From Implementation to Automation: A Step-by-Step Approach to Syndromic Surveillance Systems from a Public Health Perspective

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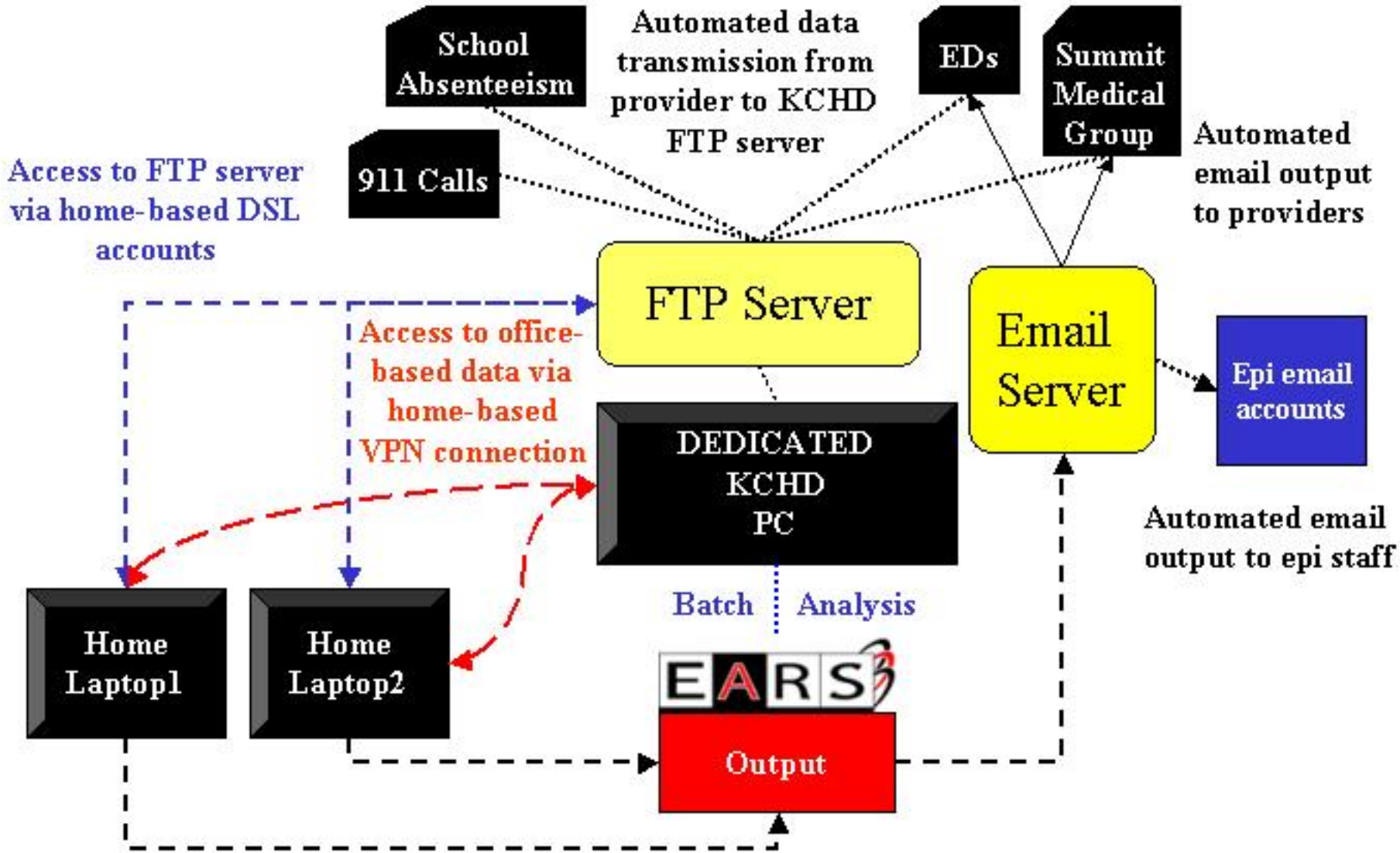
INTRODUCTION

Implementing novel surveillance for biological terrorism is becoming an essential function of local public health departments. Although syndromic surveillance systems can be implemented by a number of methods (including commercially available products), one particular model may be specifically suited to public health. The Centers for Disease Control and Prevention (CDC) has developed the Early Aberration Reporting System (EARS), a syndromic surveillance system that utilizes aberration detection models to identify deviations in current data when compared to a historical mean.

The Knox County, TN Health Department (KCHD) is currently implementing a 24-hour, 7-day/week seamless surveillance system based upon EARS programs. KCHD has developed data-sharing relationships with multiple community partners to develop a fully automated surveillance system that incorporates multiple data sources, automated data transfer via FTP, scheduled batch analysis, and remote access to surveillance data. A schematic of the KCHD system appears in Figure 1. This poster delineates a ten-step process followed by KCHD that other public health departments can use to implement their own surveillance systems.

Figure 1: A Schematic of the KCHD Early Aberration Reporting System



Methods

KCHD has developed a ten-stop process that is followed when approaching each data partner. The process is presented in the following slide series.

Step I:
Acquire EARS Programs

- EARS programs operate on a SAS platform
  - Based on CUSUM algorithm
  - Top-level file controls subprograms
  - HTML graphic and tabular output
- Contact CDC EARS staff
  - Discuss EARS structure and requirements:
    - System requirements (see Step II)
    - Data requirements: event, date, count
    - Methodology: historical vs. non-historical

Step II:
Assess Local Infrastructure

Table 1: Health Department Infrastructure Components for Operating EARS

	Health Department Infrastucture Components
Information Technology	High-end Computer
	SAS Basic Package including Base SAS v.8.2, including SAS/ASSIST, SAS/GRAPH, and choice of SAS/ACCESS product (recommended: SAS/ACCESS to PC file formats)
	Internet Connectivity (56 Kps or secure network connection)
	FTP server and software, or other means of secure transmission with automatic connection capabilities
	GIS (optional)
Personnel/ Training	Epidemiologist or other staff member with intermediate SAS programming skills
	Information technology staff for consultation regarding file type, data transfer, and data automation issues

Step III: Engage Stakeholders

- Select local data partners
  - EDs, 911 call centers, school systems, others
- Set administrative meeting to focus on:
  - EARS overview and methodology
  - Data use agreements
  - Staff assignments for specific tasks
  - Confidentiality, security, and HIPAA
- Set follow-up meetings as necessary

Step IV:
Identify Staff and Assign Tasks

- Staff may include:
  - Health dept. epidemiologist with SAS skills
  - Primary contact at data partner agency
  - Information technology staff from health dept. and data partner agency
- Set meetings with all to discuss:
  - How data are collected (electronic, paper, etc.)
  - EARS requirements: event, date, and count variables
  - How syndromes are coded
  - Data transfer capabilities (exporting, email, FTP, web-based transfer).

Step V: Select Syndromes to Monitor

- Selected by State Epidemiologist and Knox County PHO

Table 2: Data Partners and Syndromes Monitored in Knox County, TN

	911 Emergency Calls	Outpatient Physician Group	Emergency Department Visits	School Absenteeism
Data provider	911 emergency call center	Large outpatient medical practice	Large metropolitan hospital	Metropolitan public school system
Data structure	Call category	ICD-9 code	Nursing triage chief complaint	Absenteeism count by building
Syndromes	Abdominal/back pain Breathing difficulty Chest pain Sick/unknown	Pneumonia (486) Influenza (780.6) Bronchitis (490) Gastroenteritis (558.9) Diarrhea (787.91) Hemoptysis (786.3) Dysphagia (787.2)	Abdominal pain Diarrhea Chest pain Flu symptoms Pneumonia Gastroenteritis Respiratory problems	Sick/unknown

Step VI:
Pilot Test and Establish Data Exchange

- Acquire sample data and import into SAS dataset
- Establish daily data exchange protocol
  - Email, FTP, web-based, etc.
- Build a dataset for initial use with EARS
  - Non-historical: seven days of baseline data
  - Historical: three years of baseline data
- Modify EARS Top-level files
- Provide feedback and output to data partner

Step VII: Develop Automation Routines

- Schedule download or data retrieval
  - SAS ftp filename option
  - Software to schedule downloads (WSFTP-Pro)
- Automate import programs based on file naming conventions:
  - Recommend filename based on date
- Automate top-level date settings using SAS date functions

Step VIII: Schedule EARS as a Batch Job

- Create a batch file for EARS top-level file
  - Sysin- option in SAS

    (*"SAS path\sas.exe" sysin-file specification)*
  - %INCLUDE statements in top-level file to control import, subprograms, and output
  - Windows Scheduled Tasks to schedule batch file

Step IX:
Establish Review and Response Protocol

- Written protocol helpful in determining level of follow-up
- Dependent on syndromes monitored and data collected
- Approval of health dept. PHO
- See handout for Knox County, TN model

Step X:
Long-term Collaboration and Evaluation

- Finalize data use agreements
- Finalize data exchange protocols
  - Encourage/assist data partners to automate data extraction and transfer
- Review response protocols with data partners
- Develop and evaluation strategy:
  - Product evaluation: sensitivity and specificity
  - Process evaluation: experiences of end-users, data partners, and other collaborators

RESULTS AND CONCLUSION

Using EARS, the KCHD has made significant progress toward implementing a multifaceted early recognition system for biological terrorism. The system has been successful in identifying viral outbreaks in schools, tracking community shigellosis outbreaks, and identifying the onset of influenza season. Future plans for the system include complete automation of file transfers and data analysis to facilitate timely access to weekend data; comprehensive coverage of all local EDs; and identification of other potential data sources. KCHD also intends to focus on evaluation of the local EARS system.

The KCHD model has been instrumental in encouraging the Tennessee Department of Health to integrate syndromic surveillance systems as a component of normal surveillance activities to be conducted across the state. Although health department regions and data components will vary across states, this ten-stop process can serve as a general template from which public health departments can begin developing automated syndromic surveillance systems in their own regions.

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