Disease Surveillance

Soili Larkin & Joshna Mavji
Aim

To understand the basic principles of surveillance within the field of health protection
Learning Objectives

• Define disease surveillance
• Describe types of disease surveillance
• Explain the uses of disease surveillance
• Outline examples of surveillance systems
• Describe the process of surveillance
• Describe the process of evaluating surveillance systems
• Appreciate the role of surveillance in public health practice
Scenario

Since the late 1990s, diagnoses of syphilis infection rose dramatically in the United Kingdom. This was partly driven by a number of local syphilis outbreaks occurring throughout the UK. In response to the resurgence of syphilis infection, the National Enhanced Syphilis Surveillance System was established for England and Wales. This continued for almost 10 years and subsequently ceased at the end of 2010. However, the West Midlands continued to experience a rise in cases of infectious syphilis and therefore regional surveillance of infectious syphilis was introduced.
Disease Surveillance: Definition

**TASK**

What words/phrases come into your mind when thinking about disease surveillance?
Disease Surveillance: Definition

‘The ongoing systematic collection, analysis, and interpretation of outcome-specific data for use in the planning, implementation, and evaluation of public health practice’


“Systematic ongoing collection, analysis, and interpretation of data and timely dissemination to those who need to know so that action can be taken”

Last Dictionary of Epidemiology

“The continued watchfulness over the distribution and trends in the incidence of disease through the systematic collection, consolidation and evaluation of morbidity and mortality reports and other relevant data”

Alexander Langmuir, Chief Epidemiologist, CDC

“Information for action”
Disease Surveillance: Types

Passive

• Gathers disease data without stimulating health care workers to report disease
• Data requested is minimal
• Most common type
• Data is often incomplete because there are few incentives for health care workers to report the required data.
• Example: Vaccination uptake

Active

• Gathers disease data that requires a stimulus to health care workers in the form of feedback or incentives.
• Requires more time and resources
• Data is more complete than passive surveillance
• Example: trawling questionnaire for local infectious disease outbreak
Disease Surveillance: Types

**Sentinel**
- Selection of health workers/services from whom data is gathered e.g. selection of General Practices
- Requires more time and resources
- Can produce more detailed and more complete data, particularly if health care workers have volunteered to participate
- Example: Influenza surveillance

**Syndromic**
- Monitors disease indicators in real-time or near real-time to detect clusters or outbreaks of disease earlier than would normally be possible
- Based on syndromes or clinical features NOT diagnosis
- Inexpensive and rapid
- Lacks specificity
- Example: Early detection of communicable and non-communicable disease outbreaks during the 2012 Olympic Games in London
**Real-time Syndromic Surveillance Team**

- Syndromic surveillance is the process of collecting, analysing and interpreting health-related data to provide an early warning of human or veterinary public health threats, which require public health action.

- In England there are several national syndromic surveillance systems in use which are coordinated by Public Health England’s (PHE) Real-time Syndromic Surveillance (ReSS) team and involve the collection of a range of health-related data.

- These surveillance systems include:
  - Remote health advice syndromic surveillance system
  - GP in-hours syndromic surveillance system
  - GP out-of-hours syndromic surveillance system
  - Emergency department syndromic surveillance system

- The ReSS team collect and analyse health data from these sources to:
  - Look for trends which could potentially indicate higher-than-usual levels of a particular illness which may require public health action.
  - Describe the extent of illness following a known incident
  - Provide reassurance of the absence of negative impact following an incident.
Disease Surveillance: Uses

Since the late 1990s, diagnoses of syphilis infection rose dramatically in the United Kingdom. This was partly driven by a number of local syphilis outbreaks occurring throughout the UK. In response to the resurgence of syphilis infection, the National Enhanced Syphilis Surveillance System was established for England and Wales. This continued for almost 10 years and subsequently ceased at the end of 2010. However, the West Midlands continued to experience a rise in cases of infectious syphilis and therefore regional surveillance of infectious syphilis was introduced.

**TASK**

Why do we need disease surveillance systems?
Uses

- Monitor, determine and describe the magnitude and natural history (trends) of diseases – incidence and prevalence
- Identify key risk groups/populations, important risk factors and aetiological factors
- Timely detection of epidemics, outbreaks, incidents and other untoward events
- Enable prediction of future trends (i.e. predictive modelling)
- Inform or evaluate health improvement programmes
Examples of Surveillance Systems

Enhanced Tuberculosis Surveillance (ETS)
Seasonal flu vaccine uptake
Vaccination and immunisation data return collected through the COVER system
Emergency Department Surveillance
Norovirus Outbreak Reporting
Surveillance of significant occupational exposure to blood borne viruses
Mandatory HCAI surveillance
Enhanced Meningococcal disease surveillance

Hepatitis Sentinel Surveillance
NOIDs
SOPHID (survey of prevalent HIV infections diagnosed)
Surgical site infection surveillance
Statutory laboratory notifications
Enhanced surveillance of vaccine preventable disease
Real-time Syndromic Surveillance in Primary Care
The Surveillance Loop

Data collection and recording → Detailed examination of data and explaining the meaning of data → Reporting and disseminating information → Use of information

Actions to control diseases and improve health
The Surveillance Loop

**TASK**
Where could you obtain your data from?
Disease Surveillance: Data Sources

• Healthcare professionals
• Hospital activity data
• Laboratory data
• Mortality data
• Disease registers
• Internet
Disease Surveillance: Data Collection

- Paper
- Telephone
- Electronic - emails
- Online portals
- Direct access via secure network
Disease Surveillance: Data Collation and Analysis

- Microsoft Excel & Access databases
- De-duplication and de-notification
- Time, place, person (Descriptive epidemiology)
- Statistical algorithms
  - Automated exceedance calculations
  - Statistical process control charts (C-charts)
  - Statistical modelling
Disease Surveillance: Data Interpretation

Key considerations in interpreting trends

- Natural and random variation
- Data artefact – batched reporting, data entry errors, etc
- Clinical & system changes – changes in case definition, increased awareness/ascertainment, improved diagnostics.
- Corroborate findings with other datasets and explore alternative explanations - highlight caveats (if any)
- Decide if these are real changes

Key considerations in associations

- Bias e.g. self-selection of sample
- Chance i.e. pure chance association
- Confounding e.g. association explainable by a third factor
Dissemination of Findings

- Ad-hoc and routine reports
- Routine (weekly, monthly or quarterly) epidemiological summaries
- Web-based datasets/summaries
- Special reports, guidelines, briefings and queries.
- Research articles
Disease Surveillance: Evaluation

Since the late 1990s, diagnoses of syphilis infection rose dramatically in the United Kingdom. This was partly driven by a number of local syphilis outbreaks occurring throughout the UK. In response to the resurgence of syphilis infection, the National Enhanced Syphilis Surveillance System was established for England and Wales. This continued for almost 10 years and subsequently ceased at the end of 2010. However, the West Midlands continued to experience a rise in cases of infectious syphilis and therefore regional surveillance of infectious syphilis was introduced.

**TASK**

What factors would you consider in your evaluation process regarding the performance of the surveillance system?
Steps in Evaluating a Surveillance System

- Usefulness
- Simplicity
- Flexibility
- Data quality
- Acceptability
- Sensitivity
- Predictive positive value
- Representativeness
- Timeliness
- Stability
Disease Surveillance: Challenges

- Secular trends
- Defining the population at risk
- Magnitude
- Changes from background incidence (outbreaks)
- Trajectory

![Graph showing disease surveillance trends](image)
Disease Surveillance: Summary

- Information for action
- Collect, collate, analyse, interpret and disseminate
- Understand epidemiology, identify problems, guide policy, monitor changes, etc.
- Cyclical in nature
- Should be regularly evaluated
- Key component of Public Health practice