Public Health Surveillance of Foodborne Illnesses Using a Novel Dataset

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Overview of Presentation:

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- Public Health Surveillance Systems

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- Methods
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- CUSUM
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I. Burden of Foodborne Illness:

- Foodborne disease outbreaks (FBDOs) remain a public health challenge.
- Nationally, foodborne diseases account for:
  - 76 million illnesses
  - 325,000 hospitalizations
  - 5,000 deaths each year
  - Estimated annual costs of medical expenses of human illnesses between $5.6 – 9.4 billion
- Concern for emerging infectious diseases and bioterrorism

I. Public Health Surveillance Systems:

Traditional Public Health Surveillance:

Passive Surveillance: Relies on diagnostic tests

Advantages: Cheap, operational, widespread

Disadvantages: Time delays, under-reporting

Active Surveillance: Episodic

Advantages: More cases identified

Disadvantages: Resource intensive

Study findings - mixed results

I. Evolving Public Health Surveillance:

Syndromic Surveillance:

Advantages:

- Focus on clusters of syndromes and not cases
- Not new -- WHO uses to detect polio outbreaks
  - == Specific symptom: paralysis
  - == Intervention: vaccine
- Evolving national goals
  - == Early outbreak detection
  - == Improve characterization of event once detected

Disadvantages:

- Resources to date have focused on development
- Research on effectiveness minimal
- Resource Intensive

II. A Novel Dataset:

- Poison Control Centers (PCCs)
  - Real-time data (24/7)
  - Case-specific data entered into computer database
  - Allows for immediate reporting of suspected cases of illness
  - Recognized by the public
  - Utilized for medical advice

II. Reasons for an Integrated PHD and PCC Surveillance System

- An unusual cluster of individuals with non-specific symptoms may be the first sign of a serious illness.
- Early detection may result in an earlier public health response.

II. Purpose of the Study:

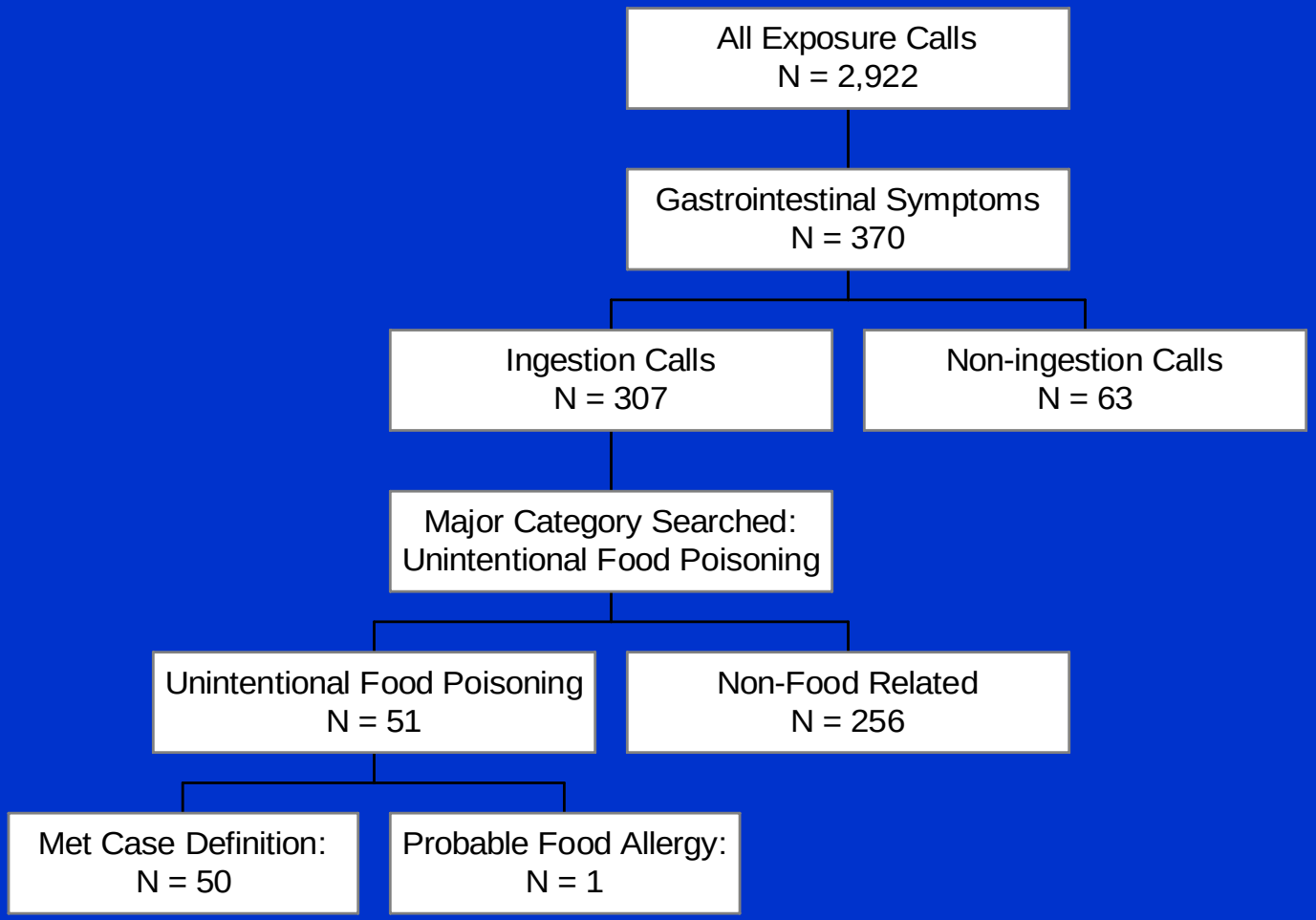
- Evaluate the usefulness of the Arizona Poison and Drug Information Center's (APDIC) data collection system as a means of early detection FBDOs, and
- Recommend changes to improve FBDO surveillance through integration of APDIC and PCHD surveillance systems.

II. Methods:

- Retrospective review of all Pima County human exposure calls from January 1 through March 31, 2000.
- Defined search process to determine if APDIC coding of calls met the predefined gastrointestinal syndrome.
- GI syndrome definition: caller reported ingestion of suspected contaminated food and any one of the following symptom(s): abdominal pain, nausea, vomiting or diarrhea.
- Exclusion Criteria:

  GI symptoms associated with an underlying medical condition, e.g., irritable bowel, reaction to medication.

II. APDIC Search Results:



II. Results: Sensitivity Analysis:

APDIC staff coded as unintentional food poisoning	Consistent with syndrome definition		Total
	Yes	No	
Yes	50	1	51
No	8	248	256
Total	58	249	307

Sensitivity = 86% (50/58)
Specificity = 99.6% (248/249)
PPV = 98% (50/51)

II. Results Continued:

- 58% of callers meeting the case definition contacted APDIC ≤ 24 hours of exposure.
- 14% of callers meeting the case definition contacted APDIC > 24 hours after exposure.
- 28% of these callers exposure history was undetermined.
- 38% of these calls involved more than one person.

II. PCHD Results:

- There were 77 laboratory-confirmed foodborne illnesses reported to the PCHD.
- There were 32 foodborne illness complaint calls received by the PCHD Office of Consumer Health and Food Safety.
- None of the APDIC calls were an exact match to a PCHD laboratory-confirmed illness case.

II. Limitations:

- Inability to confirm the suspected illness and exposure through laboratory testing and short time interval evaluated.
- Missing data may have limited our ability to match APDIC calls to PCHD cases

II. Lessons Learned Pilot Study:

- APDIC's real-time symptom data provides an independent source of syndromic surveillance data to the PCHD's surveillance system and may assist in the early detection of FBDOs.

Challenges:

- INCOMPLETE PCC and PCHD DATA
- PCC database challenges:
  - Inability to confirm exposures
  - Descriptive text data difficult to extract
- Need greater utilization of PCC by public
- HIPAA

III. Next Steps:

Hybrid Surveillance:

(Active/Syndrome Dataset)

-Referrals to PCHD:

* integrate databases
* case finding high-risk
* define FBDOs

Daily event detection:

via alerting algorithm:

- Meet CDC objectives:
  * earlier detection
  * quicker response
  * define FBDOs

III. Next Steps Hybrid Surveillance:

Referrals to PCHD:

- Meet GI syndrome definition and high-risk transmission
  - Occupations (food handler, daycare, health care provider)
  - Association with farm or livestock
  - > 2 untreated cases with same exposure
- Suspected intentional food poisonings (call to law enforcement)
- Call pattern
  - > 3 calls/ 24 hour period
  - Unusual severity or unusual presentation

Referral Process:

- Verbal consent prior to referral

  "Pima County Health Department is the agency responsible for monitoring all foodborne illness in this county. Can we release the information that you provided to them?"

III. Next Steps Data Collection:

Coding of Calls:

- Caller's age (years vs categorical)
- Exposure time
- Exposure history
- Exposure site (home, restaurant)
- Occupation (high-risk)
- Multiple patient's
- Medical outcome (minor, major)
- Management site (where referred)
- Clinical effects (symptoms)

III. Technical Approaches:

Daily Event Detection --Temporal Surveillance:

- Detection of changepoints, e.g. jumps IRs
- Detection of clusters
- Detection of overall process change, e.g., change in or institution of surveillance methods

- CUSUM (cumulative sums)
- EWMA (exponentiatied weighted moving average)

III. Technical Approaches Continued:

- CUSUM
- Change-point analysis
  - detects multiple changes
  - confidence level indicating the likelihood that the change occurred
  - confidence interval indicating when the change occurred
  - supposed to work with all data types
- Disadvantages
  - In practice, not working well with sparse data
  - Sensitive to trends, day-of-week effects
  - Alerts are influenced by current-day count
  - Difficult to interpret

III. Technical Approaches Continued:

- EWMA—Quickly detects small shifts

  - Hospitals: statistical process control charts to monitor nosocomial infections

- Plots weighted moving average values

  - Gives less weight to historical data, more weight to recent data

  - Does not require the assumption of an underlying normal distribution

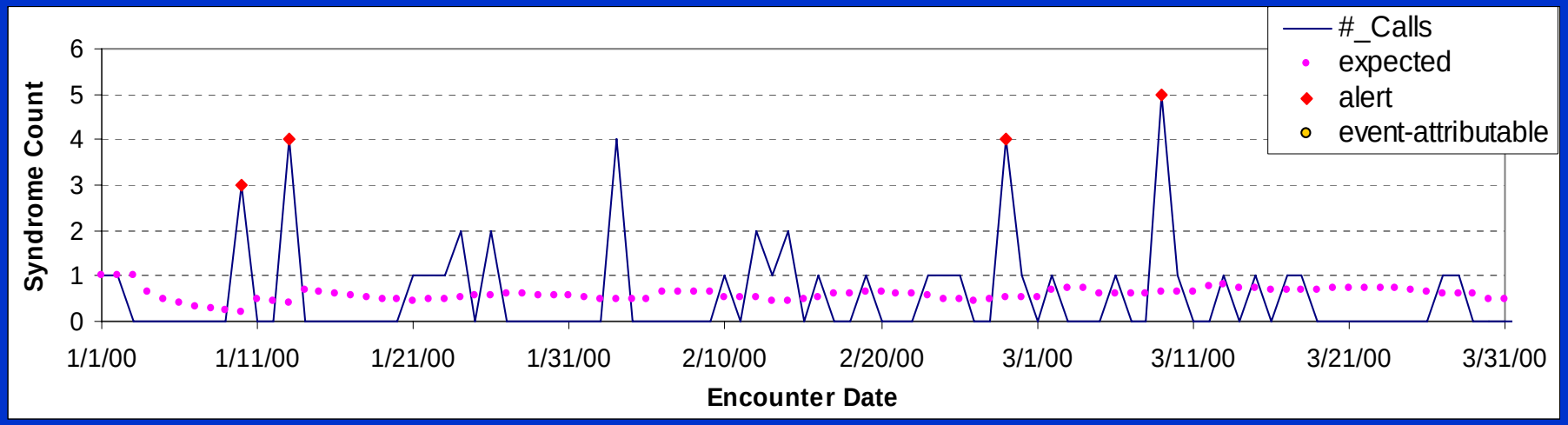
  - Weighting factor can be made sensitive to small/gradual shifts or for sudden signals

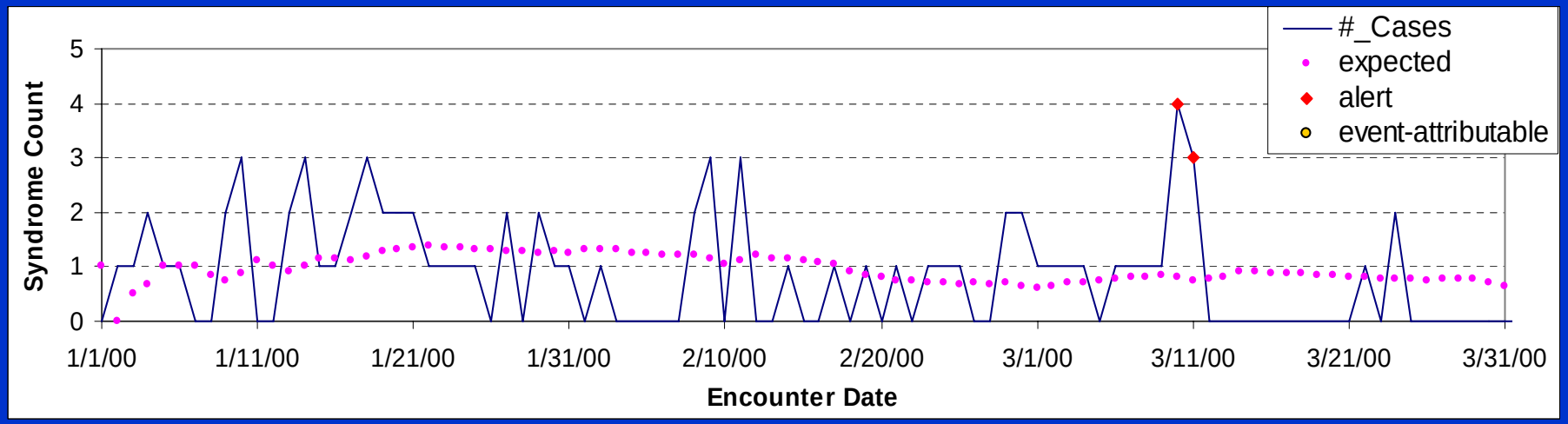
  - Less susceptible to trends, day-of-week effects

  - Preferred method for sparse data

- Difficult to construct boundaries

III. Demonstration Alerting Algorithms:





IV. Summary:

- Integrated, hybrid surveillance system will allow us to detect important FBDOs
- Alert detection will be valuable tool in identifying trends
  - cluster of early illnesses
  - temporal and geospatial relationships

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