Computing Research Needs in Homeland Security: Biodefense

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[on assignment from CDC]

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Overview

- **What is public health?**
- **Barriers to use of computing in public health**
- **Bioterrorism preparedness and response**
- **Biodefense IT requirements: detection**
- **Biodefense computing research needs**

What is public health?

- **Core Functions**
  - **Assessment – What is the health status of the community?**
  - **Policy Development – What laws, policies, and regulations are needed to protect the health of the community?**
  - **Assurance – What can be done to assure improved health in the community?**

What does public health do?

- **Prevents epidemics and the spread of disease**
- **Protects against environmental hazards**
- **Prevents injuries**
- **Promotes and encourages healthy behaviors**
- **Responds to disasters and assists communities in recovery**
- **Assures the quality and accessibility of health services**

Public Health v. Medicine

	Public Health	*Medicine*
Patient	Population	Individual
Intervention	Assess, Policy, Assurance	Medical, Surgical Care
Process	System Management	Patient Management
Outcome	Healthy Community	Healing

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Public Health v. Medicine (2)

	Public Health	Medicine
Data Sources	Clinical, lab, environmental, motor vehicle accidents, justice records, occupational safety, ...	Clinical, lab

Organization of Public Health

- **Local**
  - Perform public health functions in the community
  - Can be county or state agencies
  - Usually very small
    - 2/3 serve populations of <=50K
    - 75% have fewer than 25 employees
  - Limited ability to perform specialized functions
  - Often provide personal health services

Organization of Public Health (2)

- **State**
  - Primary responsibility for health of citizens
  - Independent or part of larger agency
  - Program coordination
  - Specialized functions
    - Epidemiology
    - Laboratory testing
  - Data collection and dissemination
  - Consultation to LHDs

Organization of Public Health (3)

- **Federal**
  - **Health Resources and Services Administration (HRSA)**
  - **Centers for Disease Control and Prevention (CDC)**
  - **Agency for Toxic Substances and Disease Registry (ATSDR)**
  - **Food and Drug Administration (FDA)**

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Barriers to IT in Public Health

- **Information**

- **Infrastructure**

- **Informatics**

Information

- **Surveillance data**
  - **Only 15-20% of reportable cases reported**
  - **Delays of days to weeks**
  - **Not typically in electronic form**
- **Other relevant data not electronically available**
  - **Environmental, injury, etc.**
  - **Guidelines**
  - **Contacts**
  - **Training materials**

Infrastructure

- **Information technology**
  - **Only 48.9% of local health departments have high-speed continuous internet connections (NACCHO, 1999)**
- **Workforce**
  - **83% of local health departments indicate that computer training is a key need (NACCHO, 1996)**

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Informatics

- **Definition: the systematic application of computer & information science and technology to public health practice, research, and learning**
- **Management skills**
  - **IT projects expensive and high risk**
  - **Interdisciplinary teams required**
  - **New skills needed by public health managers**

Bioterrorism: Intersection of components and stakeholders

Intelligence/law enforcement, etc.

Environment/science, etc.

Terrorist

Biological agent

Living target

Natural disease outbreak

Bioterrorism
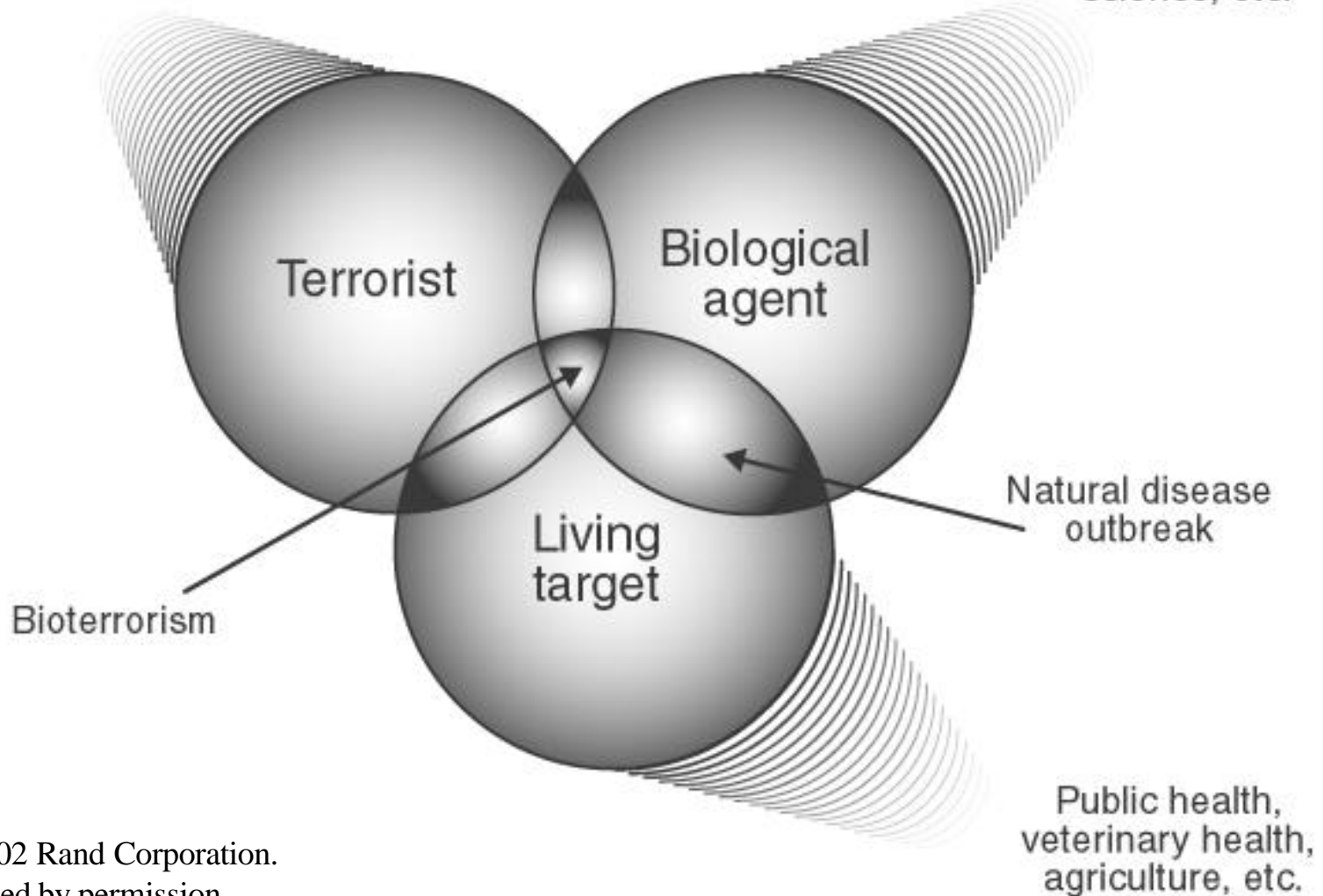
Public health, veterinary health, agriculture, etc.

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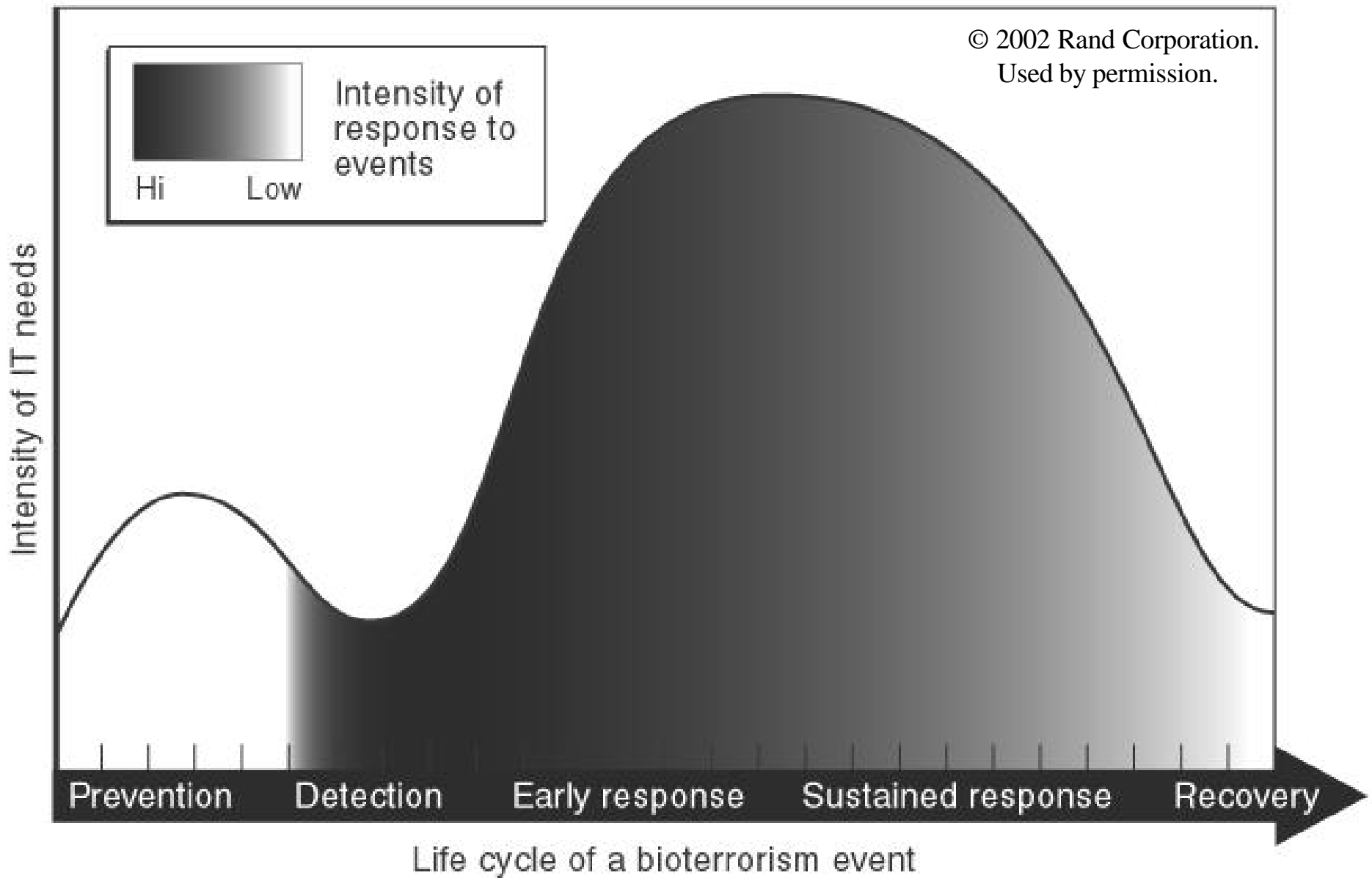
Biodefense IT Requirements

- **Monitor**

- **Detect**

- **Respond**

Biodefense IT Requirements

- **Monitor** — Continuously collect clinical, lab, 911, absenteeism, selected retail sales, other relevant data streams

- **Detect**

- **Respond**

Biodefense IT Requirements

■ **Monitor**

Continuously collect clinical, lab, 911, absenteeism, selected retail sales, other relevant data streams

■ **Detect**

Compare incoming data to known patterns to detect important anomalies; generate notifications upon detection

■ **Respond**

Biodefense IT Requirements

Monitor

Continuously collect clinical, lab, 911, absenteeism, selected retail sales, other relevant data streams

Detect

Compare incoming data to known patterns to detect important anomalies; generate notifications upon detection

Respond

Validate anomalies detected; initiate response, establish command & control, engage established operation plans, activate information sharing
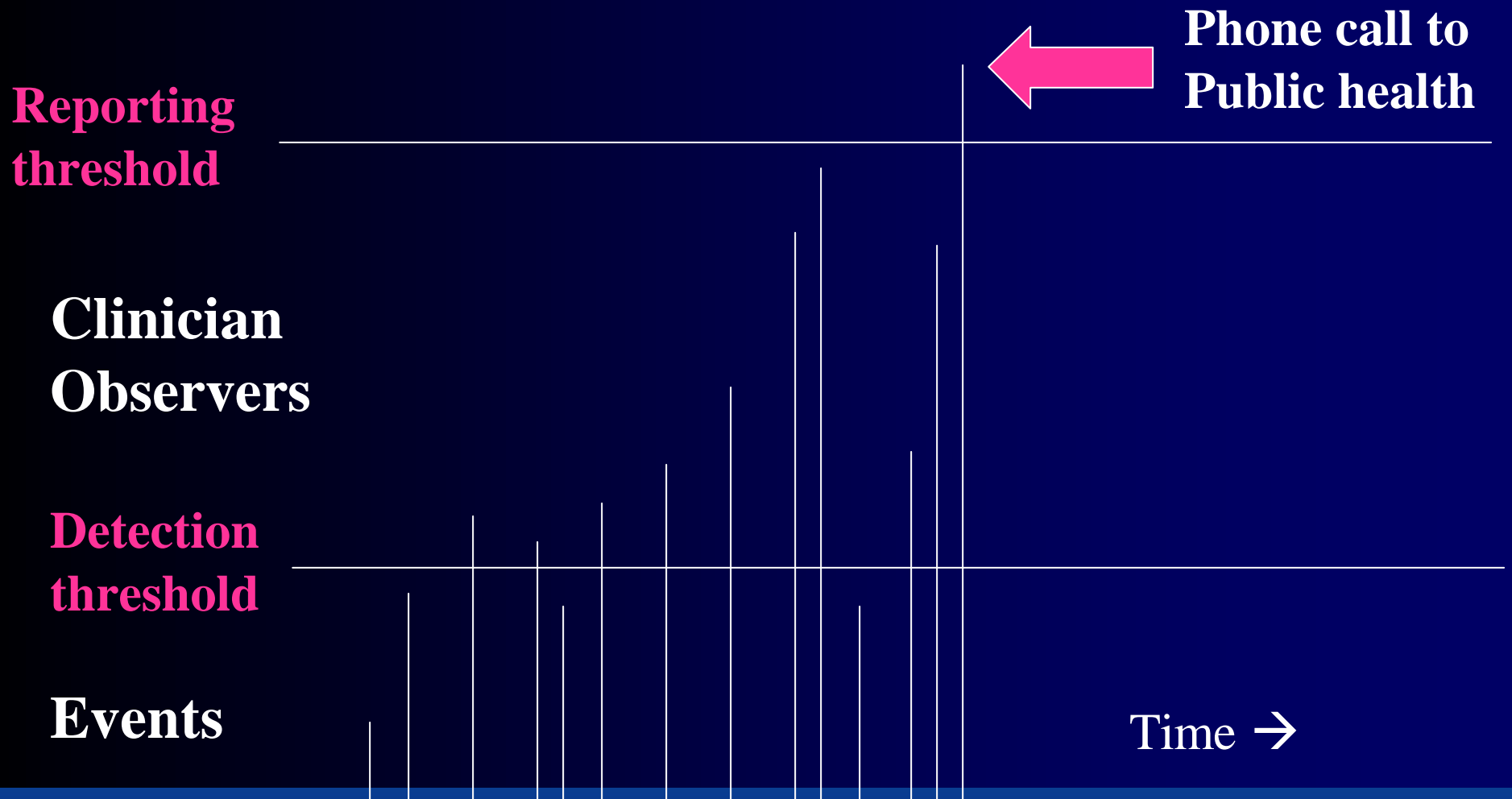
Biodefense IT Requirements
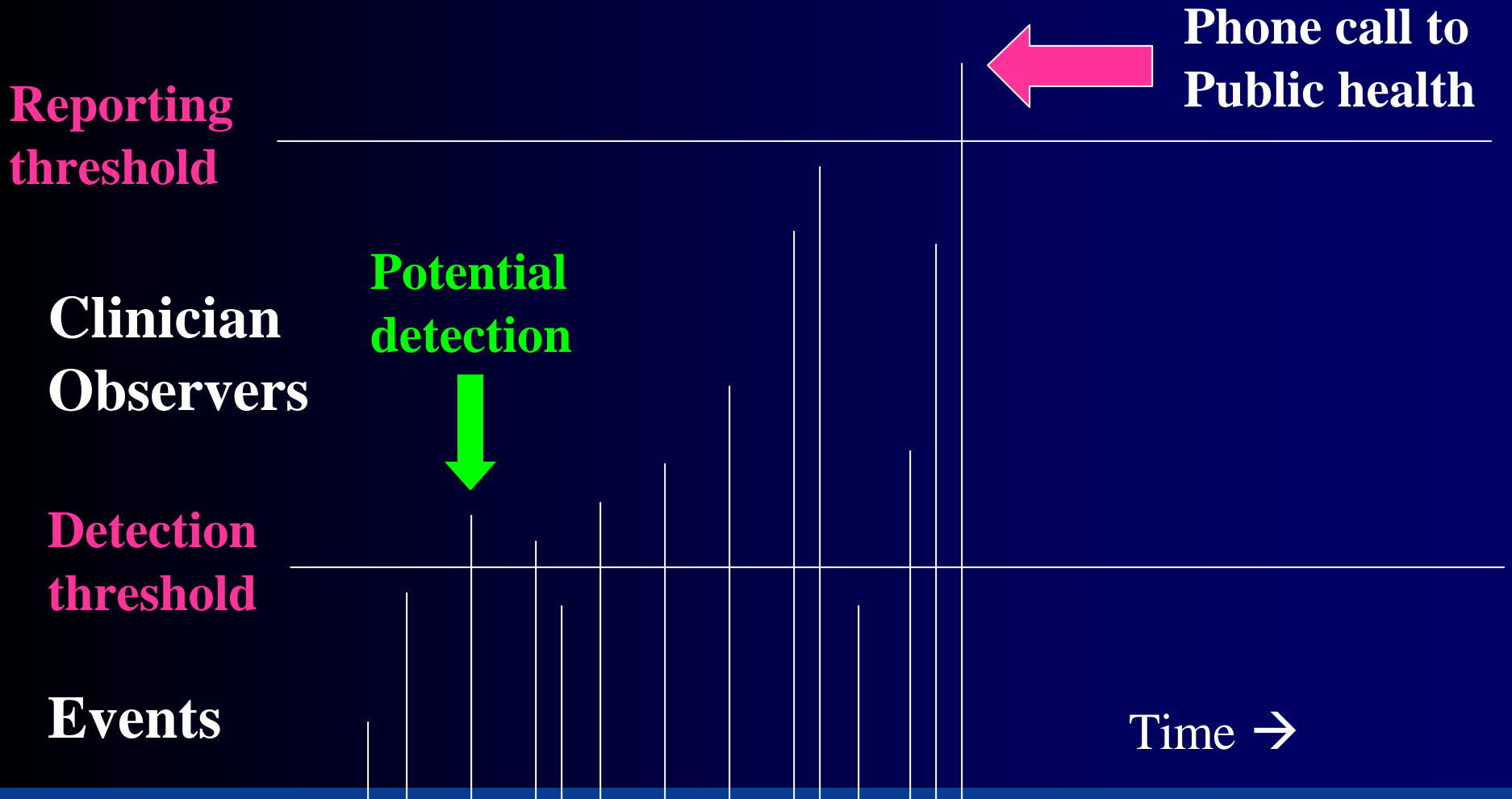
Detection System

Continuously collect clinical, lab, 911, absenteeism, selected retail sales, other relevant data streams

Compare incoming data to known patterns to detect important anomalies; generate notifications upon detection

Response System

Validate anomalies detected; initiate response, establish command & control, engage established operation plans, activate information sharing

Biodefense IT Requirements

Detection System

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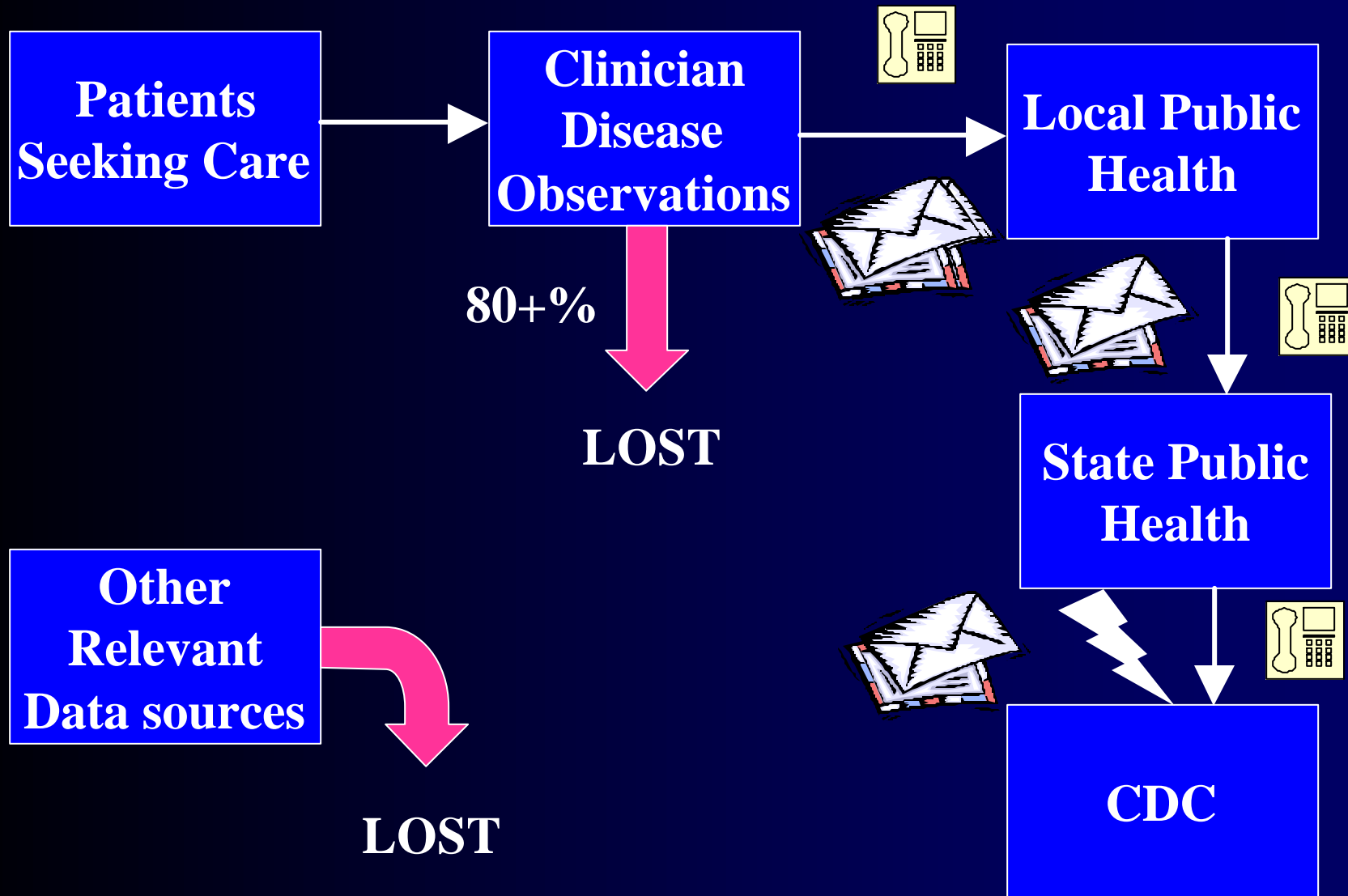
Needed Detection System

Phone call to Public health
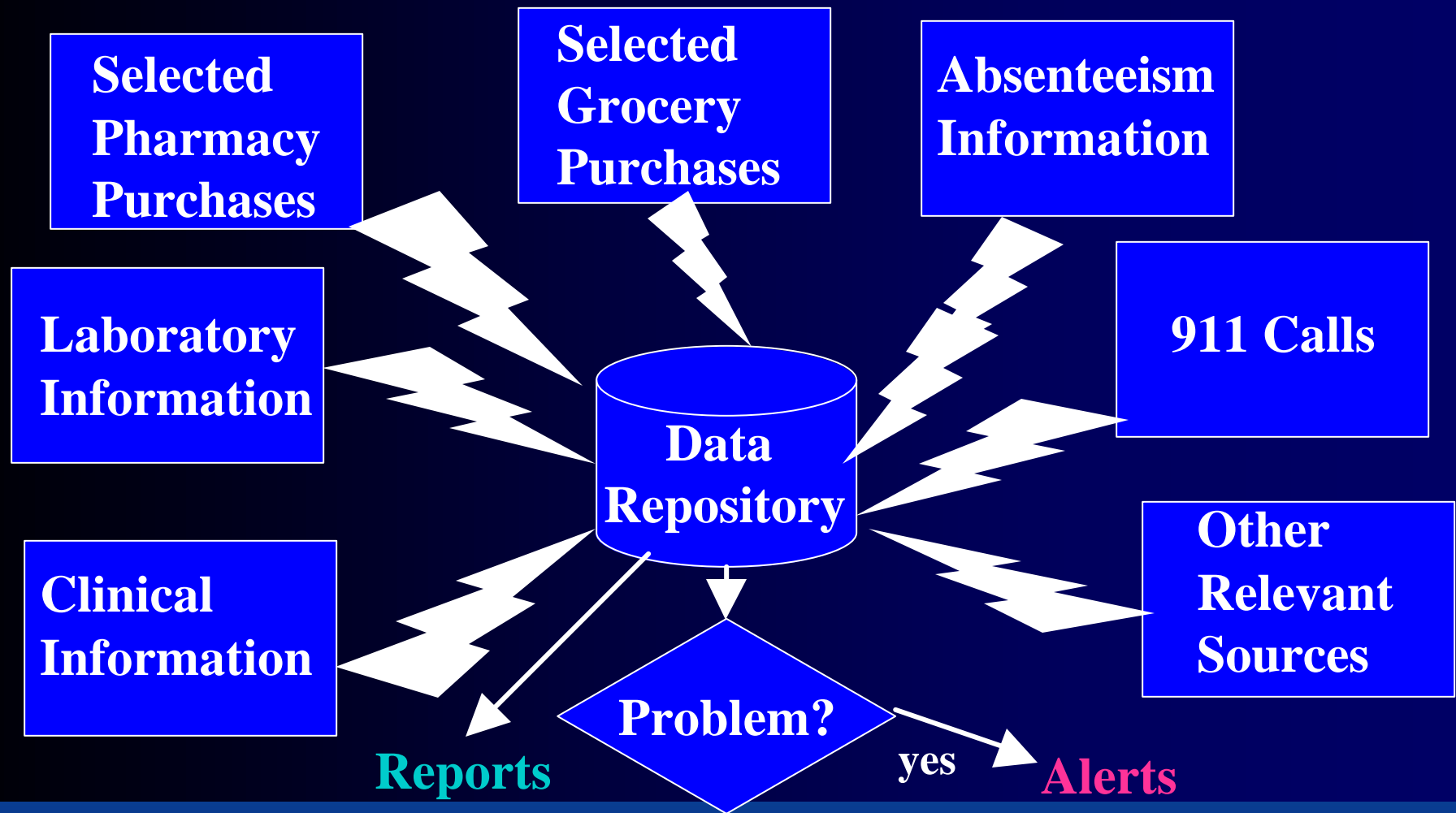
Reporting threshold

Potential detection

Clinician Observers

Detection threshold

Events

Time →

Current Architecture

Biodefense Computing Research Needs

- **Pattern Recognition/Anomaly Detection/Data Mining**
  - High Sensitivity – detect events
  - High Specificity – reasonable costs
- **Automatic Database Linkage (middleware)**
  - Schema level
  - Use metadata to find, map and link "equivalent" data elements
  - Data integration "on the fly"

THANK YOU!

- **Questions?**

- **Contact information:**

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Public Health Informatics Institute (PHII)

- **Goals**
  - **Foster collaborative information system development by multiple public health agencies (to meet shared requirements)**
  - **Facilitate exchange and distribution of successful information systems among public health agencies**
- **Avoid "reinventing the wheel"**

PHI Institute (continued)

- **Non-profit, independent**
  - **Funded by Robert Wood Johnson Foundation**
  - **Outcome of the Spring 2001 AMIA meeting**
- **Additional activities**
  - **Clearinghouse of information about public health information systems**
  - **Executive education workshop in PHI**