Role of the laboratory in disease surveillance

Training on CamLIS data analysis
Kep Bay Hotel
19-20 November 2018

Laboratories and disease surveillance

Before the outbreak

- Early warning signals

- Outbreak detection

During the outbreak

- Outbreak response and management

In between outbreaks

- Trend monitoring

- Intervention evaluation

- Monitoring progress towards a control objective

Early warning signals

Detection of pathogens that have potential to spread

Sentinel events requiring early control measures

- Isolation of a single epidemic prone isolate (e.g. non-typhoidal salmonella isolated from a neonate in a hospital neonatal intensive care unit)

- Emergence of resistant strains in the hospital or the community (e.g. multi-drug resistant tuberculosis)

Outbreak detection

Outbreak detection by the laboratory

Outbreak detection with assistance from the laboratory

Outbreak detection by the lab

Identification of a cluster of:

- Infections with an unusual pathogen
- Specific subtype of a pathogen
  - Outbreak of antibiotic-resistant strains
  - Subtypes of a pathogen (e.g. *Shigella dysenteriae* type I)

Reference centres may capture outbreaks disseminated over a large area

Outbreak detection with lab help

Epidemiologist captures an increased incidence

Laboratory:

- Confirms the diagnosis
- Allows for a more specific case definition
- Detects a new pathogen
- Provides additional details on the pathogen (e.g., phage type)

Effective participation of the laboratory in surveillance requires good communication between the epidemiologists and the laboratories

Laboratory role during outbreaks

- Laboratory confirmation of early cases
  - On a subset of cases
- Identification of new pathogens
- Typing of the pathogen
  - Link clusters when the epidemiological data is not sufficient
- Antimicrobial susceptibility testing to guide treatment
- Post-outbreak surveillance
- Environmental investigations
- Detection of carriers

Laboratory role during outbreaks

For new and emerging pathogens:

• Identify the pathogen

• Develop laboratory tests

• Patient treatment/management
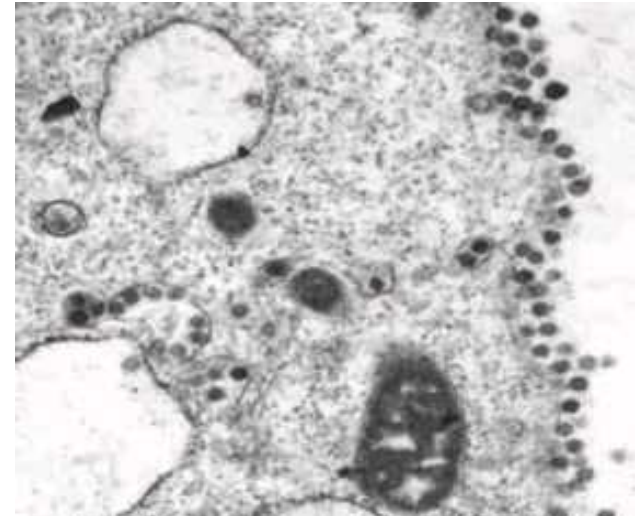
SARS

Courtesy:
The University of Hong Kong

Monitoring endemic disease trends

Confirm diagnosis

  – Case definitions that include laboratory criteria

Monitor resistance patterns

Monitor subtypes of a pathogen
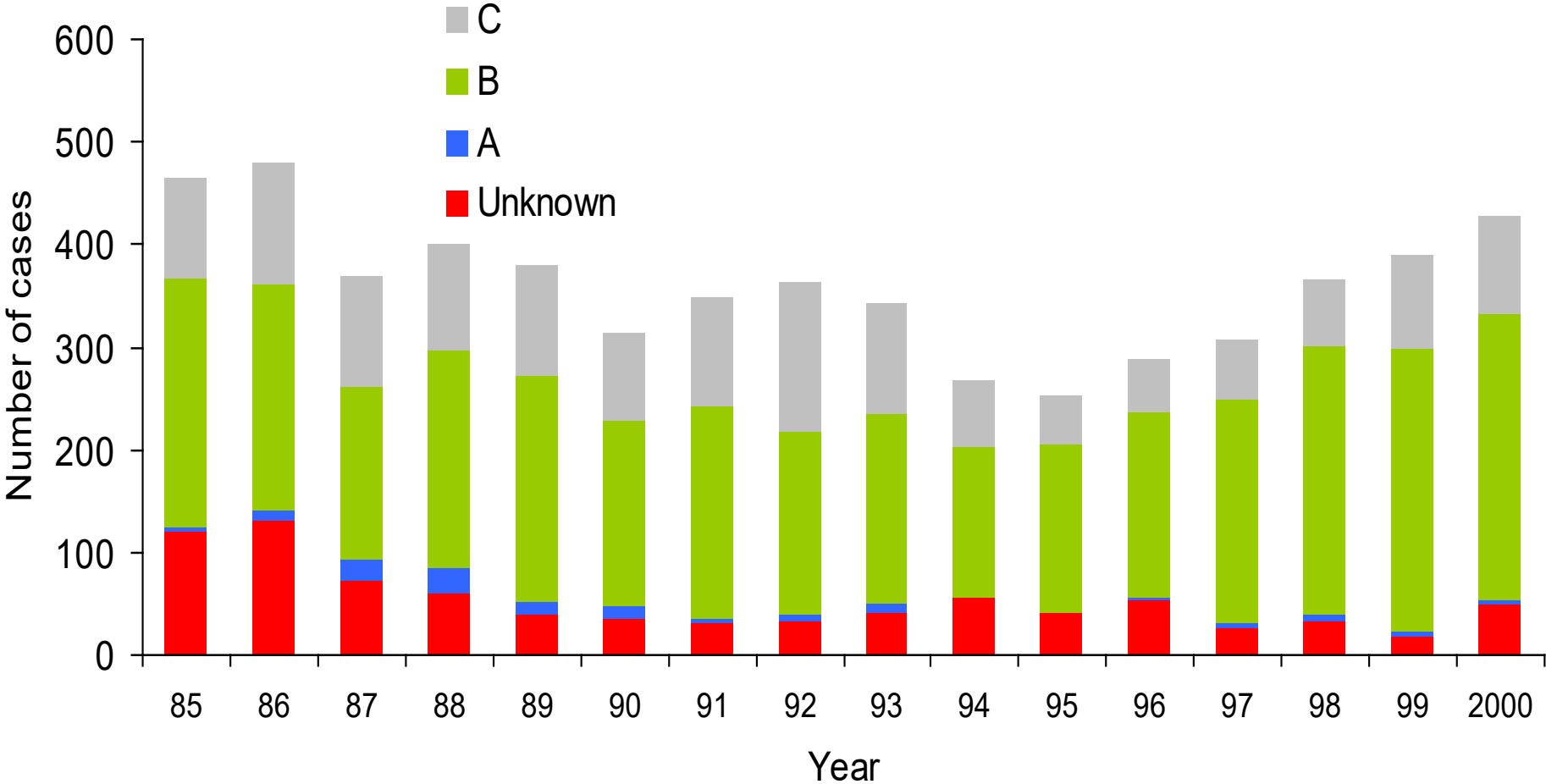
Monitoring endemic disease trends

Examples:

Circulating strains of bacterial meningitis

- Impact on treatment protocols
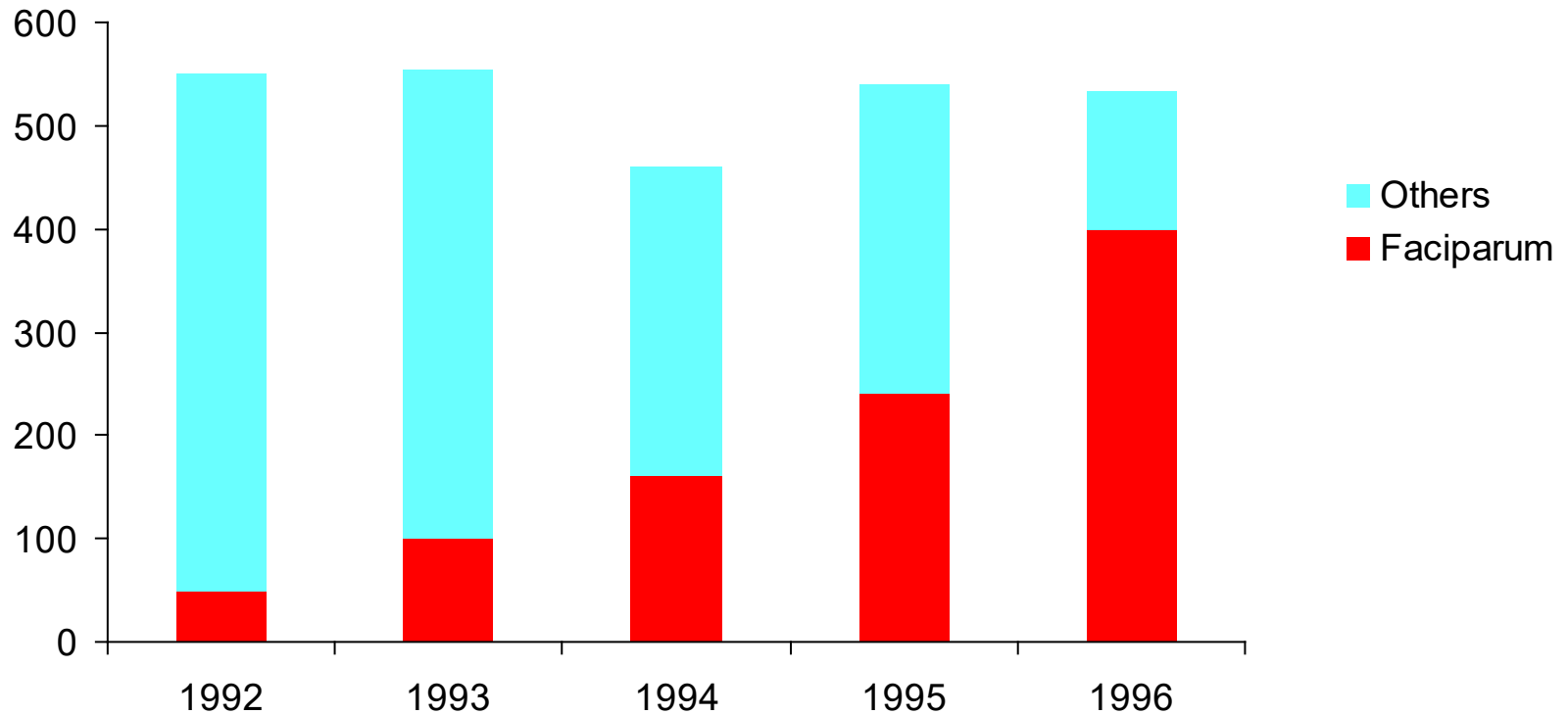- Impact on immunization policies

Antibiotic resistance

- Methicilin resistant *Staphylococcus aureus*
- Vancomycin resistant enterococcus
- Tuberculosis

Invasive meningococcal infection serogroups by year, Country X, 1985-2000

Cases of malaria by species, Region A 1992-1996

The increased proportion of falciparum is an early warning

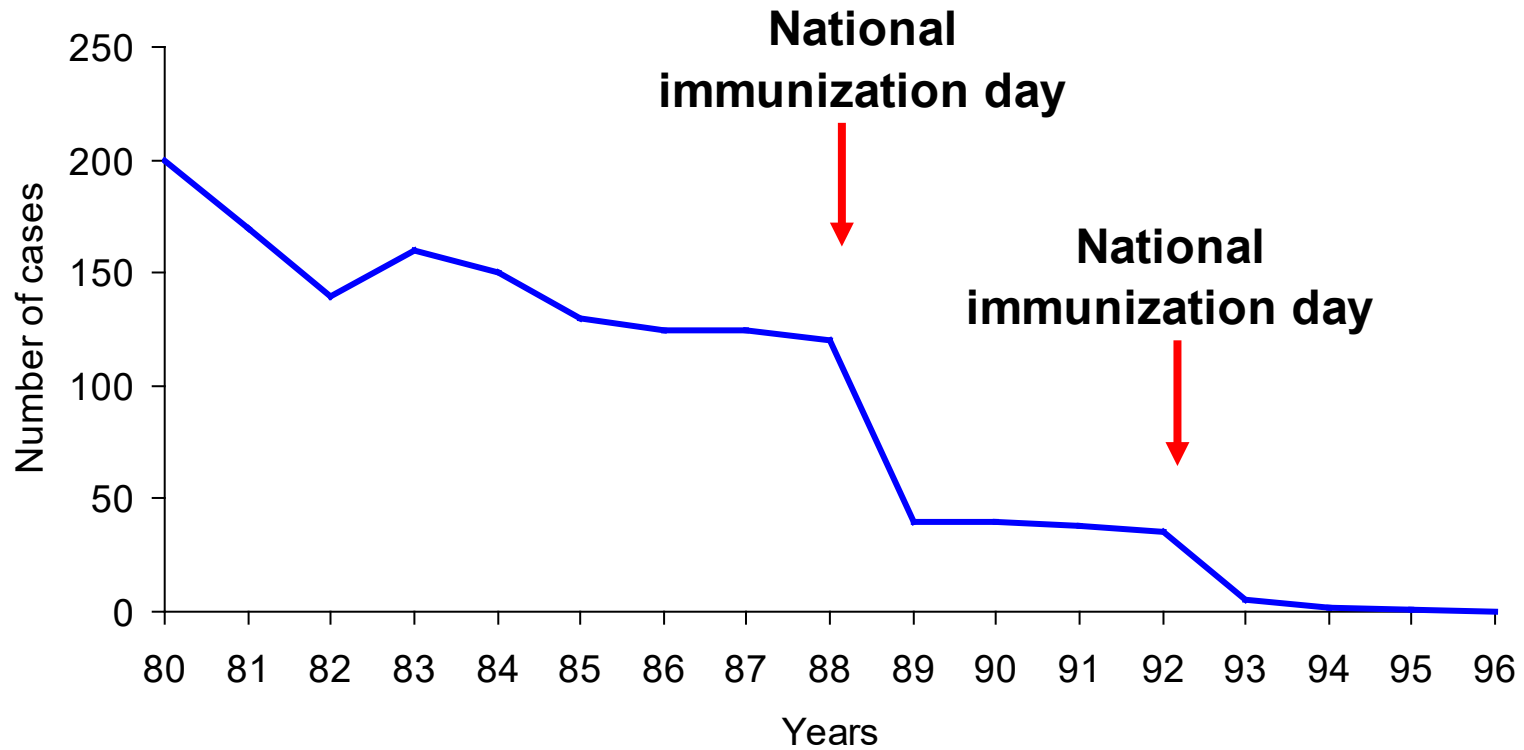# Eradication/elimination monitoring

The elimination phase requires more specific tests as positive predictive value decreases

Laboratory confirmed diagnosis

– Polio surveillance

– Measles

Typing helps identifying the origin

Cases of polio where wild poliovirus was isolated in children, District X 1980-1996

Establishing laboratory support for public health surveillance

- Identify diseases of public health importance
- List diseases that require laboratory confirmation
- Determine tests to be performed
- Map laboratory facilities and human resources, including reference laboratories
- Establish laboratory networking
- Identify a focal person to coordinate laboratory activities
- Determine information flow

Establishing laboratory support for public health surveillance

- Define roles and responsibilities, identify referral system

- Ensure supplies, logistics, guidelines and forms

- Organize communication between lab and epi
  - Prompt, regular reporting of results and feedback

- Plan quality assurance, biosafety and waste management

- Supervise and monitor

- Develop epidemic preparedness and response plans

Establishing laboratory support for public health surveillance

- Diagnosis and early warning signal
- Routine lab surveillance with intensification before epidemic season
  - Environmental monitoring
  - Epidemic prone disease monitoring
  - Proper collection, transport and storage of samples
  - Reporting of results
  - Outbreak investigation, epi-lab coordination

Surveillance: Lab & epi functions

- Outbreak detection and investigation:
  - Outbreak detection within the laboratory
  - Tracing spread through typing and characterization
  - Detection of carriers and natural foci of infection
  - Determine the end of an outbreak
  - Determine elimination or eradication of disease
- Develop case definition; determine case management
- Environmental monitoring
- Understand the natural history of disease
- Evaluate interventions
- Monitor progress towards control
- Develop immunization strategies
- Prevalence studies

Surveillance: Lab functions

Confirmation of etiology to resolve syndromic presentation

Data intelligence for:

- Antimicrobial resistance monitoring
- Emergence of unusual isolates
- Detection of new pathogens
- Sero-surveillance

Indicator-based surveillance (IBS)

- Weekly data transferred from Health Center to national level every Wednesday using web based database

- Number of new cases and deaths of the 7conditions:

1. ACUTE WATERY DIARRHOEA
2. FEVER WITH RASH
3. ACUTE FLACCID PARALYSIS
4. SEVERE RESPIRATORY INFECTION
5. SUSPECT DENGUE FEVER
6. MENINGITIS / ENCEPHALITIS
7. ACUTE JAUNDICE

Data flow

Database Server

Internet

CDC

PHD + PH

OD + RH

115 System

Health Center with Mobile Phone

Health Center with Computer + Internet
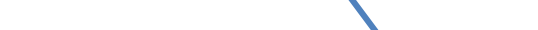
Event-based surveillance (EBS)

- 3 hotlines (2 mobiles & 1 land line)
- Data gathering : Public, Rumor, partners, private clinic, media…

EBS Screenshots
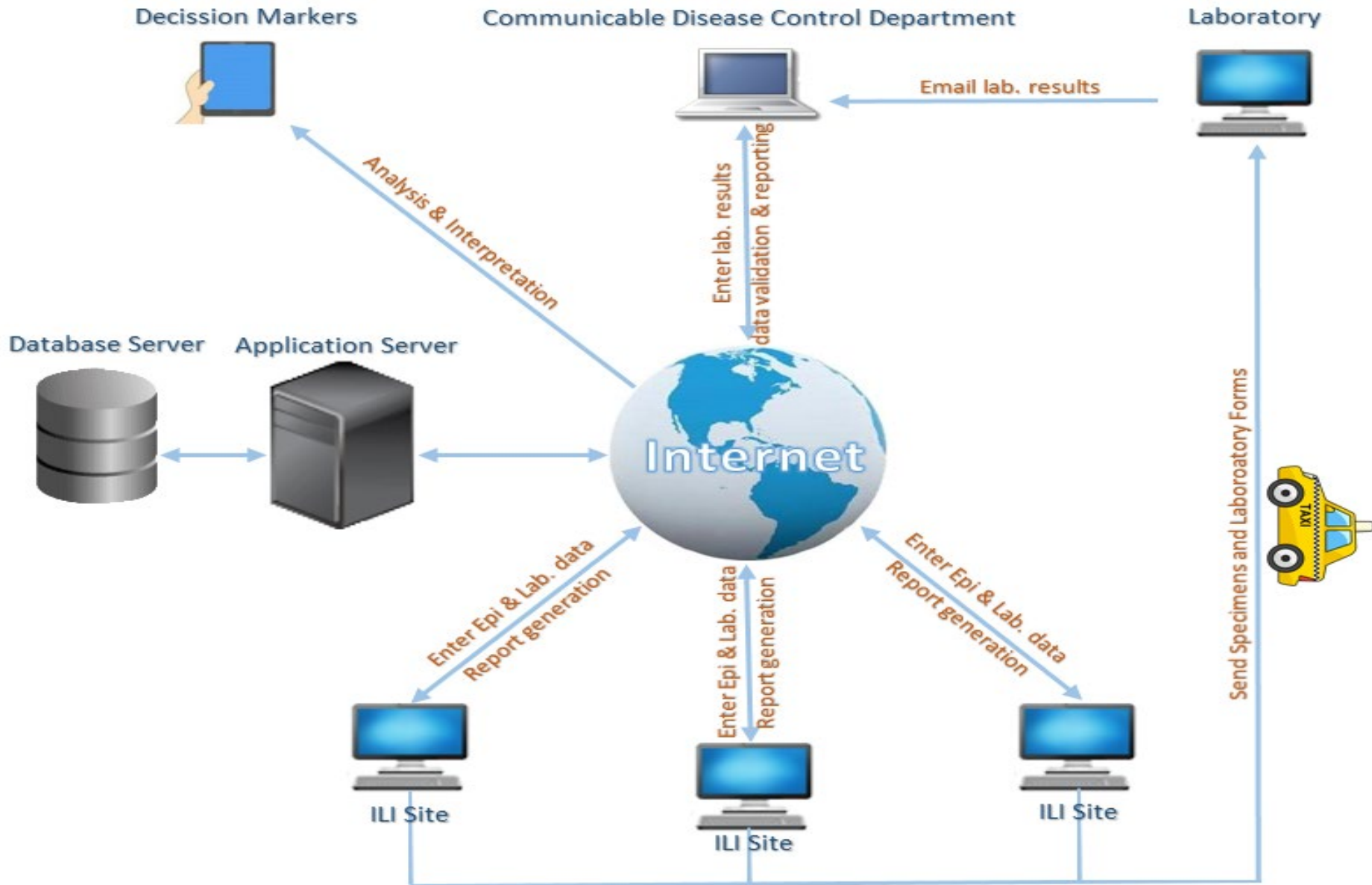
Influenza Sentinel Surveillance

1- Influenza Like Illness

- To provide background epidemiological data on influenza like illness (ILI) in Cambodia
- To identify circulating influenza viruses
- To provide the public health intervention

2- Severe Acute Respiratory Illness

- To determine epidemiology and burden of influenza associated severe respiratory disease
- To report proportion of influenza case and death among SARI and hospitalization cases timely
- To establish sentinel surveillance for human cases of avian influenza
- To provide circulating strains of influenza viruses for seasonal vaccine development
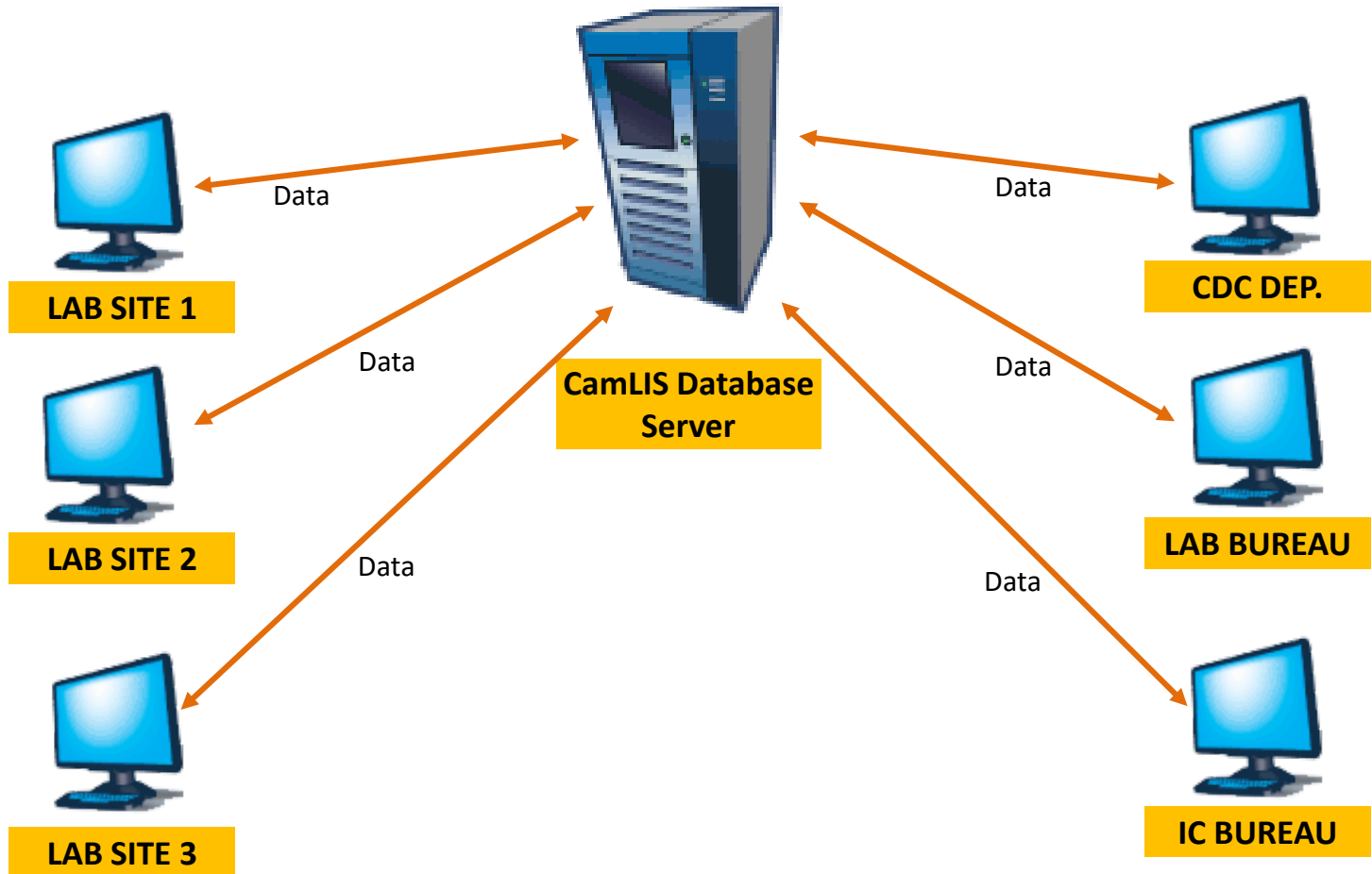
ILI/SARI web based system

Decision Markers

Communicable Disease Control Department

Laboratory

Email lab. results

Analysis & Interpretation

Enter lab. results

data validation & reporting

Database Server

Application Server

Internet

Send Specimens and Laboratory Forms

Enter Epi & Lab. data
Report generation

Enter Epi & Lab. data
Report generation

Enter Epi & Lab. data
Report generation

ILI Site

ILI Site

ILI Site

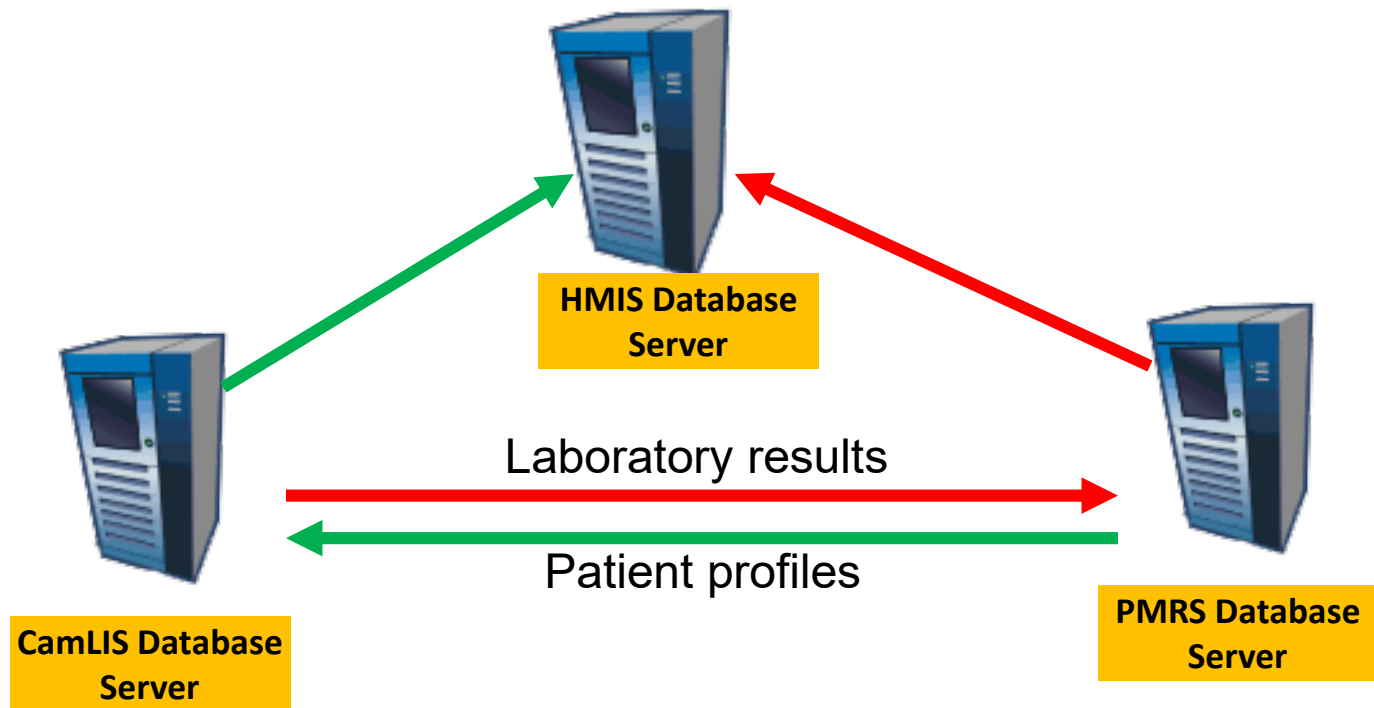# Cambodia Laboratory Information System

Objective: The system is used for effective management of high volume laboratory data for diagnosis, treatment and disease surveillance.

Data Flow:

LAB SITE 1

LAB SITE 2

LAB SITE 3

Data

Data

Data

CamLIS Database Server
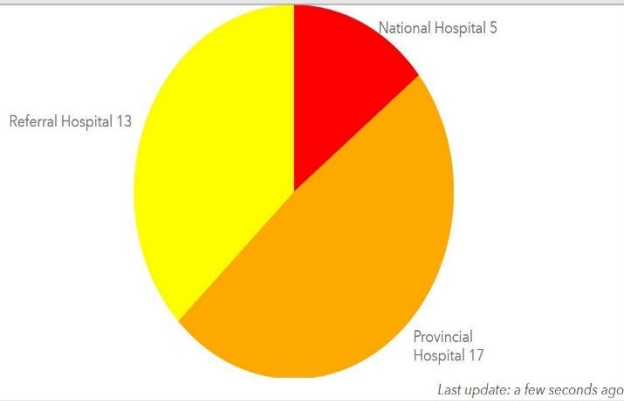
CDC DEP.

LAB BUREAU

IC BUREAU

Data

Data

Data

Integrated with PMRS

- Exchange information (patient record)
- Speed up data entry process
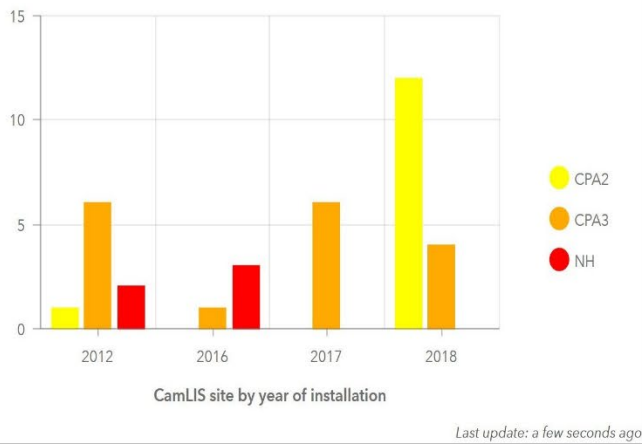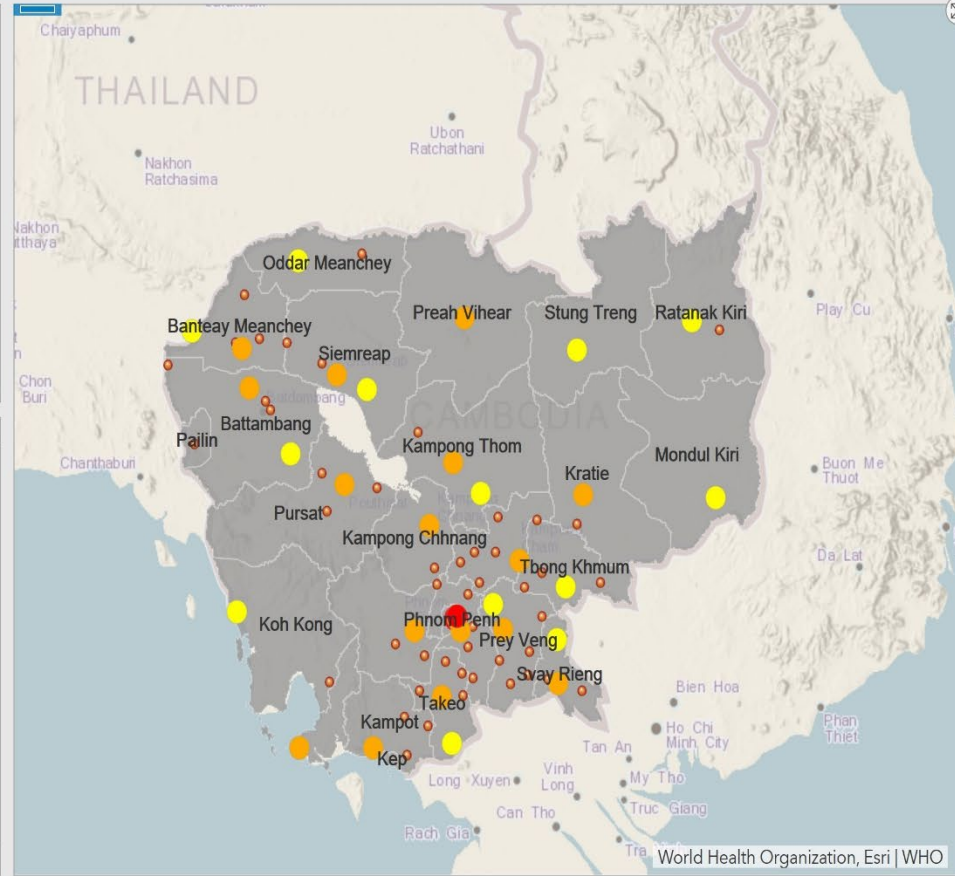- Link with national health information system

HMIS Database Server

CamLIS Database Server

PMRS Database Server

Laboratory results

Patient profiles

Cambodia Laboratory Information System

Outcomes

- Timeliness
  - Faster data collection and more timely from lowest level up to national level
  - Faster response and provide feedback
- Completeness
  - More data is capturing at each level
  - Improvement the relationship among health staff
- Data Analysis
  - Faster data analysis
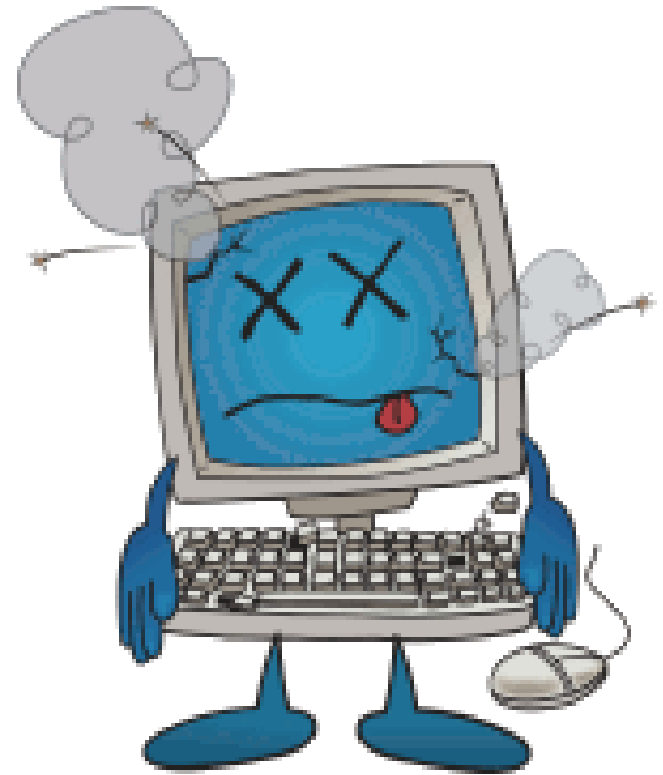 - Reports can be generated in various ways

Uses

- Surveillance (AMR, routine diagnostic monitoring)
- Outbreak detection (nosocomial and others)

Challenges

- Hardware & Software failure : PCs & Phone
- Human resources with ICT capacity
- Data quality
- Behavior change
- Risk assessment

Thank you!