



BACTrack: A Surveillance Technique for Detecting and Locating Bioagent Attacks

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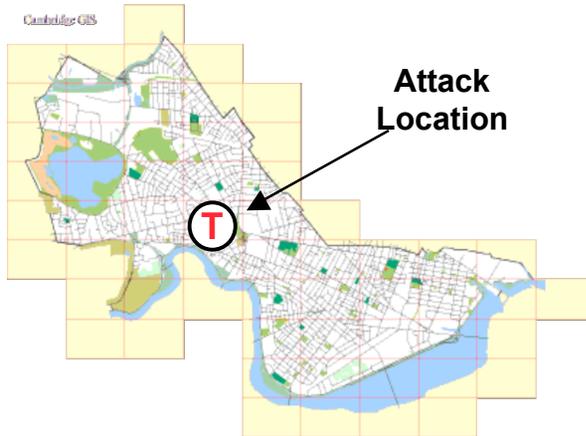
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An Example Scenario

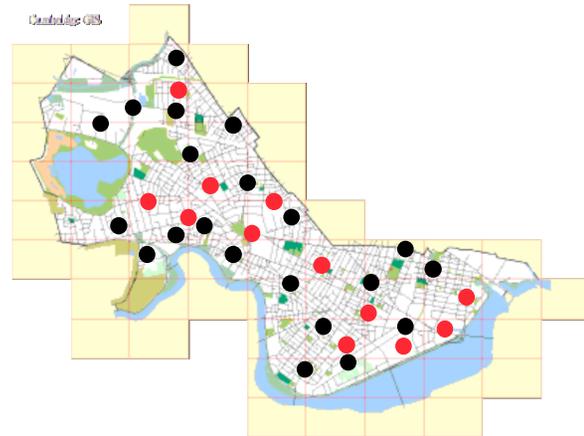
Attack Phase – day 0



- Covert Anthrax attack on T station
- Victims are infected but show no signs of illness

Localized population
Timely
Not detectable

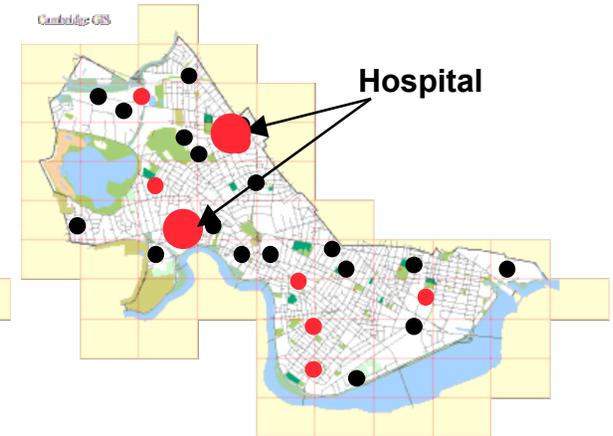
Early Symptom Phase – day 2



- Some victims show non-specific symptoms
- Victims are widely distributed geographically

Cannot detect
Cannot localize

Treatment Phase- day 5



- More victims begin to show signs of illness
- The sickest victims report to ER and doctors offices

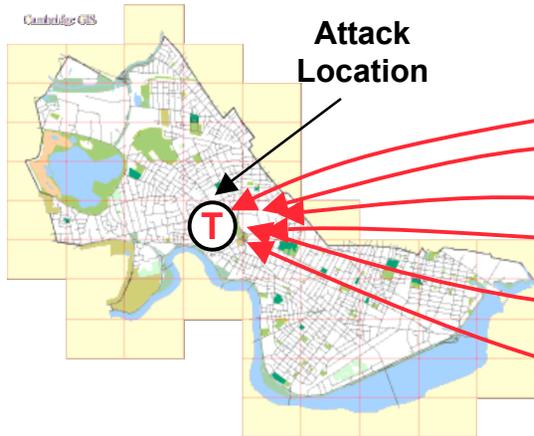
Not Localized
Not Timely
Detectable



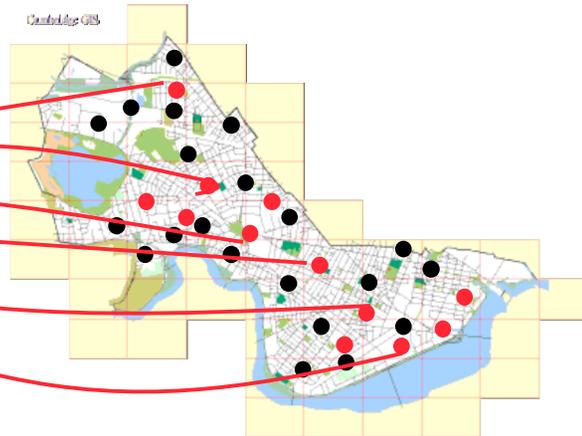
BACTrack

Biological Attack Correlation Tracker

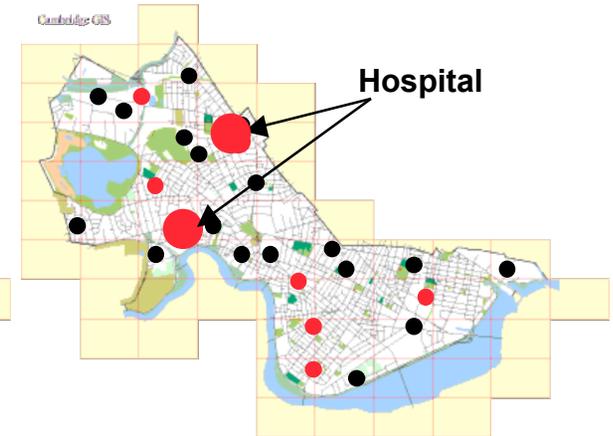
Attack Phase – day 0



Early Symptom Phase – day 2



Treatment Phase- day 5



- **Sampled Population**
 - Participants log a history of location versus time
 - When a participant feels ill, they download their symptoms and track history to a central processing facility
- **BACTrack processing**
 - Tracks of people reporting current symptoms are played back in time
 - Attack detection based on finding area with high concentration of symptomatic participants

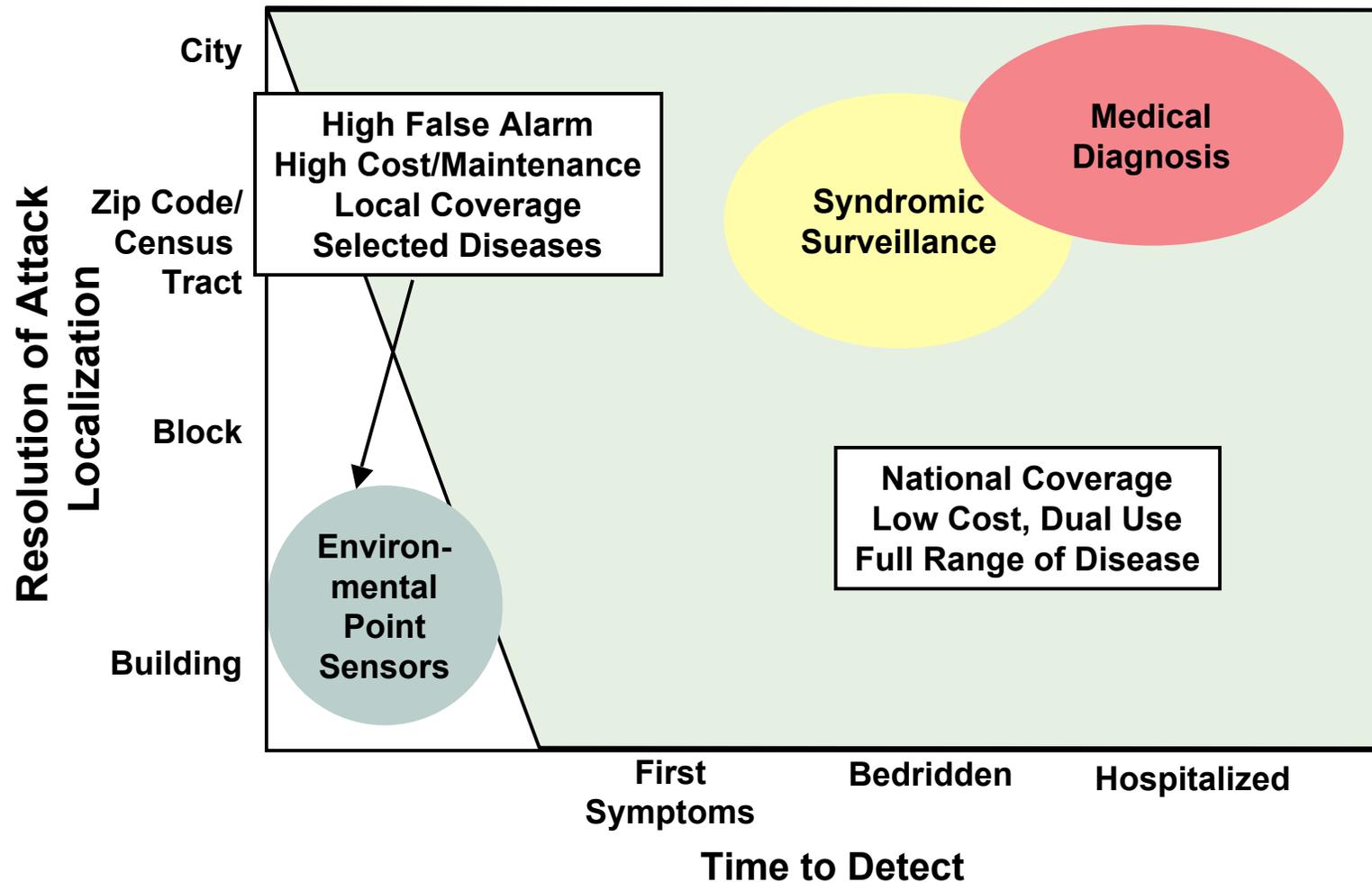


Unique Aspects of BACTrack

- **BACTrack performs epidemiology in reverse**
 - First postulate a common point of infection, then follow-up to discover nature of ailment
 - Yields simultaneous detection and localization
- **Utilizes non-specific symptom information**
 - Filters noisy symptom data through geographical correlation
 - Allows automated self-reporting
- **Location tracking can yield signal-to-noise gain**

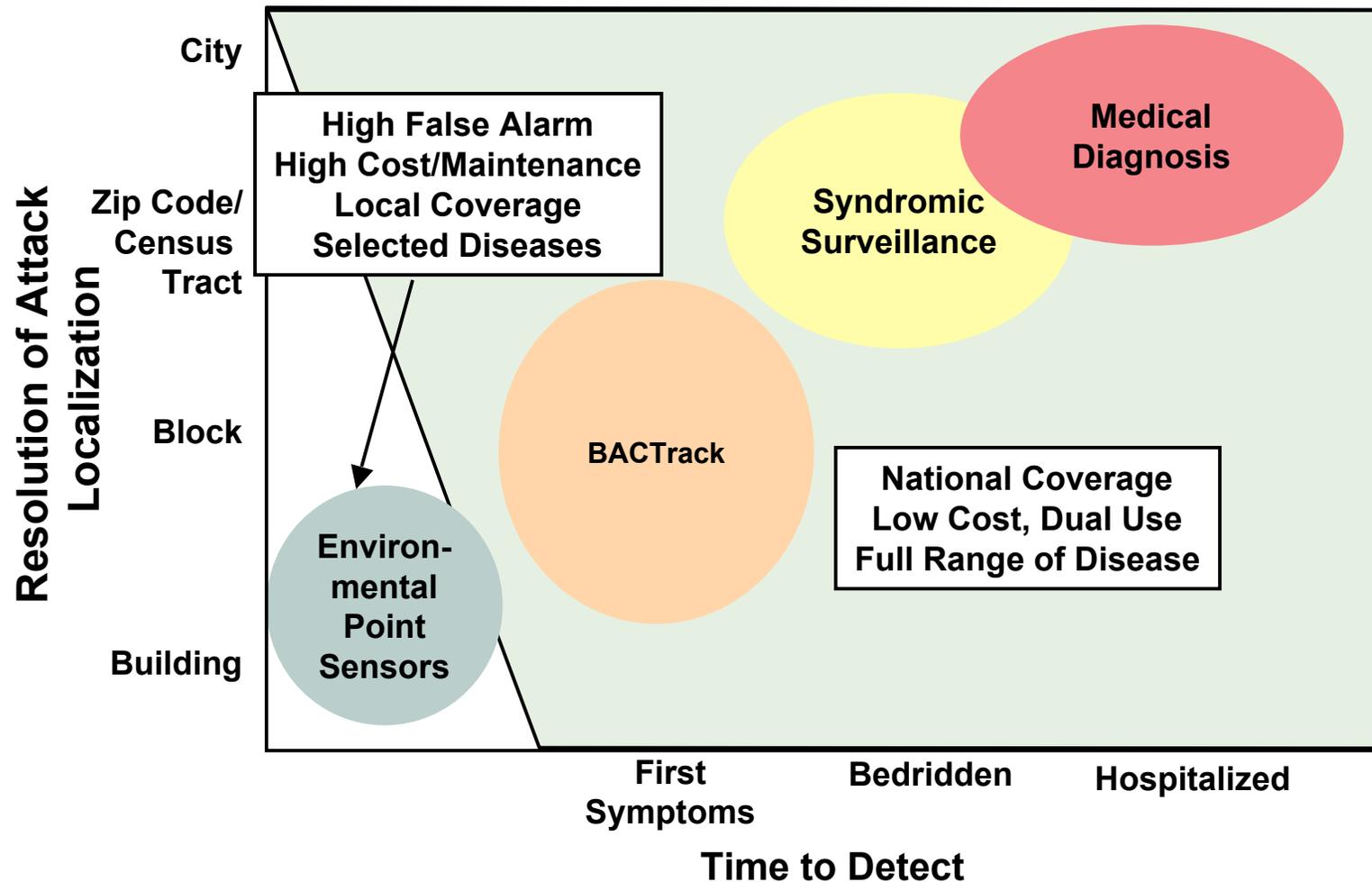


Comparison Of Detection Techniques





Comparison Of Detection Techniques



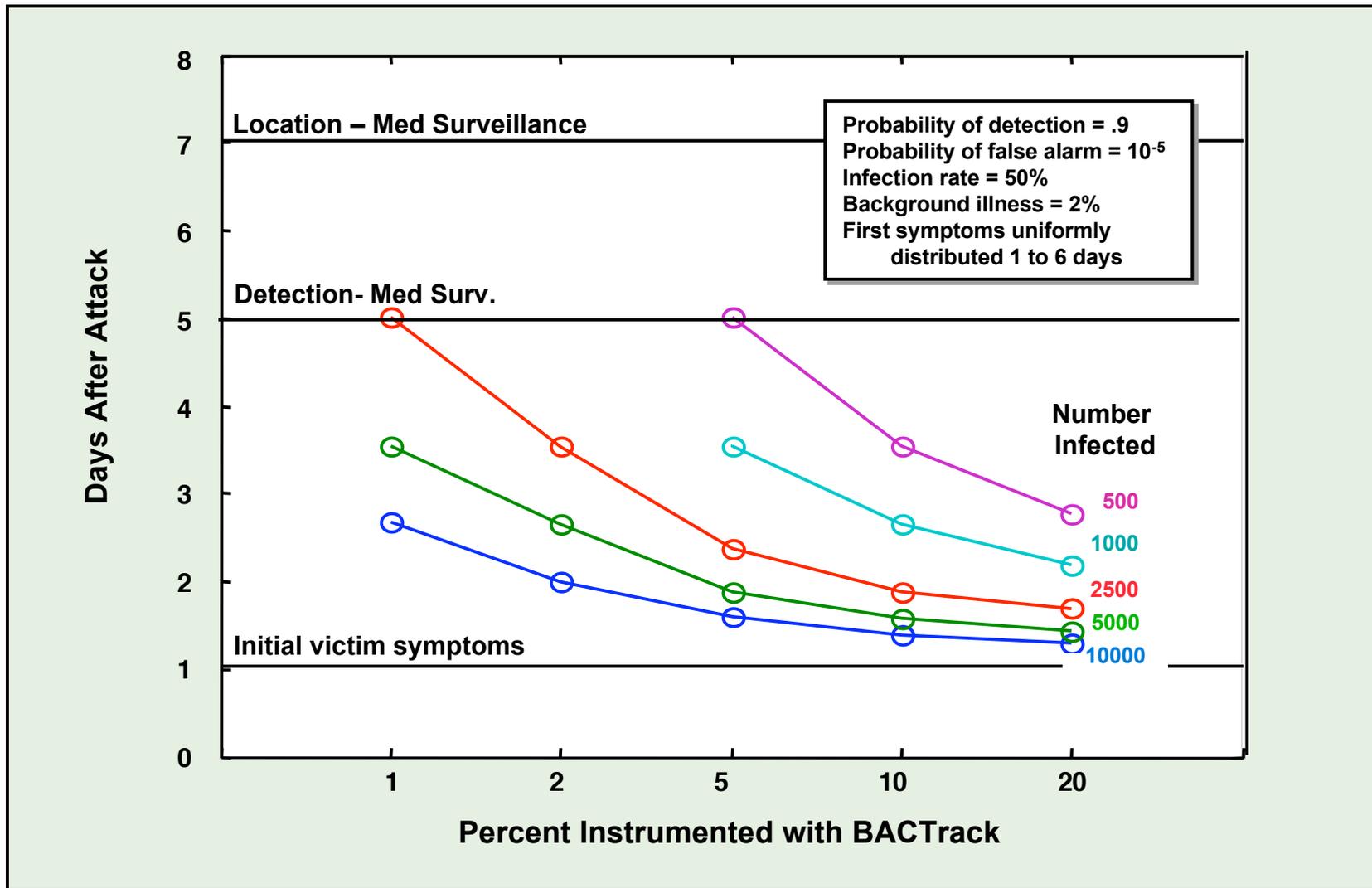


Key Questions

- **Detection sensitivity and false alarm rate**
 - **Attack size**
 - **Size of instrumented population**
 - **Ambient background illness**
 - **Time to detect**
- **Concept of operations**
 - **Tracking methods**
 - **Surveillance algorithms**
 - **Response**



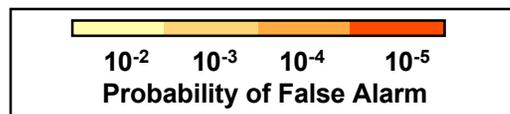
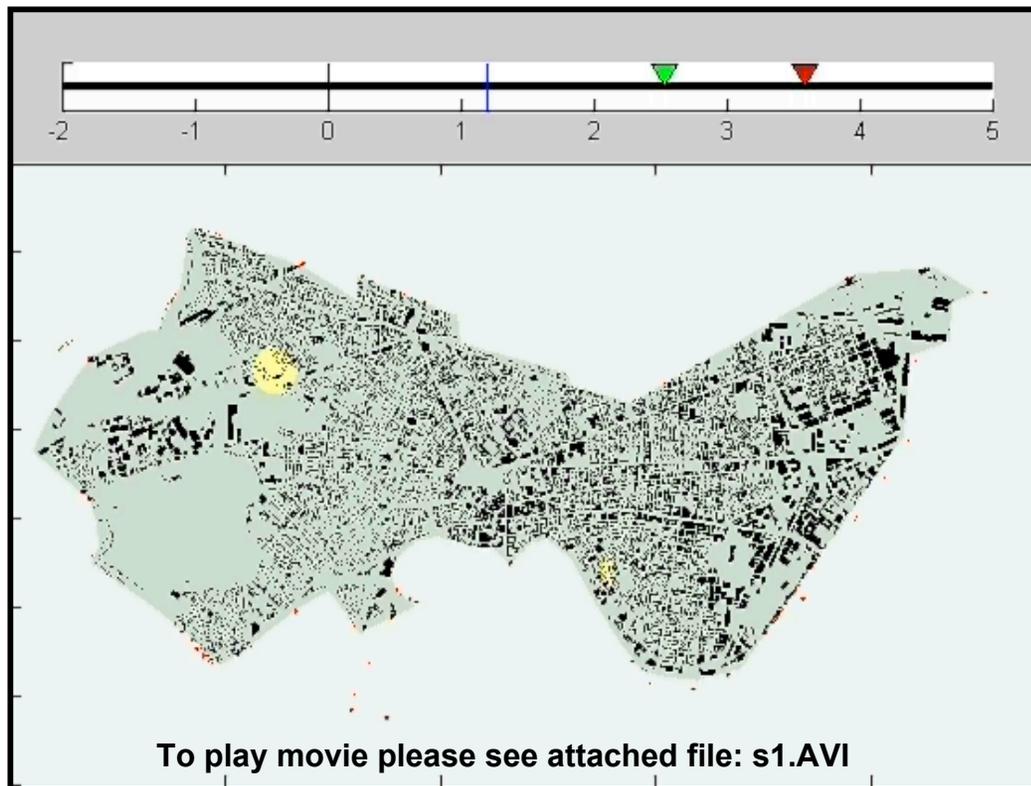
BACTrack Performance



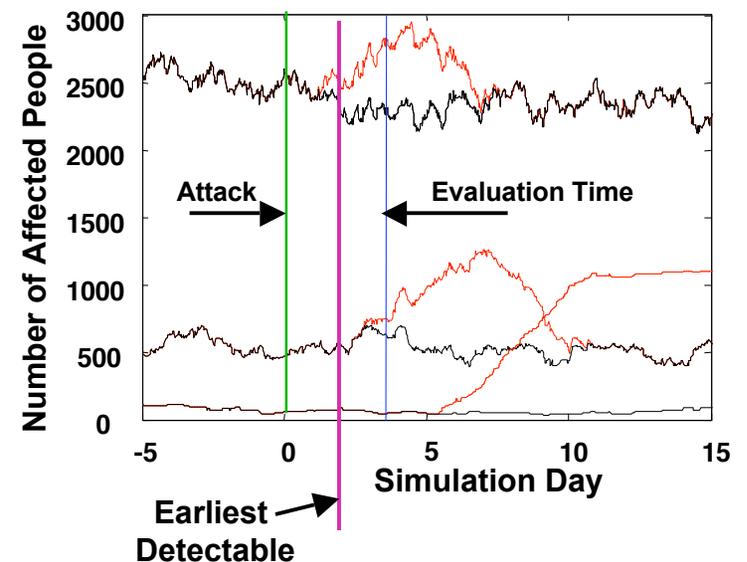


Building Attack Case

Detection Map



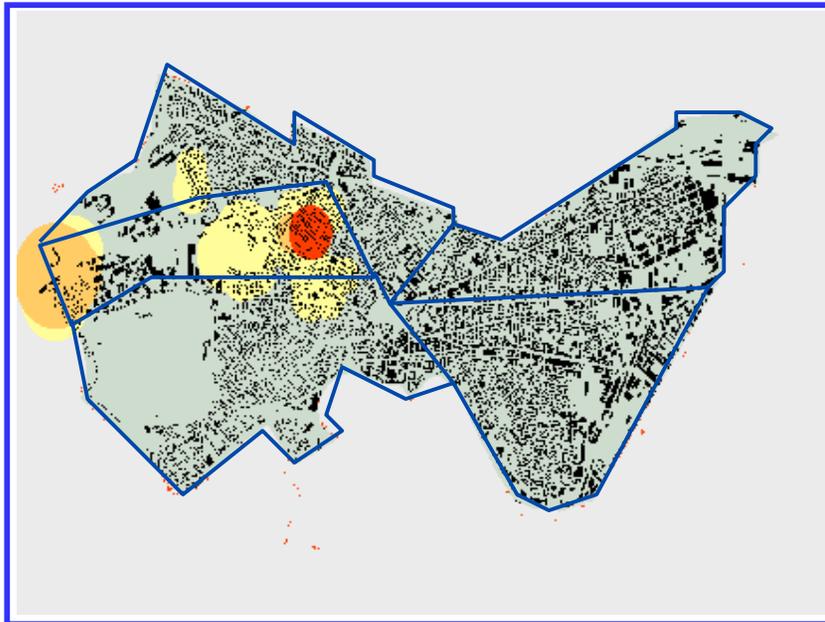
- Scenario: Anthrax is introduced into HVAC system of supermarket at peak shopping hour
- Simulation statistics
 - 10% of population BACTrack instrumented
 - 2% background illness
 - BACTrack detection based on report from 63 victims



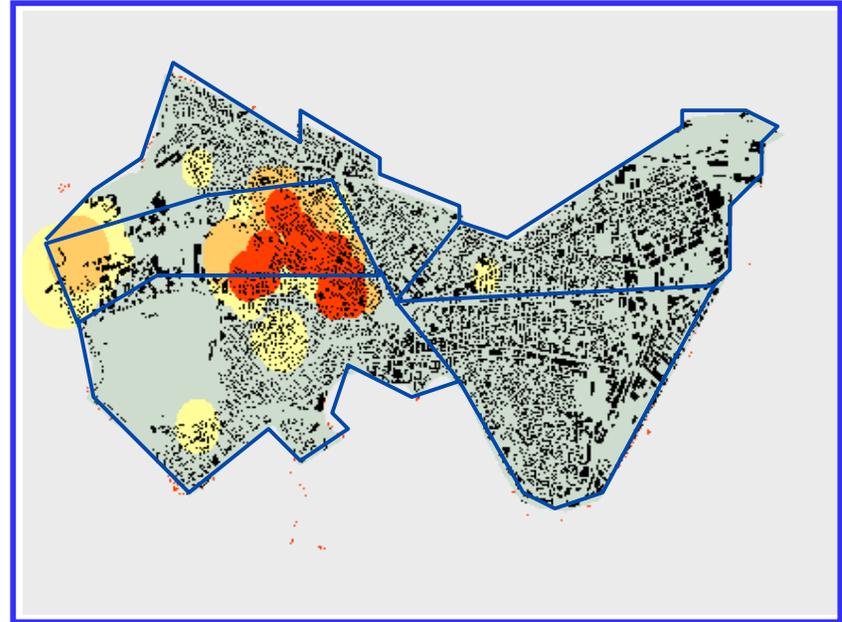


Water-Borne Contamination Case

**Evaluation 5 days after contamination
2.5 days after first symptom**



**Evaluation 7 days after contamination
4.5 days after first symptom**



- **Waterborne attack detectable < 3 days after first symptom**
- **Simulation demonstrates public health benefit**



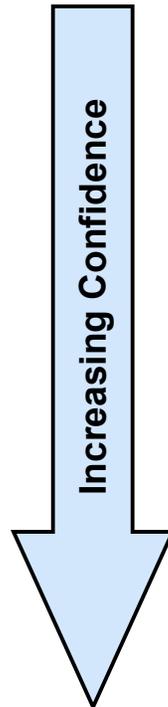
BACTrack User Implementation

- **Location History**
 - Location tracking/storage using cell-phone network
(geo-location mandated by 2006)
- **Subscription Services**
 - BACTrack location available as a phone provider service
 - Interactive Location Based Service forecast to grow to \$4B/year market by 2006
- **User Reporting**
 - User reports symptoms through automated cell-phone interface using password
 - Individual reports only releasable with password
 - Summary information available to health department and all users
- **User Benefits**
 - User receives public health information including attack alerts and natural disease outbreaks





Response Sequence



	First responders Forensics	Docs/Hospitals Public Health
Obtain additional site information	<ul style="list-style-type: none">• Check local events• Phone calls	<ul style="list-style-type: none">• Increase patient testing
Environmental Testing	<ul style="list-style-type: none">• Site visit• On-site bio-analysis• Lab tests	<ul style="list-style-type: none">• Look for other medical indicators• Order CDC push-pack
Medical Alert	<ul style="list-style-type: none">• Deny site Access	<ul style="list-style-type: none">• Prepare treatment centers
Proxy Testing	<ul style="list-style-type: none">• Declare as crime scene	<ul style="list-style-type: none">• Treat most likely victims
General Public Alert	<ul style="list-style-type: none">• Search for perpetrators	<ul style="list-style-type: none">• Treat public at large



Summary

- **BACTrack offers a new way to detect and locate bioagent attacks**
- **The study has shown the utility of coupling location history with health information**
 - **Earlier detection and location relative to medical surveillance**
- **The cell-phone location based service market can offer a means to implement BACTrack and to distribute its costs**