

APL

The Johns Hopkins University
APPLIED PHYSICS LABORATORY



Using Electronic Surveillance Systems in Resource-Poor Settings: Why and How

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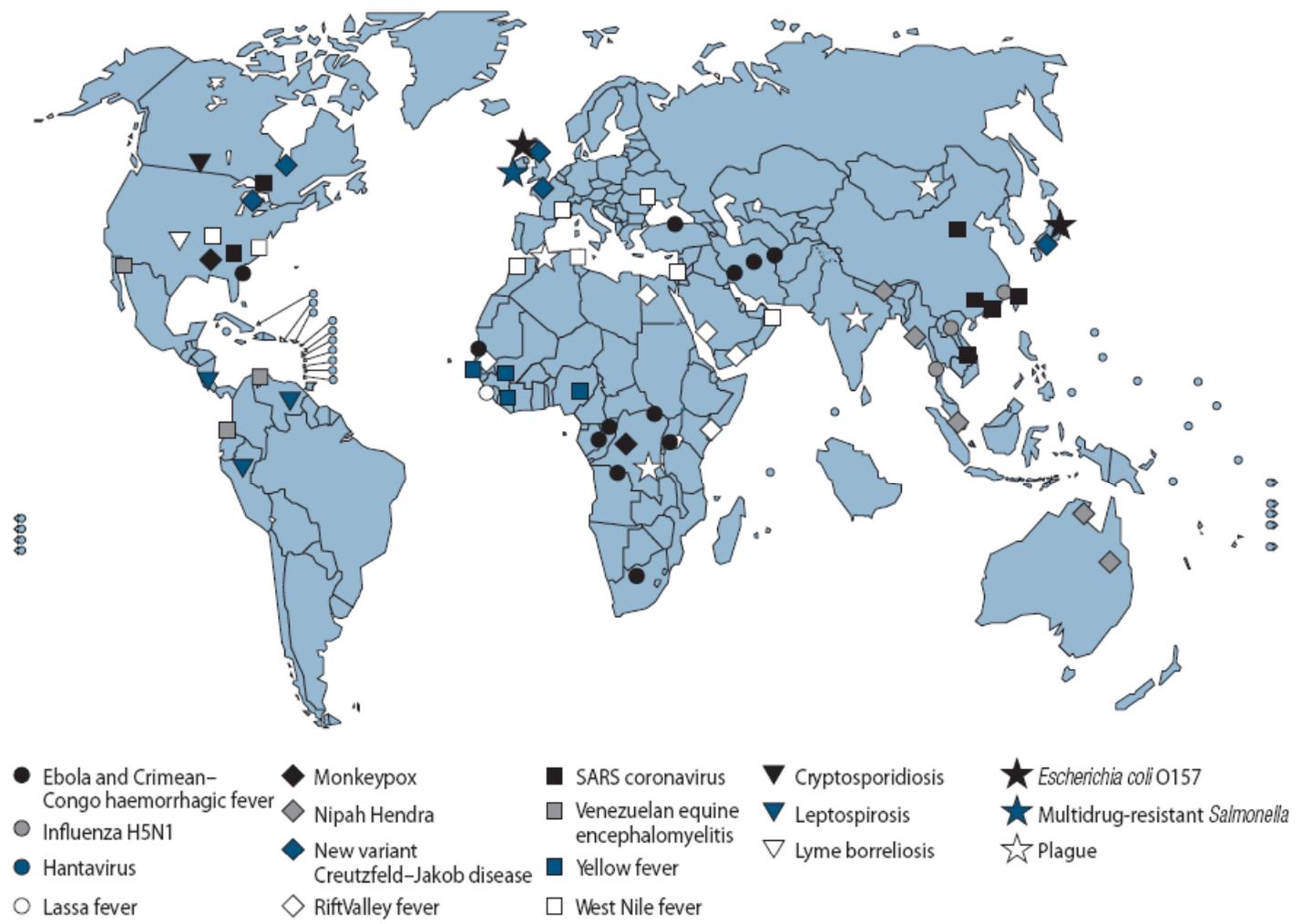
Countries with Activities Supported by U.S. Agencies, 2004-2006



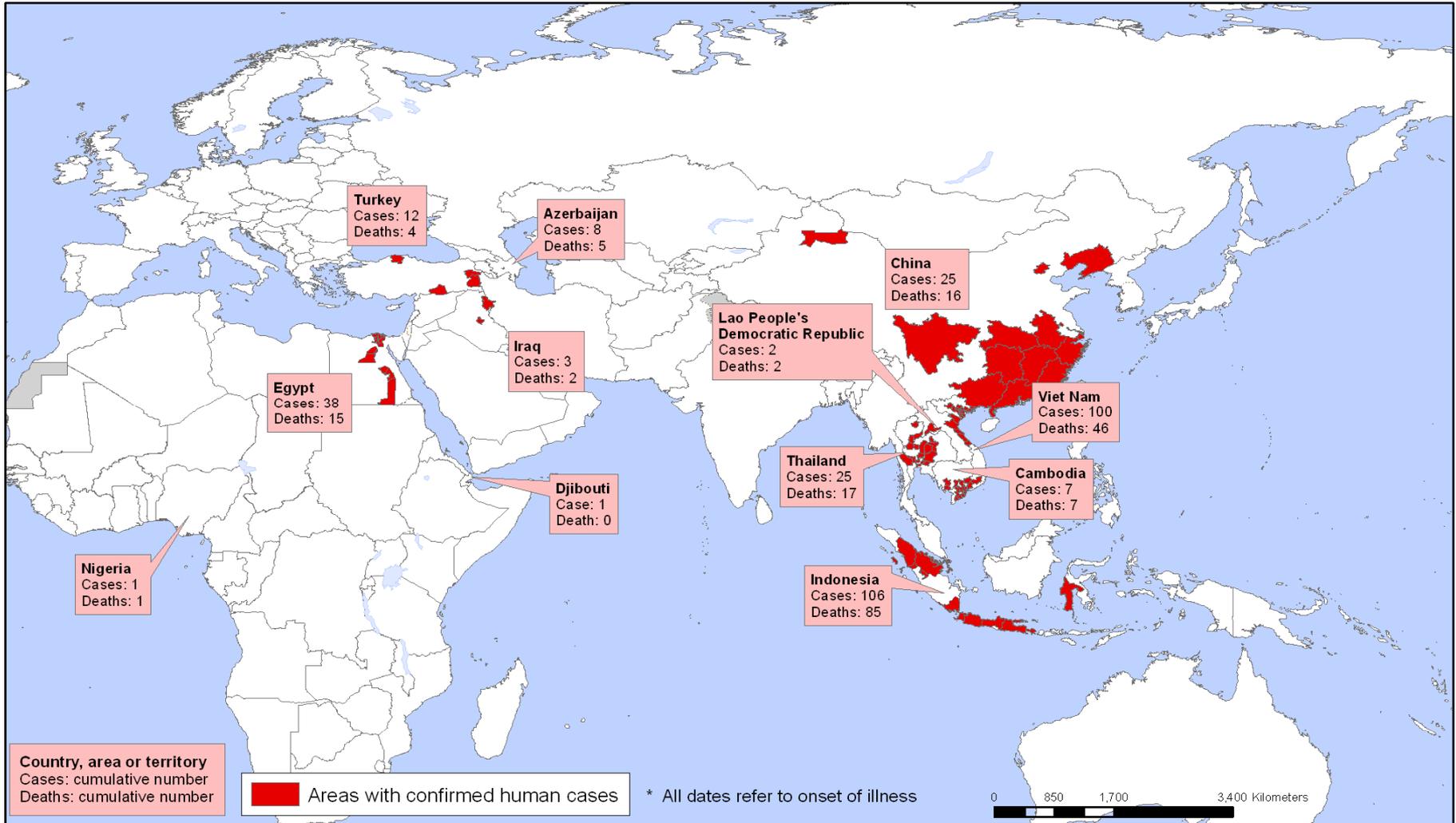
Sources: GAO; Map Resources (map clip art).

Selected emerging and re-emerging infectious diseases: 1996–2004

Most common public health threats are **infectious diseases**



H5N1 Confirmed Cases and Deaths since 2003

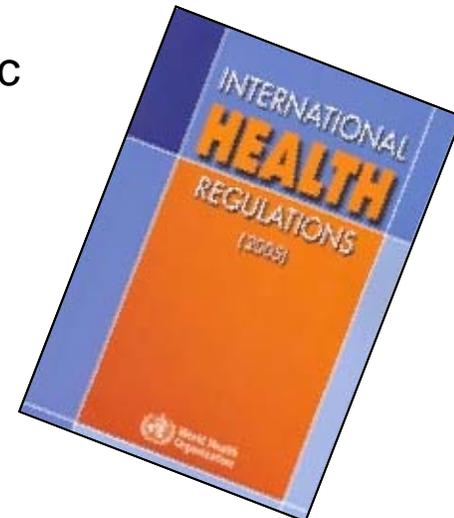


Purpose of the WHO International Health Regulations 2005

...to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade
(IHR 2005, Article 2).

Key Highlights of IHR (2005)

- IHR (1969) outdated, limited in scope
- Notification of any event that may constitute a public health emergency of international concern
- Entered into force 15 June 2007
- Emphasis on collaboration with WHO
- Requirement to strengthen each member country's surveillance and response capacity
- Implementation of health measures for travelers



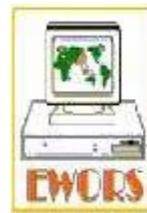
Site Visits

Site visits to resource-limited countries with existing disease surveillance systems help define the issues to be considered during system implementation.

- Firsthand knowledge of system setting
- Ability to speak with implementers and end users
- Assess what is successful and why
- Identify potential areas for improvement



Site visit to Lao PDR, September 2006



Site visit to Peru, March 2007

Conduct a thorough review of current practices

Items for consideration include:

- Understand Ministry of Health organizational structure
 - Review existing reporting requirements
 - Determine if the MoH is centralized or decentralized
- Determine what surveillance activities are in place
 - Hospital-based surveillance
 - Private physician offices
 - Laboratory-based surveillance
 - Village health workers, community-based surveillance
- Ascertain if any data are collected electronically
 - At what level and with what frequency and reliability?
 - By what mode and how often are data transmitted?

What are the purpose and requirements of the enhanced surveillance system? Consider the following:

- What diseases are of most importance?
- Why is surveillance being conducted?
- What is a realistic expectation with respect to data collection?
- How much data should be collected?
- How frequently will data be analyzed?
- Will routine training be available?

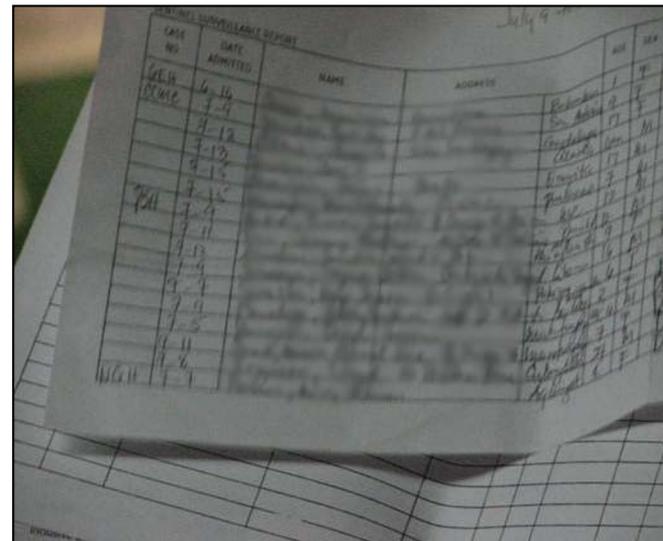
Key Considerations in Planning Electronic Syndromic Surveillance Systems in Low-Resource Settings¹

Technical	<ul style="list-style-type: none"> • Use existing data feeds, when possible • Automated decision-support may facilitate timely data transmission • Training is essential • Technical partnerships can facilitate implementation
Financial	<ul style="list-style-type: none"> • Use best fitting low cost data collection methodology / technology for the locale • Open-source based / customized software preferred • Partner, where possible, to share technology needs
Political	<ul style="list-style-type: none"> • Competition for limited health resources may exist • Local political support is essential in decentralized MoHs • Engage key stakeholders to ensure there are no conflicting priorities • Systems must be locally supported and not sponsor-driven
Ethical, Societal, Cultural	<ul style="list-style-type: none"> • Privacy safeguards may address patient concerns of data capture • Education may improve patient acceptability of surveillance • Education on diseases may enhance both detection and patient care • Health-seeking behavior may limit system effectiveness

¹Adapted from a model (from Singer PA et al. *Nature* 2007;449:160-3) for assessing the potential success of certain health-related biotechnologies in resource-poor regions.

Considerations include:

- What is the lowest level at which data can be reasonably collected?
 - ✓ *Village health center, hospital, clinic*
- What data will be collected?
 - ✓ *Minimum data set for surveillance or additional variables for future use*
- By what method will data be collected?
 - ✓ *Computer, PDA, phone, etc.*
- How will data be transmitted to others?
 - ✓ *Internet, phone, USB flash drive, etc.*



TECHNOLOGY	PROS	CONS
Laptop – regular	Captures detailed data, battery-powered, built-in networking	Hard to replace broken parts, risk of theft
Laptop – special for remote areas	Durable, energy-efficient, some self-powered	Similar to regular laptop and limited functionality
USB flash drive (up to 8GB memory)	Captures detailed data, inexpensive, portable	Virus risk, risk of theft/loss, may fail without obvious reason
56K dial-up modem	Uses existing lines, lower hack/virus risk than wireless	Slow, relies on phone service, monopolizes phone line
Metro-area Network Card	Sends detailed data, minimal setup, scalable access	Network may not be established, may rely on local cell service

***Recurring monthly/yearly connection cost that is inherent in all the technologies*

TECHNOLOGY	PROS	CONS
PDA	Captures data at point-of-care, intuitive interface possible, could be used with store and forward data collection	Entering detailed data may be difficult
Cell phone	Inexpensive, cellular infrastructure is global	Cumbersome data entry, relies on cell signal
Smartphone	Pros of PDA and cell phone	Cons of PDA and cell phone
Interactive Voice Response	Uses existing phones	Relies on local utilities, laborious set-up if hosted in-country
Multiplatform survey software	Many communication modes, uses existing infrastructure	Costly, additional service fees if hosted by private company
Satellite Phone	Global service	Must be outdoors, short calls, expensive

***Recurring monthly/yearly connection cost that is inherent in all the technologies*

Is there an existing analytical package being used by the epidemiologists?

- If **YES**, consider enhancing the existing tools for the purposes of early event detection.
- If **NO**, consider using open-source packages to ensure affordability and long-term sustainability or developing custom software if existing packages will not meet needs.

Concerns of potential implementers and users:

- Ministries of Health feel less ownership when using commercial technology.
- Introducing software/technology with expensive recurring costs should be avoided.
- Beware of training/resource costs of software upgrades.

- **Visit to National Epidemiology Center (Manila)**
 - Decentralized health care structure
 - Existing surveillance activities (ILI, lab-based, animals)
 - New country-wide policy for disease surveillance and response activities
 - Field Epidemiology Training Program
 - Basic system requirements defined
 - Using EpiInfo
- **Visit to Regional Epidemiology Surveillance Unit (RESU) (Cebu City)**
 - Self-contained, stable population
 - Hospital-based surveillance / private physician reporting
 - Lacking in resources (hardware, paper, etc.)
 - Difficulties in data transmission (slow, network failures, risk of corruption)
 - Using EpiInfo for data entry and analysis
 - Data collection during outbreak investigations is difficult

- **Visit to City Epidemiology Surveillance Unit (CESU) (Cebu City)**
 - One doctor for every 3-4 health centers
 - Health workers (non-doctors) can handle “ordinary” illness
 - Divided into 5 areas, each with a nurse manager for data validation / review
 - ILI surveillance, fever surveillance
 - In-home inspections for confirmed dengue cases
 - Excellent political support
- **Visit to Guadalupe Health Center (Cebu City)**
 - Population of 30,000, approximately 3,500 families
 - Specific morbidity days
 - Records kept in notebooks, files cleaned every five years
 - Patient’s vitals and weight recorded at the start of the visit
 - Forms are filled out for mothers and children living in recorded households

Summary of Findings

- Potential exists for enhanced data collection activities.
- Need for enhanced software for event detection.
- Need for improved data collection / transmission.



- Electronic disease surveillance can and is being used successfully in resource-limited areas.
- There must be desire and commitment at every level of the health infrastructure in order to sustain a system.
- System requirements and data collection methodologies must be carefully considered and understood prior to system implementation.
- Evaluations are essential in order to ensure that money is being used efficiently and effectively and undue burden is not being placed on the system.

- U.S. Naval Medical Research Unit No.2 (NAMRU-2)
- Naval Medical Research Center Detachment (NMRCDD)
- Armed Forces Research Institute of Medical Sciences (AFRIMS)
- Peru Ministry of Health
- Philippines National Epidemiology Center (NEC)
- Lao PDR National Centre for Laboratory and Epidemiology (NCLE)
- World Health Organization

QUESTIONS?

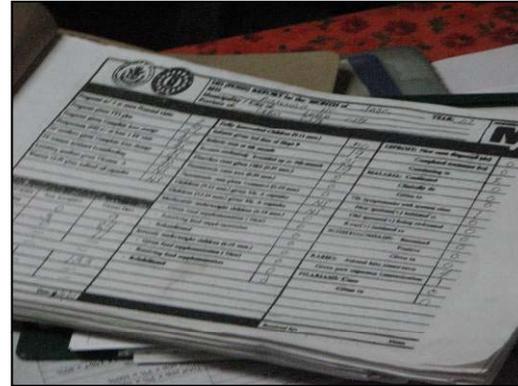
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KASAMBAGAN HEALTH CENTER SCHEDULE OF ACTIVITIES		DOCTORS SCHEDULE	
MON:	A.M - MORBIDITY P.M - RECORDING	18 TUE - PULANGBATO	20 WED - CAMBINGCOT
TUE:	A.M - PRE-NATAL P.M - RECORDING	20 THU - SIRAO	30 TUE - MABINI
WED:	A.M - IMMUNIZATION P.M - RECORDING	30 THU - UNVILLE	42 TUE - PULANGBATO
THU:	A.M - MORBIDITY P.M - HOME VISIT	18 TUE - PULANGBATO	18 WED - ADLAIN
FRI:	A.M - FAMILY PLANNING P.M - HOME VISIT	20 WED - CAMBINGCOT	20 THU - SIRAO
SAT:	A.M - RECORDING	30 WED - SIRAO	42 TUE - PULANGBATO
		42 WED - LUSARAN	

