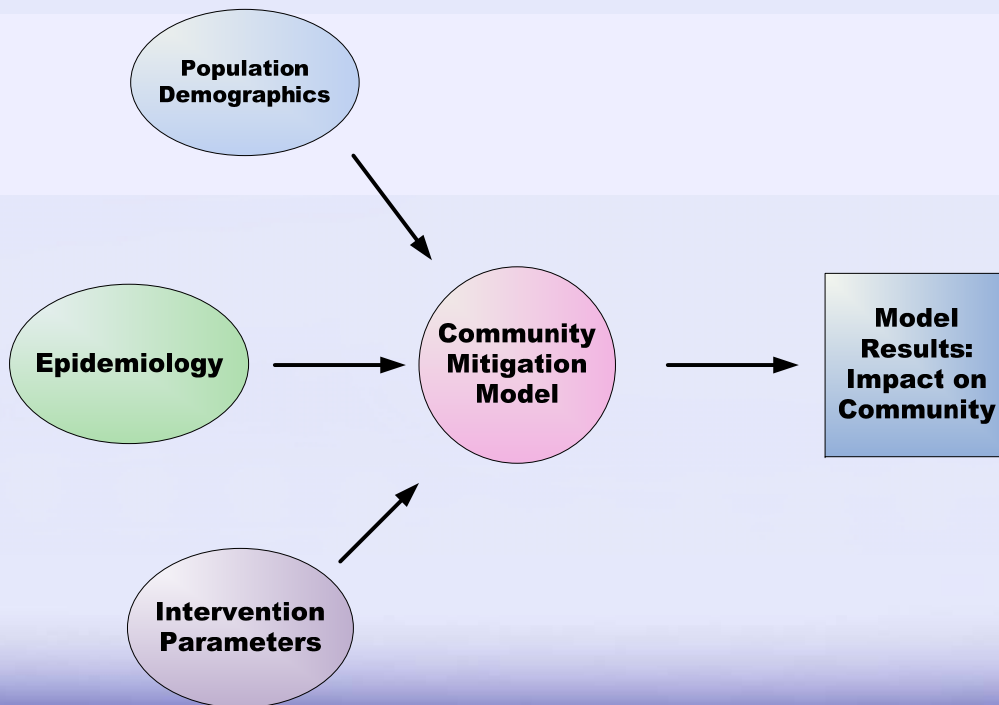
- ▶ Improve understanding of LA County specific epidemic
 - Assess community impact
- ▶ Evaluate predicted effects of community containment and mitigation interventions
 - Pharmaceutical Interventions (PI)
 - Non-Pharmaceutical Interventions (NPI)
- ▶ Identify gaps in current assumptions and operational plans
- ▶ Develop and refine recommended planning guidelines, practical policies and executable protocols





Community Mitigation Model

Community Mitigation Model: General Design



Composite of:

- Computer codes
- Mathematical equations
- Disease transmission parameters
- Statistical probabilities



Community Mitigation Model

Population Demographics

- ▶ Synthetic LA County population:
 - 4 Mixing Groups: Work, School, Home, Community
 - Groups: Specific rules that reflect contact probabilities, disease transmission rates, commuter/transpiration patterns, etc.
 - Population: census tract (2007 estimates): density, age and H/H size

Epidemiology

- Types of pandemic: medium (R_0 1.6) v. severe (R_0 2.0)
- Randomly seeded with infectious individuals (via LAX) and allowed to “run” for 180 days; 12 hour day/night cycles





Community Mitigation Model

Intervention Parameters

► Pharmaceutical

— Vaccines: Different Scenarios

- Non-adjuvant: 90 μ [1] v. Adjuvanted: 7.5 μ [2]
- Efficacy: Pre-pandemic v. Reactive

— Anti-virals (AV):

- Tx only v. TAP (Ring Prophylaxis)

Intervention Combinations

None

Vaccine only

Anti-Viral only

NPI only

Vac. + AV

Vac. + NPI

AV + NPI

Vac. + AV + NPI

► Non-Pharmaceutical (NPI)

— School Dismissal

- Timelines

— Quarantine & Isolation

- Liberal Leave policies
- Self Isolation





Community Mitigation Model- Sample Initial Results

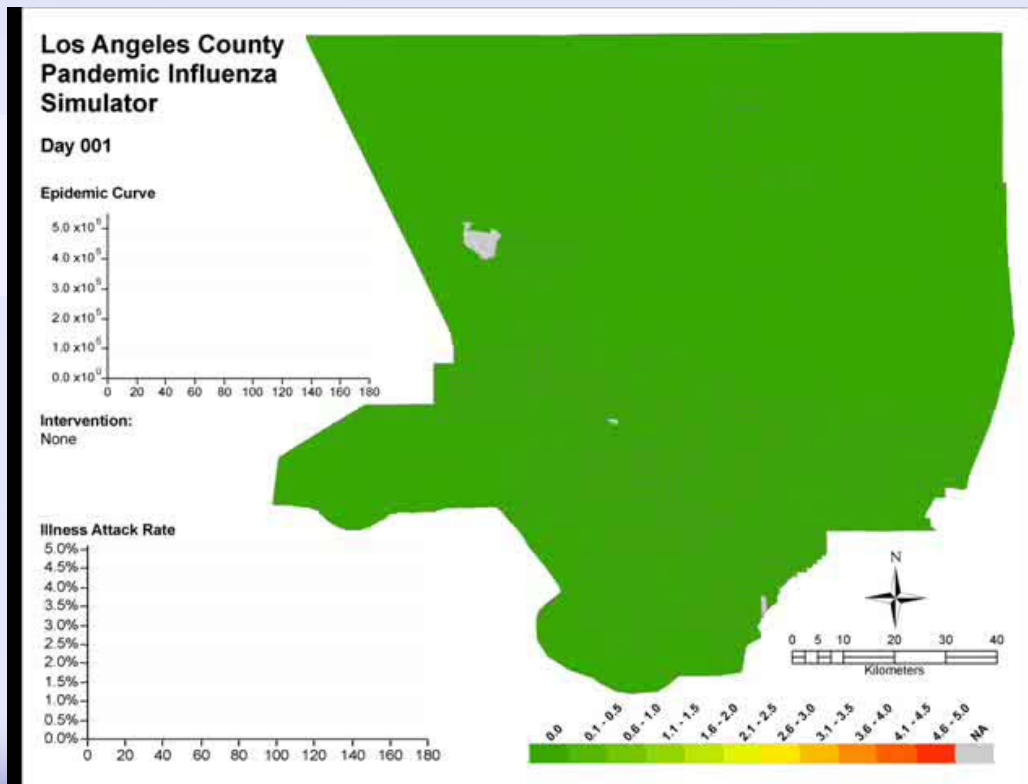
Strategy	avg. Attack Rate (%)	Cases (x10,000)
None	45.4	503.9
Pre-Pan Vac [1]	43.7	484.6
Pre-Pan Vac [2]	0.1	1.4
Reactive Vac [1]	43.4	481.8
Reactive Vac [2]	0.3	3.2
HH TAP	40.5	449.1
School Dismissal	30.8	341.1
Home Q.	39.3	435.5
Liberal Leave	43	477.1
Combined NPI	2.3	25.1





Community Mitigation Model

Sample Results

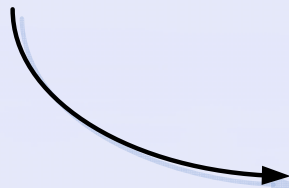
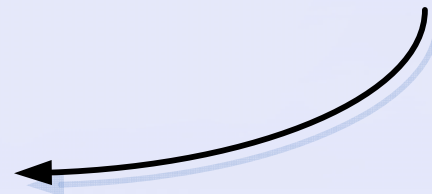
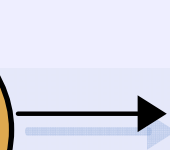
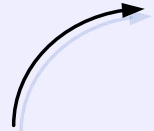




Models: Transition from Demand to Supply

How will a pandemic affect LA County?

“Demand”

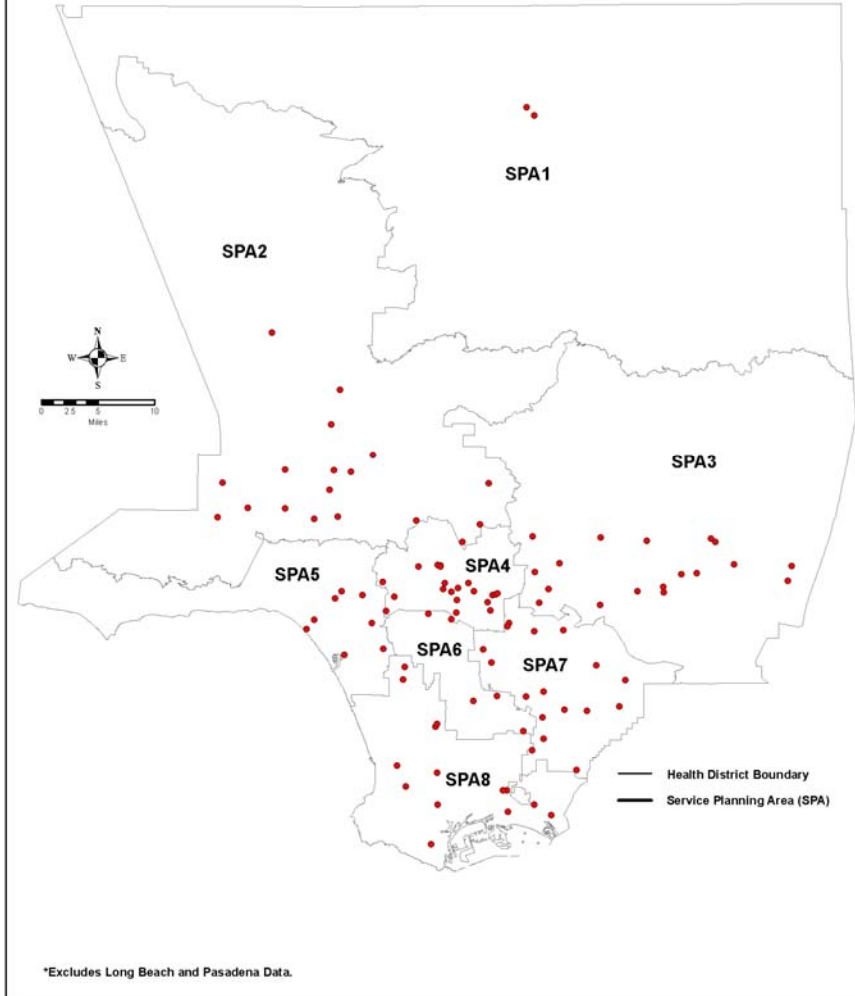


How will a pandemic affect LA County hospitals?

“Supply”



Acute General Hospitals by Service Planning Area (N=104)



*Excludes Long Beach and Pasadena Data.





Hospital Supply Model

Driving Questions

- ▶ Does demand for beds vary across the county?
 - If so, how?
- ▶ How many patients need a bed but never find one?
 - Where are the hospital service gaps?
- ▶ How many elective surgeries need to be cancelled to provide enough beds?
- ▶ What happens if payer source is ignored?
- ▶ When does the expected surge begin to wane?



Hospital Supply Model

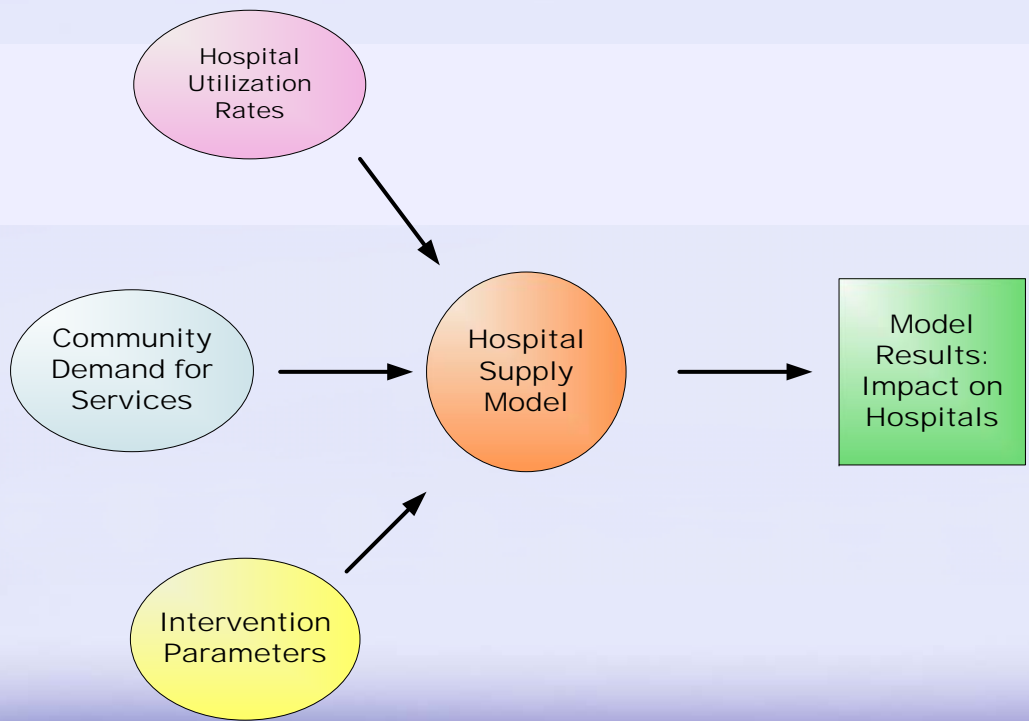
Objectives

- ▶ Model inpatient hospital “supply” of beds against “demand” over time, by geography
- ▶ Evaluate effects of predicted interventions on increasing bed supply
- ▶ Identify gaps in current assumptions, plans and capacities
 - Bridge between Public Health and EMS
- ▶ Develop and refine policies and protocols for individual hospitals, networks and County systems
 - Alternate Care Site Planning



Hospital Supply Model

Hospital (Surge) Supply: General Design



- Queuing model: Every one in, every one out (10 million+ people)
- 25 week cycles
Multiple iterations ("runs")
- 108 hospitals



Hospital Supply Model- Description

Hospital Utilization Rates

- ▶ Patient and Hospital specific data
 - California State healthcare utilization data (OSHPD)
 - Includes locations and bed capabilities of every hospital in LA County (108)

Community Demand for Services

- ▶ Baseline pandemic morbidity data → Directly from Community Mitigation Model
 - Cases over time by geography
 - Much more specific and relevant than available FluAid data



Hospital Supply Model- Description

Intervention Parameters

- ▶ Hospital policy and protocols:
 - Cancellation of elective surgeries
 - Length of stay
 - Staffing Ratios
 - Bed allocation: ICU v. medical surge v. Acute Respiratory Support
- ▶ Non-payer status
- ▶ Initial results expected by April 2009



Model Integration and Use: So What?

- ▶ Realistic outcomes, driven by local objectives
- ▶ Success =
 - Realistic
 - *Influence on planning, plans and policies*
- ▶ “Community” engagement: federal, state and local officials
 - Public Health and EMS
 - School officials
 - Hospital associations
 - Hospital administrators
- ▶ Development of targeted exercise and training to improve pan flu decision making skills





Thank you

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