Surveillance of vaccine preventable diseases

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Learning objectives

- Understand the key principles of surveillance and why appropriate surveillance is important
- Identify surveillance systems providing VPD data in Australia
- Be aware of why surveillance needs depend on the objectives of the surveillance program and the epidemiology of VPDs
Definition of surveillance

- The ongoing acquisition of information for use in public health action
  - systematic collection, analysis and interpretation of data
  - dissemination/feedback of data to those who need to know
  - use information for disease prevention and control

- Data collection methods
  - practical
  - timely
  - uniform
VPD related surveillance

- Immunisation coverage
- Vaccine effectiveness
- Vaccine adverse events
- Epidemiology of the disease
  - indirect
    - serological surveys
  - direct
    - numbers (notified cases, laboratory reports, GP visits)
    - morbidity (absenteeism, GP visits, hospitalisations)
    - mortality (deaths)
Objectives of disease surveillance

- Measure occurrence/burden
- Detect trends
- Identify outbreaks and at risk populations
- Monitor and evaluate programs
- Stimulate research
- Guide policy decisions
Types of surveillance systems

- Three main types
  - passive
  - active
  - sentinel

Choice depends on disease, resources and surveillance objectives
Passive surveillance

- Most common
- Initiated by data provider
- Cheaper and easier than active
- Underestimates disease burden
Active surveillance

- Investigator actively solicits reports from provider
- Used commonly in epidemics
- Resource intensive
- Usually more complete than passive
Sentinel surveillance

- Sample of sites
- Provides detailed information on cases
- Not necessarily representative of other populations
Example 1:
The National Notifiable Diseases Surveillance System (NNDSS)

- Established in 1990
- More than 60 notifiable diseases
  - including most VPDs on current immunisation schedule
- Information collected includes onset date, demographics of case, vaccination status
Identification of presumptive/confirmed case by laboratory, treating clinician, hospital

Notification by phone, mail, electronically

State/Territory health authorities

Electronic transmission of de-identified data

National collation NNDSS

Dissemination of collated data

Publication
- quarterly report in Communicable Disease Intelligence (CDI)
- the internet:
NNDSS - strengths and limits

- **Strengths**
  - national picture of trends and burden of disease
  - used to illustrate success of immunisation programs

- **Limitations**
  - incomplete
  - States/territory differences in case definitions and reporting mechanisms
  - changes over time in diagnostic methods and reporting mechanisms


Enhanced passive surveillance, eg. Hib

NCIRS Haemophilus influenzae type b
Enhanced surveillance notification (amended January 2010)

To be completed for:
1. Isolation of H. influenzae type b from any normally sterile site, OR
2. Identification of Hib antigen in cerebrospinal fluid, with other laboratory parameters consistent with meningitis.
Note: Diagnosis of epiglottitis by direct vision, laryngoscopy or X-ray without a positive sterile site culture is now NOT notifiable.

Patient Information

State/Territory Notification (Unique ID): ..................................................
Surname: (First 2 Letters) _______  First name: (First 2 Letters) _______
Sex: (M / F) _______  Date of Birth: _______ _______ _______
Postcode of Residence: _______ _______  State of Residence: _______ _______
Treating doctor: ............................................................................  Phone No: ..................................................

Clinical Data

1. Date of onset: _______ _______ _______
2. Aboriginal or Torres Strait Islander:  
   - Yes  
   - No  
   - Unknown
3. Clinical diagnosis:  
   - Meningitis  
   - Epiglottitis  
   - Septicaemia without focus  
   - Cellulitis  
   - Other - please describe ..........................................................................
4. Outcome:  
   - Discharged apparently well  
   - Discharged with abnormality - please specify ............................................
   - Died

Risk Factors

5. Premature (< than 37 weeks gestation) ___ weeks
6. Does the case have an underlying illness requiring regular medical supervision?  
   - No underlying illness  
   - Splenectomy  
   - Immunosuppressive drug - please specify .............................................
   - Immunosuppressive condition - please specify ...........................................
   - Congenital or chromosomal abnormality - please specify ......................
   - Other - please specify: ..........................................................................

Microbiology Data

7. Date of laboratory specimen _______ _______ _______
8. Method of confirmation (if blood and another site, please indicate both):  
   - Blood culture  
   - CSF culture  
   - Other sterile site _______ (Please specify)
   - Antigen CSF
9. Laboratory performing microbiology: ..........................................................
Address (if known): ............................................................................  Telephone: ..................................................
10. Confirmation as type b:  
    - CIDMLS (Sydney)  
    - MDU (Melbourne)  
    - Other laboratory, specify _______  
    - Not sent  
    - Not known

Note: All isolates should be confirmed as type b by an approved reference laboratory

Vaccination Data

11. Was the child vaccinated against Hib?  
    - Yes  
    - No  
    - Unknown
12. Source of information:  
    - Australian Childhood Immunisation Register  
    - Verbal report from provider
    - Other written record - please specify .............................................
    - Verbal report from parent
13. Dates of Hib Vaccination Type/Brand Batch Numbers  
    (Approximate if Necessary) (If Available) (If Available)
   1st _______ _______ _______ HibTITER Pedvax Comvax Infanrix hexa
   (Please specify) (Please specify)
   2nd _______ _______ _______ HibTITER Pedvax Comvax Infanrix hexa
   (Please specify) (Please specify)
   3rd _______ _______ _______ HibTITER Pedvax Comvax Infanrix hexa
   (Please specify) (Please specify)
   4th _______ _______ _______ HibTITER Pedvax Comvax Infanrix hexa
   (Please specify) (Please specify)

Reported by: .............................................................................
Telephone: (_____) ___________________  Email: ............................................
Date of report: _______ _______ _______
Example 2: 
PAEDS: Paediatric Active Enhanced Diseases Surveillance

- Developed by
  - Australian Paediatric Surveillance Unit (APSU)
  - National Centre for Immunisation Research and Surveillance (NCIRS)
  - Paediatricians in an existing informal network of infectious disease clinicians working in four major paediatric hospitals

- Funded by Department of Health and Ageing from 2007
PAEDS
Paediatric Active Enhanced Diseases Surveillance

Hospitals involved in PAEDS:

Children’s Hospital at Westmead, Sydney
Royal Children’s Hospital, Melbourne
Women’s and Children’s Hospital, Adelaide
Princess Margaret Hospital, Perth
Royal Children’s Hospital, Brisbane
Daily search for potential cases - Review of ED and inpatient databases, contact with key clinicians

Meets case definition criteria?

- YES
  - Consent ?
    - YES
      - Data collection: immunization, presentation, treatment, outcome
      - Biological sample collection, dispatch and follow-up

    - NO
      - No further follow-up

- NO
  - No further follow-up

Data entry

Database at each hospital

Weekly export of data

Central PAEDS database

Relevant laboratory (eg. VIDRL)

Sample

Results

Data extraction and analysis

Reports and publications
Conditions under surveillance

- Acute flaccid paralysis
  - data to Polio Expert Committee
- Varicella and herpes zoster
  - Includes isolate genotyping
- Pertussis
- Acute childhood encephalitis
- Intussusception
  - Vaccine association
- Febrile Seizures
  - Vaccine association
Additional capacity achieved by PAEDS

- Ascertainment of severe cases unlikely to be detected through existing surveillance systems
  - Timely case ascertainment and data review
  - Obtaining data not routinely collected (clinical presentation, treatment and outcome)
  - Potential for collection of biological samples linked to clinical data
  - Flexibility and responsiveness to urgent or emerging conditions
  - Potential for verification of ICD coded conditions
Other surveillance data

- National Hospital Morbidity Database
  - all hospital admissions have at least one disease code recorded at discharge
  - Strengths (compared with notification data)
    - fewer changes to data collection procedures over time
  - Limitations
    - only measures serious illness
    - coding errors
    - lack of specificity of codes for some diseases (eg. Hib)
    - records per admission not per case

- National Mortality Database
How do you determine which type of surveillance system(s) to use?

- What public health action do we want to take?
  - Monitor trends only
  - Detect outbreaks
  - Respond aggressively to all cases

- Characteristics of disease
  - How diagnosed
  - Where cases present

- Stage of epidemiology
  - Pre-vaccination
  - Post-vaccination
  - Elimination
Pre-vaccination phase

- Surveillance objectives
  - measure disease burden
  - determine natural history of disease
  - identify at risk groups

- Surveillance needs
  - clinical diagnosis as a case definition for notification (when disease incidence is high)
  - grouped data rather than individual case investigation (numbers by age/sex/region)
Post program implementation phase

- Surveillance objectives
  - measure impact of program
  - identify characteristics of remaining cases
  - detect adverse events following immunisation

- Surveillance needs
  - individual case data & vaccination status
  - immunisation coverage and effectiveness
  - adverse event monitoring
Example: Pertussis

- Long history of funded immunisation
  - changes in vaccine formulations and schedule
- Disease still common
- Notifiable in all states/territories
  - NNDSS
- Adverse events monitoring
- Other sources of information
  - hospitalisations
  - serological surveys
Established immunisation programs – moving towards elimination

- Move to ‘enhanced surveillance’
  - sensitive case definition to identify all suspected cases
  - detailed investigation of each suspect case

- Increasing need to
  - laboratory confirm suspected cases
  - identify and characterise circulating strains
  - rapidly detect and fully investigate all outbreaks
Example: measles

- Now rare
  - 0.7 notifications per 100,000 in 2013
- Sensitive clinical case definition
- Highly specific laboratory definition for confirmation
- Enhanced data required on confirmed cases
  - source of infection
  - molecular typing of measles isolate from each outbreak
  - linkage to other cases or outbreak
Surveillance following elimination

Disease no longer endemic (no ongoing transmission)

Example: polio

- International requirements for surveillance methods
- Surveillance to detect ALL cases
  - sensitive case definition - acute flaccid paralysis (AFP)
  - active and sentinel AFP surveillance – APSU and PAEDS
  - comprehensive laboratory confirmation of cases
- Maintain high coverage at least until eradicated
- Ensure biocontainment of laboratory isolates
Conclusions

- Successful immunisation policies require adequate information
- One vital source of information is routine surveillance data
- Surveillance requirements
  - depend on the surveillance objectives
  - will evolve with the phases of disease control