

# Modeling the public health system response to a terrorist event

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# National Center for Food Protection and Defense

## - Agents

- Detection
- Inactivation
- Decontamination

## - Training

- Risk communication
- Education

## - Systems

- Supply chain
- Public health response
- Economic analysis
- Security

# Project Team

- Don Schaffner
- Craig Hedberg
- Greg Paoli
- Todd Ruthman
- Andy Jaine
- Ben Miller
- Katherine Grimm

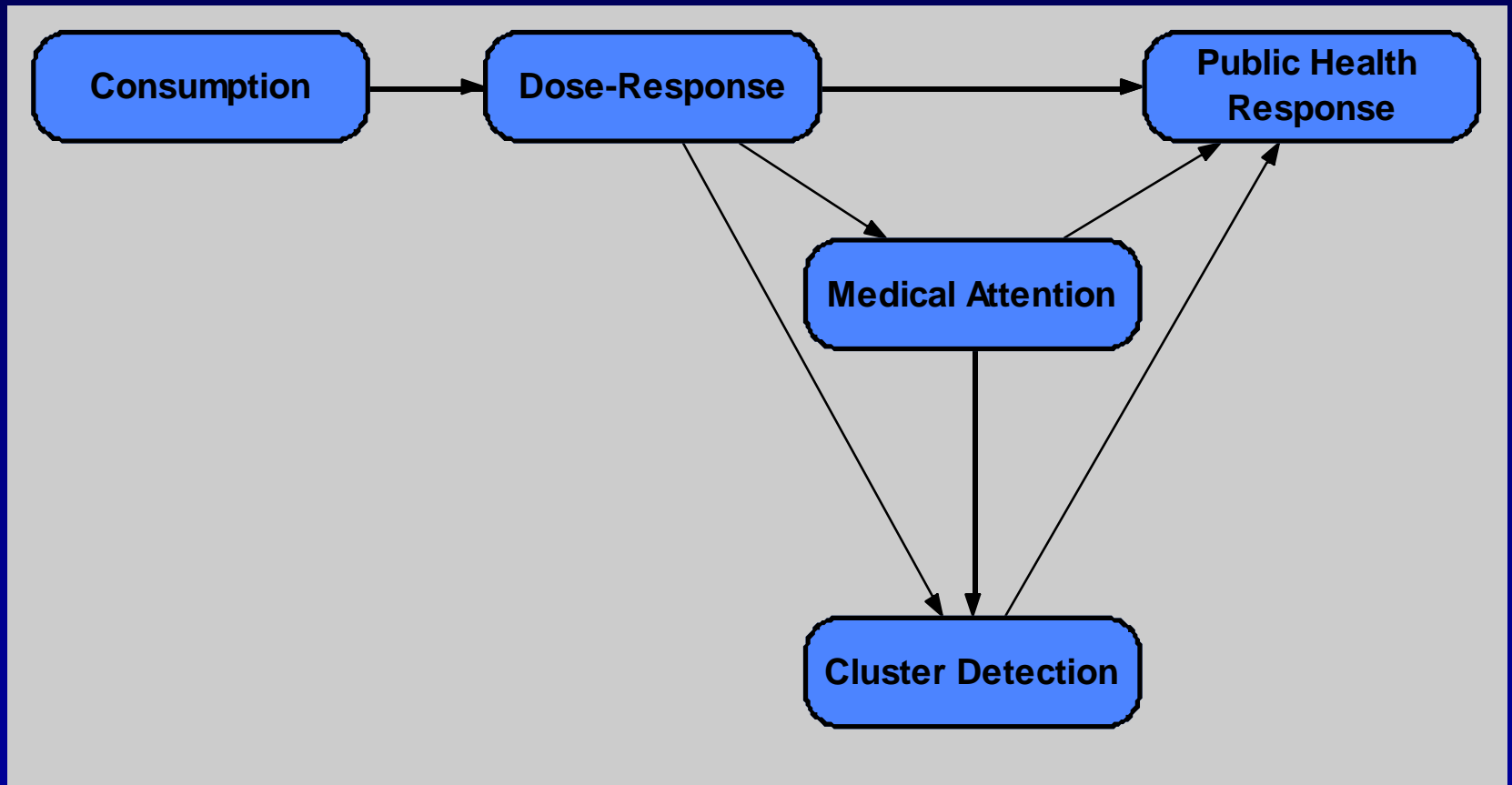
# Public Health Response Modeling

- Develop a model which describes the behavior of the public health system in response to a contamination event
- Model should also be able to predict the effect of interventions
- Model can be useful for deliberate and accidental contamination

# Current model details

- Developed in Analytica
- Fifty (50) days
- Sixty (60) dose-events (i.e. contaminated servings)
- Dose response has single probability of illness with 3 severities
  - Low, Moderate, High

# Analytica screenshot



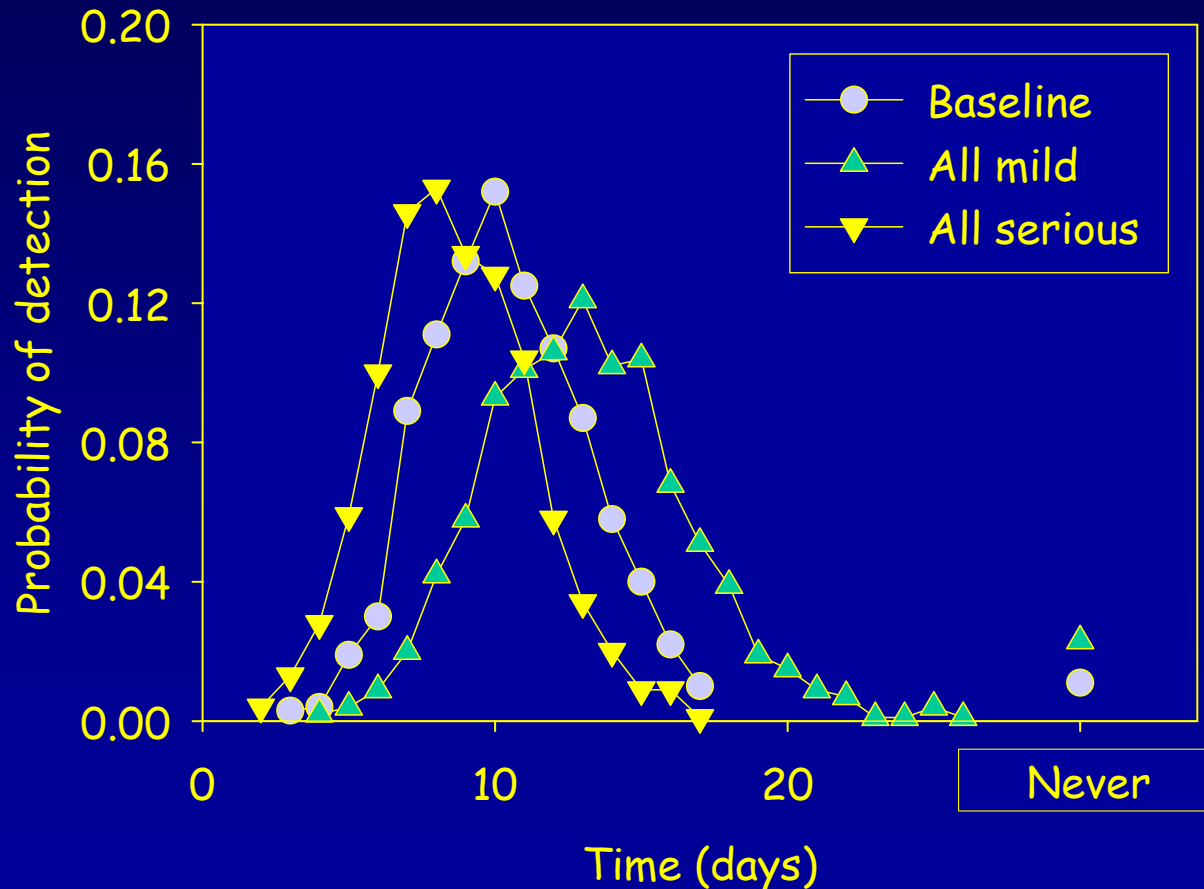
# Current model details

- Outbreak cluster detection is based on a "detection constant"
- Cases are weighted by severity

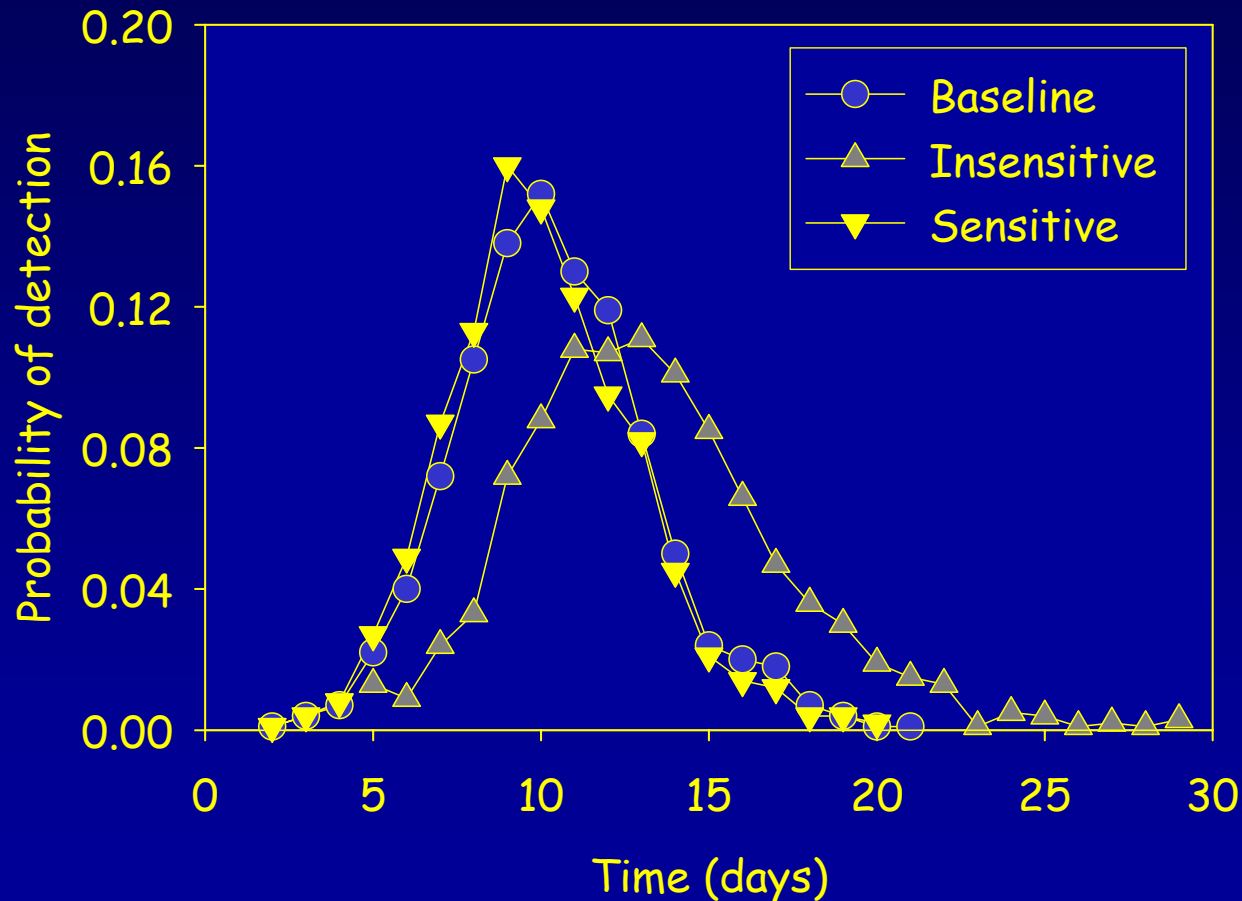
$$1 - e^{-(dc * \text{total weighted cases})}$$

- Ideally, this constant would be related to the number of cases and the specificity of symptoms (i.e. some pathogens may have a more obvious signature than others when diagnosing cases)

# Effect of illness severity on time to outbreak detection



# Effect of "detection constant" on time to outbreak detection



# Improvements, future directions

- Add more realistic public health data
  - Expert elicitation
  - EDITS (Enteric Disease Investigation Timeline Study)
- Add pathogen "signature" to flag distinct pathogens easily
  - *Clostridium botulinum* vs. *Salmonella*
  - The hospital system capacity data (e.g. Ventilator capacity and anti-toxin availability)
- Add mitigating effect of intervention
  - Time dependent feedback
  - Risk messages and audiences for those messages from the Risk Communication team

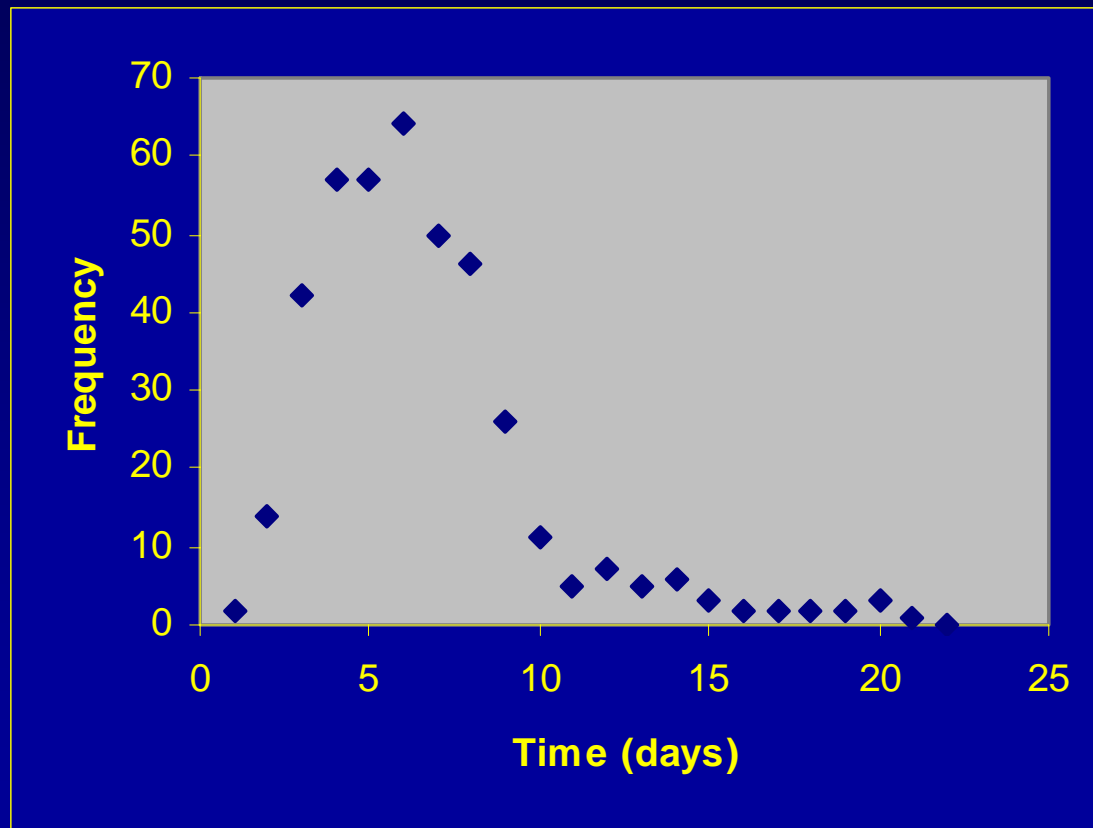
# EDITS data summary

	Salmonella	Shigella	Campy	E. coli	Listeria
Onset of Illness	328	162	145	163	31
Specimen Collection Date	479	194	174	175	36
Initial Report Date	258	99	117	55	19
State Report Date	196	94	96	32	13
Isolate Submission Date	441	165	91	160	24
PFGE Set Up Date	117	35	0	79	0
PFGE Subtyping Date	351	114	0	147	19
Interview Date	225	98	105	154	21
Total observations	537	253	251	188	45
Complete records, all dates	3	0	0	8	0

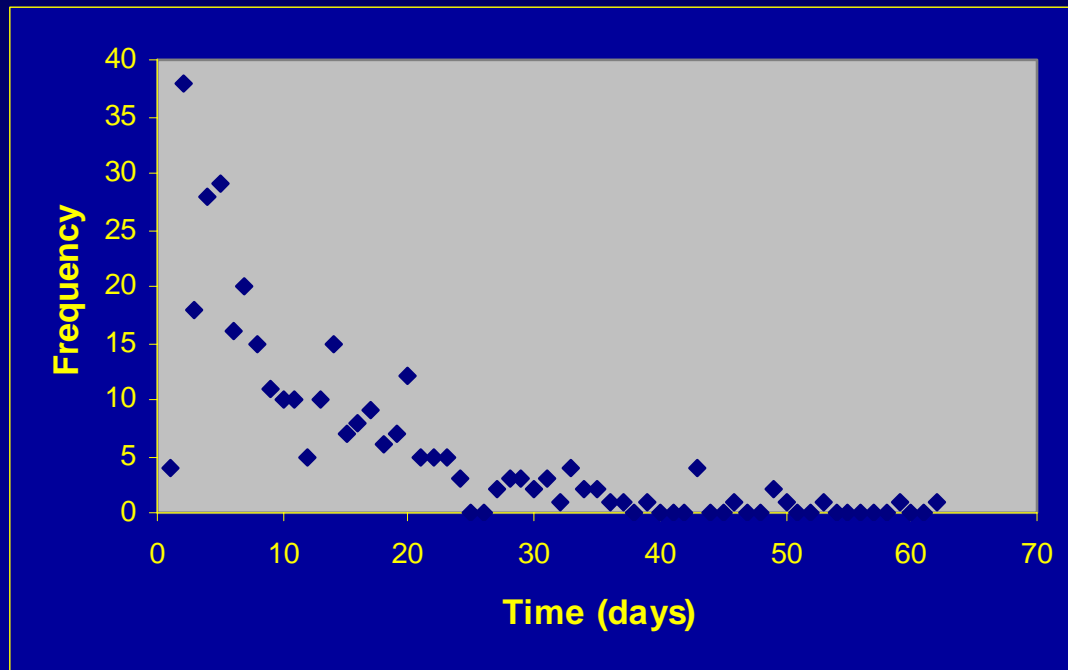
# Sample *Salmonella* EDITS data

- Determining cause by microbiology
  - Time from specimen to microbe isolation
  - Isolation to subtyping
- Determining cause by epidemiology

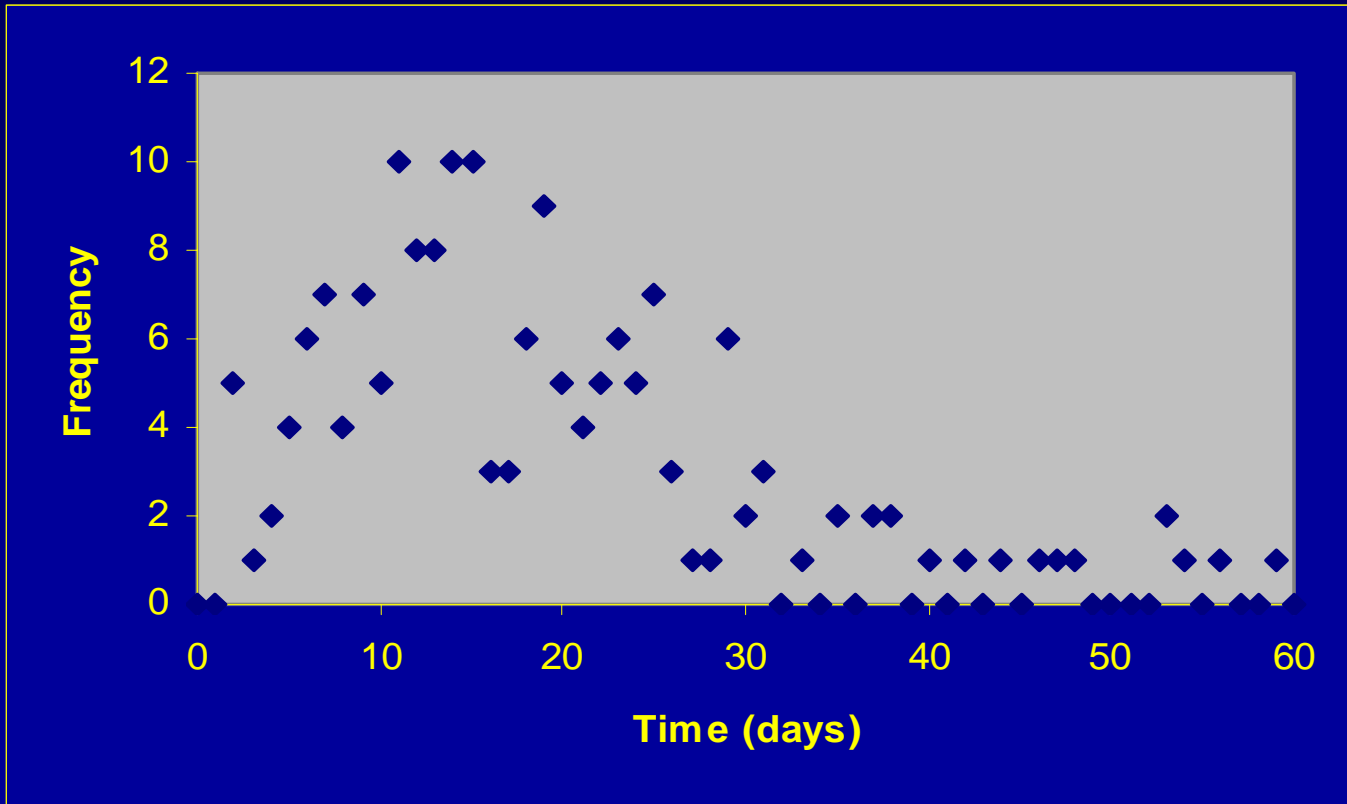
# Time from obtaining specimen until organism is isolated



# Time from obtaining isolate to completed sub-typing



# Time from disease onset until interview



# Recap: a work in progress...

- We still require
  - More realistic public health data
  - More pathogen specific data
  - The ability to model the mitigating effect of intervention
- Final product will be useful in optimizing the performance of the public health system