R. Sukanya

WHO-recommended standards for surveillance of selected vaccine-preventable diseases

GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION
EXPANDED PROGRAMME ON IMMUNIZATION

World Health Organization
Geneva

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Contents

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Contents

List of acronyms

AFRO	WHO Regional Office for Africa
9GPW	9th Global Programme of Work
AFRO	WHO Regional Office for Africa
AFP	Acute flaccid paralysis
AMRO	WHO Regional Office for the Americas
CIE	counter immunoelectrophoresis
CSF	cerebrospinal fluid
DTP3	third dose of diphtheria-tetanus-pertussis vaccine
EMRO	WHO Regional Office for the Eastern Mediterranean
EPI	Expanded Programme on Immunization
EURO	WHO Regional Office for Europe
GPV	Global Programme for Vaccines and Immunization
HAV	hepatitis A virus
HBc	hepatitis B core
HBV	hepatitis B virus
HCV	hepatitis C virus
HDV	hepatitis D virus
HEV	hepatitis E virus
HBsAg	hepatitis B surface antigen
HepB3	third dose of hepatitis B vaccine
Hib3	third dose of *Haemophilus influenzae* type b vaccine
IgA	immunoglobulin A
IgG	immunoglobulin G
IgM	immunoglobulin M
ml	millilitre
NT	neonatal tetanus
OPV3	third dose of oral polio vaccine
PAB	protected at birth
PCR	polymerase chain reaction
SEARO	WHO Regional Office for South-East Asia
TT	tetanus toxoid
TT2+	second and subsequent doses of tetanus toxoid
WHO	World Health Organization
WPRO	WHO Regional Office for the Western Pacific

Introduction

The purpose of this document is to provide WHO recommendations on surveillance standards for selected vaccine-preventable diseases. These recommendations should be carefully adapted to meet national needs according to a country's own disease control priorities, objectives and strategies.

Disease surveillance is defined as the routine ongoing collection, analysis and dissemination of health data. An effective surveillance system has the following functions:

- detection and notification of health events
- collection and consolidation of pertinent data
- investigation and confirmation (epidemiological, clinical and/or laboratory) of cases or outbreaks
- routine analysis and creation of reports
- feedback of information to those providing the data, and
- feed-forward (i.e. the forwarding of data to more central levels).

The *rationale* for surveillance of a specific health event must be established and based on clear national priorities, disease control objectives and strategies; otherwise, the disease surveillance data collected may be irrelevant. Decisions as to what data to collect should be based on what analyses are needed to guide public health decision-making. To avoid overburdening health staff at peripheral levels, the surveillance system should be as streamlined as possible by collecting the ***minimum*** amount of data necessary, and by using the most efficient and appropriate means to collect, consolidate and transfer data. Staff at all levels should be trained and encouraged to analyse and *use* their data. Data that can be more efficiently collected from other sources (e.g. survey) should not be included in a surveillance system.

An effective surveillance system is:

- useful
- efficient
- flexible
- representative
- simple

These attributes should be assessed when evaluating a surveillance system.

At the national level, clear surveillance "standards" must be established for maximum efficiency and so that data are comparable throughout the country. These standards would include:

- a case definition
- the type of surveillance to be conducted
- the data elements to be collected
- the minimum analyses and routine reports to be created
- the use of data for making decisions

For surveillance to be operational, the following needs to be carefully defined:

- the process of surveillance
- the tasks at each level
- the data/specimen flow
- the logistics, including staff issues
  - designation of staff
  - staff training
  - appropriate tool distribution (e.g. means of communication, transportation, specimen kits)

As a part of supervision, standard performance indicators should be monitored to identify weaknesses in the system so that corrective action can be taken.

Diphtheria

Rationale for surveillance

Diphtheria is a widespread severe infectious disease that has the potential for epidemics. The control of diphtheria is based on the following three measures. 1) Primary prevention of disease by ensuring high population immunity through immunization. 2) Secondary prevention of spread by the rapid investigation of close contacts, to ensure their proper treatment. 3) Tertiary prevention of complications and deaths by early diagnosis and proper management. Surveillance data can be used to monitor levels of coverage (target > 90%) and disease as a measure of the impact of control programmes. Recent epidemics have highlighted the need for adequate surveillance and epidemic preparedness.

Recommended case definition

Clinical description

An illness characterised by laryngitis **or** pharyngitis **or** tonsillitis, ***and***
an adherent membrane of the tonsils, pharynx and/or nose.

Laboratory criteria for diagnosis

Isolation of *Corynebacterium diphtheriae* from a clinical specimen, **or**
fourfold or greater rise in serum antibody (but only if both serum samples were obtained before the administration of diphtheria toxoid or antitoxin).

Case classification

Suspected:	Not applicable
Probable:	A case that meets the clinical description
Confirmed:	A probable case that is laboratory confirmed or linked epidemiologically to a laboratory confirmed case

Note: Persons with positive *C. diphtheriae* cultures and not meeting the clinical description (i.e. asymptomatic carriers) should not be reported as probable or confirmed diphtheria cases.

Recommended types of surveillance

- Routine monthly reporting of aggregated data of probable or confirmed cases is recommended from peripheral level to intermediate and central levels. Zero reporting should be required at all levels
- All outbreaks should be investigated immediately and case-based data collected
- In countries achieving low incidence (usually where coverage is >85-90%) immediate reporting of case-based data of probable or confirmed cases is recommended from peripheral level to intermediate and central levels

Diphtheria (continued)

Recommended minimum data elements

Aggregated data:

- Number of cases
- Number of third doses of diphtheria toxoid containing vaccine (e.g. DTP3) administered to infants

Case-based data:

- Unique identifier
- Geographical area (e.g. district) name
- Date of birth
- Date of onset
- Date of first treatment
- Treatment type:
  1=antibiotic & antitoxin; 2=antibiotic only; 3=antitoxin only; 4=no or other treatment; 9=unknown.
- Laboratory result:
  1=toxigenic *C. diphtheriae* isolated; 2=non-toxigenic *C. diphtheriae* isolated;
  3=*C. diphtheriae* isolated, toxigenicity unknown; 4=*C. diphtheriae* not isolated;
  5=no specimen processed; 9=unknown.
- Total diphtheria vaccine (DTP, DT or Td) doses received
- Date of last dose
- Final classification of the case:
  1=confirmed; 2=probable; 3=discarded
- Outcome:
  1=alive; 2=dead; 3=unknown

Recommended data analyses, presentation, reports

Aggregated data:

- Incidence rate by month, year, and geographic area
- DTP3 coverage by year and geographic area
- Completeness/timeliness of monthly reporting
- Proportional morbidity (compared to other diseases of public health importance)

Case-based data: same as aggregated data plus the following:

- Age-specific incidence rate
- Cases by immunization status, laboratory results, treatment type
- Cases treated "on time" (≤ seven days of onset)
- Case fatality rate
- Proportional mortality (compared to other diseases of public health importance)

Diphtheria (continued)

Special aspects

More detailed information available from the Expanded Programme on Immunization (EPI), Global Programme for Vaccines and Immunization (GPV).

Principle uses of data for decision-making

- Monitor case fatality rate and, if high, determine cause (e.g. poor case management, lack of antibiotics/anti-toxin, patients not seeking treatment in time) so that corrective action can be taken
- Determine age-specific incidence rate, geographical area, and season of diphtheria cases to know risk groups and risk periods
- Monitor incidence rate to assess impact of control efforts
- Monitor immunization coverage per geographical area to identify areas of poor programme performance
- Detect outbreaks and implement control measures
- Investigate outbreaks to understand epidemiology, determine why the outbreak occurred (e.g. vaccine failure, failure to immunise, accumulation of susceptibles, waning immunity, new toxigenic strain), and ensure proper case management

Note: In addition to surveillance, carefully designed serologic studies can be used to monitor the immune status of different age groups.

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Acute viral hepatitis

Rationale for surveillance

Several distinct infections are grouped as viral hepatitis. Transmission is mainly through the oral-faecal route for hepatitis A and E, and percutaneous exposure to body fluids, including sexual intercoure, for hepatitis B, C, and D. The course of the disease may be fulminating (e.g. hepatitis E in pregnancy); chronic infection and severe sequel occur mainly for hepatitis B, C, and D.

Control measures for blood-related transmission include ensuring transfusion safety, injection safety, and (for hepatitis A and hepatitis B at least) immunization. Hepatitis B is targeted by WHO (9GPW6.3) for reduced incidence/prevalence

Recommended case definition

Clinical description

An acute illness typically including acute jaundice, dark urine, anorexia, malaise, extreme fatigue, and right upper quadrant tenderness. Biologic signs include increased urine urobilonogen and >2.5 times the upper limit of serum alanine aminotransferase.

Note: Most infections occur during early childhood.
A variable proportions of adult infections are asymptomatic.

Laboratory criteria for diagnosis

Hepatitis A:	positive for IgM anti-HAV
Hepatitis B:	positive for IgM anti-HBc-positive **or** (less preferably) hepatitis B surface antigen (HBsAg)
Non-A, non-B:	negative for IgM anti-HAV and IgM anti-HBc **or** (less preferably) HBsAg

Note: The anti-HBc IgM test, specific for acute infection, is not available in most countries. HbsAg is often available, but is less preferable since it cannot distinguish acute new infections from exacerbation of chronic hepatitis B. Nevertheless, continued HBsAg seropositivity (> six months) is an indicator of chronic infection. For patients with non-A, non-B, the following testing is used for a diagnosis of acute hepatitis C, D, or E:

Hepatitis C:	positive for anti-HCV
Hepatitis D:	positive for IgM anti-HBc **or** (less preferably) HBsAg plus anti-HDV positive (N.B. only occurs as co-infection or super-infection of hepatitis B)
Hepatitis E:	positive for IgM anti-HEV

Case classification

Suspected:	A case that is compatible with the clinical description
Probable:	Not applicable
Confirmed:	A suspected case that is laboratory confirmed **or**, for hepatitis A only, a case compatible with the clinical description, in a person who has an epidemiological link (i.e. household or sexual contact with an infected person during the 15-50 days before the onset of symptoms) with a laboratory-confirmed case of hepatitis A

Acute viral hepatitis (continued)

Recommended types of surveillance

- Routine monthly reporting of aggregated data of suspected cases, and if available, the number of confirmed cases of each type of hepatitis is recommended from the peripheral level to intermediate and central levels
- Zero reporting should be required at all levels
- All outbreaks should be investigated immediately and confirmed serologically

Recommended minimum data elements

Aggregated data:

- Number of third doses of hepatitis B vaccine (HepB3) administered to infants
- Number of suspect cases
- If available, number of confirmed cases by each type of hepatitis

Recommended data analyses, presentation, reports

(from multiple sources of data, in addition to surveillance data):

- HepB3 coverage in infants by year and geographic area
- Acute viral hepatitis incidence by year, month, geographical area, and (if data exist) age group
- Where data exist on etiologic agent, incidence rate of each type of acute viral hepatitis by geographic area, year, month and age group
- Proportion of all cases of chronic liver disease, cirrhosis, and primary liver cancer that are HBsAg positive or anti-HCV positive.(see special aspects section)

Principle uses of data for decision-making

- Monitor HepB3 coverage by geographic area to measure areas with weak performance and take action
- Investigate all suspected/reported outbreaks
- Determine the specific cause of acute viral hepatitis cases (reported routinely or during outbreaks), so that corrective measures can be taken
- Understand the epidemiology of hepatitis by etiologic agent in terms of distribution over time, by age group, and by geographic area
- Measure the incidence (including age-specific incidence) and prevalence of HBsAg and anti-HCV
- Measure the proportion of acute viral hepatitis, chronic liver disease, cirrhosis, and primary liver cancer that are hepatitis B virus or hepatitis C virus carriers to:
  1) determine the burden of the disease in the population;
  2) prioritize it among other diseases of public health importance; and
  3) choose the proper strategies for its control

Acute viral hepatitis (continued)

Special aspects

Surveillance data of acute viral hepatitis from developing countries should be interpreted with caution. Differentiation of types of viral hepatitis (A to E) based on clinical diagnosis is unreliable and serologic testing is necessary for accurate diagnosis. Unfortunately, many developing countries do not have access to diagnostic reagents. Most infections with hepatitis A, B, C and E virus occur asymptomatically (in developing countries usually among children) and will not be detected and reported to the surveillance system. Therefore, a low incidence of acute viral hepatitis should not be misinterpreted as a low prevalence of viral hepatitis infection.

Understanding the epidemiology and burden of disease of viral hepatitis requires an understanding of the sequellae of hepatitis B, C and D infection. These includes asymptomatic chronic infection, chronic hepatitis, cirrhosis, and primary liver cancer. Measuring the burden of these conditions requires data collection from sources not traditionally used by infectious disease epidemiologists, including data on hospital discharge and mortality data (for chronic hepatitis, cirrhosis, and liver cancer), and cancer registers. Special sero-prevalence surveys may be needed to measure the prevalence of hepatitis B and hepatitis C infection in the general population and in special groups such as blood donors, pregnant women, military recruits, health care workers, certain patient groups (e.g. patients with liver disease, people on dialysis, haemophiliacs), and ethnic sub-populations.

Assessing coverage of hepatitis B vaccine is similar to that for other EPI vaccines. Vaccine is given to infants (and in some industrial countries to adolescents) primarily to prevent the development of chronic liver disease and liver cancer; serological testing to document sero-conversion in children is usually not necessary because numerous studies have shown that the vaccine is 85% to 100% effective in preventing chronic infection.

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Haemophilus influenzae type B (Hib) disease

Rationale for surveillance

Hib is the most common cause of bacterial meningitis in children, and one of the two most common causes of severe bacterial pneumonia. Pneumonia is the largest single remaining infectious disease killer of young children in the developing world. Hib may also cause other diseases, including arthritis, skin infection, and epiglottitis. Surveillance data are critical for clarifying the burden of disease and evaluating the impact of immunization programmes. Although in many countries Hib pneumonia is more common than the other types of infection, diagnosis of Hib pneumonia is extremely difficult. Routine surveillance should focus on meningitis and other Hib infections, diagnosed with microbiologic tests on blood, cerebrospinal fluid (CSF), and other body fluids (such as pleural fluid) that usually do not contain bacteria. Such infections are often called "invasive Hib disease". Countries may also wish to report potential cases of bacterial meningitis, both as a performance indicator for Hib detection, and to clarify the burden of meningitis attributable to all bacteria.

Recommended case definition

Clinical description

Bacterial meningitis is characterized by acute onset of fever, headache and stiff neck. Meningitis is not specific for Hib disease, and Hib disease cannot be diagnosed on clinical grounds.

Laboratory criteria for diagnosis

Culture method: isolation of Hib from a normally sterile clinical specimen, such as cerebrospinal fluid (CSF) or blood (i.e. culture of Hib from a non-sterile site, such as the throat, does not define Hib disease, since the bacteria can grow in these other areas and not cause disease). Antigen detection methods: identification of Hib antigen in normally sterile fluids (i.e. CSF or blood) by antigen detection methods such as latex agglutination or counter immunoelectrophoresis (CIE).

Case classification

Potential:	Bacterial meningitis case: a child with a clinical syndrome consistent with bacterial meningitis
Probable:	Not applicable
Confirmed:	A case that is laboratory confirmed by growing or identifying Hib in the CSF or blood

Note: Any person with Hib isolated from CSF or blood may be reported as a confirmed case, regardless of whether their clinical syndrome was meningitis.

Haemophilus influenzae *type B (Hib) disease (continued)*

Recommended types of surveillance

- Routine monthly reporting of aggregate data of confirmed cases is recommended from peripheral level to intermediate and central levels
- Zero reporting should be required at all levels
- All potential cases should also be reported if laboratory performance indicators are to be monitored (see Note)

Note: Since laboratory confirmation is required for all cases, the extent of surveillance will of necessity vary depending on the capabilities of individual countries. Surveillance does not need to be national in scope to fulfil goals as noted in "Rationale" section above. It is more important to have a well-functioning system in some areas than to have a national system that functions poorly.

Recommended minimum data elements

Aggregated data for reporting

- Number of cases
- Number of 3rd doses of Hib vaccine (Hib3) administered to infants

Case-based data for reporting and investigation

- Unique identifer
- Geographical area (e.g. district and province) names
- Date of birth
- Date of onset
- Specimen type, if specimen collected:
  1=blood; 2=CSF; 3=both; 4=other
- Culture result, if done:
  1=positive; 2=negative; 3=pending; 4=not done
- Antigen detection result, if done:
  1=positive; 2=negative; 3=pending; 4=not done
- CSF white cell count/ml, if done
- Outcome:
  1=alive; 2=dead; 9=unknown
- Number of Hib doses received:
  9=unknown
- Final classification:
  1=potential; 2=confirmed

Recommended data analyses, presentation, reports

Aggregated data

- Incidence rate by year and geographic area
- Hib3 coverage by year and geographic area
- Completeness and timeliness of reporting

Haemophilus influenzae *type B (Hib) disease (continued)*

Case-based data: Same as aggregate plus:

- Age-specific incidence rate
- Case fatality rate
- Cases by immunization status
- **Performance indicators of surveillance quality** **Target**
  - Percent of all potential bacterial meningitis cases for which CSF/blood was obtained for evaluation ≥ 90%
  - Percent of potential bacterial meningitis cases in which a bacterial pathogen was identified from CSF or blood:
  - Among CSF with 10 or more white blood cells/ml ≥ 20%
  - Among CSF with 100 or more white blood cells/ml ≥ 50%

Note: Although persons with bacterial meningitis have a wide range of CSF white blood cell counts, the proportion of potential bacterial meningitis cases with identifiable bacterial causes increases with increasing CSF cell counts. For evaluation of performance, programme personnel may wish to determine proportion of potential bacterial meningitis cases in which bacterial causes have been identified in one or both of the above categories. Results below the target levels suggest some cases of bacterial meningitis are not being identified, and that review of laboratory and clinical practices should be performed.

Principle uses of data for decision-making

- To determine incidence of Hib meningitis and invasive disease for estimation of Hib disease burden
- To measure impact of immunization program and identify areas needing additional input
- To monitor coverage and take action to correct low coverage areas

Special aspects

Since Hib surveillance requires laboratory confirmation, nation-wide surveillance may not be practical in many countries. However, most surveillance goals may be approached with a less comprehensive plan. Surveillance in areas with appropriate clinical and laboratory capacity can provide necessary information on burden and immunization impact. Coverage data should be obtained nation-wide. Evaluating the combination of nation-wide coverage data, and area-specific disease data can provide necessary information for making immunization programme decisions. Additional guidance on surveillance methodology can be obtained in WHO publication WHO/VRD/GEN/95.05.

Contact information

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Measles

Rationale for surveillance

Measles is targeted for a reduction by 90% in incidence and by 95% in mortality (9GPW 6.2). Surveillance for measles should evolve with each phase of measles control. Countries in the "measles control" phase are endemic and should concentrate on raising routine measles immunization coverage and focusing extra immunization efforts in areas with high measles morbidity. Countries in the more advanced "measles outbreak prevention phase" are achieving high routine measles coverage and low incidence with periodic outbreaks. Surveillance in these countries should be used to predict potential outbreaks and identify high risk areas and populations. Countries in the measles elimination phase" in which the objective is to completely interrupt measles transmission require very intensive case-based surveillance to detect and confirm every suspect measles case in the community.

Recommended case definition

Clinical case definition

Any person in whom a clinician suspects measles infection **or**
any person with fever, **and** maculopapular rash (i.e. non-vesicular), **and** cough, coryza (i.e. runny nose) or conjunctivitis (i.e. red eyes)

Laboratory criteria for diagnosis

At least a four-fold increase in antibody titre, or isolation of measles virus, or presence of measles-specific IgM antibodies.

Case classification

Probable:	Not applicable
Clinically confirmed:	A case that meets the clinical case definition
Laboratory confirmed*	A case that meets the clinical case definition and that is laboratory confirmed or linked epidemiologically to a laboratory confirmed case.

* only for outbreak confirmation and during the elimination phase

Recommended types of surveillance

- **Control phase**: When measles is endemic, routine monthly reporting of aggregated data of clinical measles cases from peripheral to intermediate and central level. Only outbreaks (not each case) should be investigated
- **Outbreak prevention phase**: When low incidence of measles is achieved with periodic outbreaks due to accumulation of susceptibles, routine monthly reporting of aggregated data of clinical measles cases is recommended from peripheral to intermediate and central level. All suspected outbreaks should be investigated immediately and case-based data collected. Suspected measles epidemics should be confirmed by conducting serology on the first few cases only
- **Elimination phase**: Case-based surveillance should be conducted and every case reported and investigated immediately from peripheral level to intermediate level, and also included in the weekly reporting system. Laboratory specimens should be collected on every case
- **During all phases**: zero reporting should be required at all levels

Measles (continued)

Recommended minimum data elements

Control phase (aggregated data):

- Number of cases
- Number of measles vaccine doses administered to infants (or one year of age depending on the immunization schedule)

Outbreak prevention phase (aggregated data): same as control phase, plus the following:

- Number of cases by age group and immunization status

Elimination phase (case-based data):

- Unique identifier
- Geographical area (e.g. district and province) names
- Date of birth
- Date of rash onset
- Date of notification
- Date of case investigation
- Date of specimen collection
- Number of measles vaccine doses received:
  99=unknown
- Source of infection identified:
  1=yes; 2=no; 9=unknown
- Results of serology:
  1=positive; 2=negative; 3=no specimens processed; 9=unknown
- Final classification:
  1=clinically confirmed; 2=confirmed by laboratory; 3=confirmed by epidemiological-link; 9=discarded

Note: In every phase, completeness and timeliness of weekly measles reporting should be monitored.

Recommended data analyses, presentation, reports

For control phase

- Incidence rate by month, year, and geographic area
- Measles vaccine coverage by year and geographic area
- Completeness/timeliness of monthly reporting
- Proportional morbidity (compared to other diseases of public health importance)
- Proportion of known outbreaks that were investigated

For outbreak prevention phase: same as control phase plus the following:

- Age-specific incidence rate
- Cases by age group and immunization status

Measles (continued)

Measles elimination: same as outbreak prevention phase plus the following:

Performance indicators	Target
– % of weekly reports received	≥ 80%
– % of cases* notified ≤ seven days of rash onset	≥ 80%
– % of cases* investigated ≤ 48 hours of notification	≥ 80%
– % of cases* with adequate specimen** and lab results	≥ 80%
– % of confirmed cases with source of infection identified	≥ 80%

* all cases that meet the clinical case definition

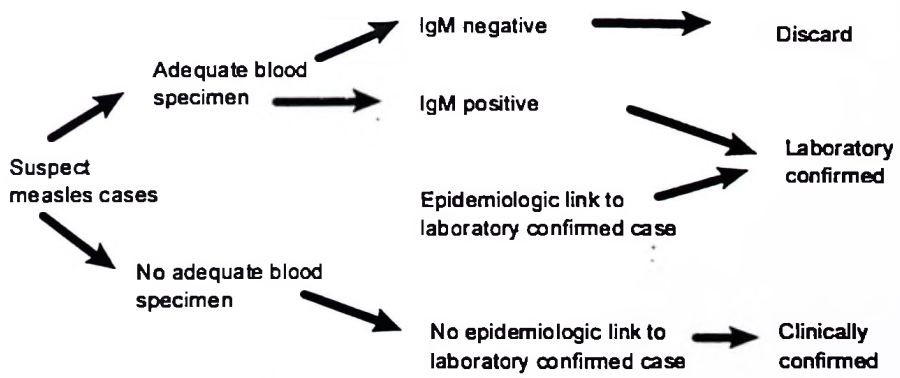
** adequate specimen is one blood specimen collected within 3-28 days of rash onset

Principle uses of data for decision-making

- **Control phase**: Monitor incidence and coverage to monitor progress (e.g. decreasing incidence and increasing coverage), and to identify areas at high risk or with poor programme performance
- **Outbreak prevention phase**: Describe the changing epidemiology of measles in terms of age and inter-epidemic period. Identify high-risk populations. Determine when the next outbreak may occur due to a build-up of susceptibles and accelerate activities beforehand
- **Elimination phase:** Use data to classify cases (See special aspects section) Determine where measles virus is circulating or may circulate (i.e. high risk) and the performance of the surveillance system (e.g. reaction time for notification, and specimen collection) to detect virus circulation or potential importation
- **During all phases**: Detect and investigate outbreaks to ensure proper case management, and determine why the outbreak occurred (e.g. failure to vaccinate, vaccine failure or accumulation of susceptibles)

Special aspects

Figure 1: Final classification of measles cases (elimination phase)



Measles (continued)

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Neonatal tetanus

Rationale for surveillance

Neonatal tetanus is targeted by WHO for **elimination** as a major public health burden (9GPW 6.2). High tetanus toxoid (TT) coverage of pregnant women, clean delivery and the identification of, and implementation of corrective action in high risk areas (i.e. TT immunization of childbearing-aged women) are the three primary strategies towards this goal. Epidemiological surveillance is useful in the identification of areas at high risk for neonatal tetanus (NT) and for monitoring impact of interventions.

Recommended case definition

Clinical case definition and case classification

Suspected case: Any neonatal death between 3-28 days of age in which the cause of death is unknown; **or** any neonate reported as having suffered from neonatal tetanus between 3-28 days of age and not investigated

Confirmed case: Any neonate with a normal ability to suck and cry during the first two days of life, **and** who between three and 28 days of age cannot suck normally, and becomes stiff or has convulsions (i.e. jerking of the muscles) or both

Note: The basis for case classification is entirely clinical and does not depend upon laboratory confirmation. NT cases reported from hospitals are considered confirmed.

Recommended types of surveillance

- Number of confirmed NT cases should be included in routine monthly surveillance reports of all countries and should be reported as a separate item from other (non-neonatal) tetanus. Zero reporting should be required at all levels
- Active surveillance for NT should be conducted in major health facilities on a regular basis
- A retrospective record review for NT cases should be conducted at least once annually in major hospitals
- In "low risk" geographical areas where NT incidence<1/1000 live births and surveillance is performing well (i.e. surveillance data are reasonably representative of the population and there is good reporting completeness), all suspect cases should be investigated to confirm and identify the cause
- Community surveillance is recommended in "silent" areas (i.e. where routine reporting is not functional but, based on other indicators, where neonatal tetanus could be a problem)

Recommended minimum data elements

Aggregated data:

- Number of cases
- Doses of TT administered to pregnant or child-bearing aged women (depending on national policy) or % of newborns protected at birth (PAB) [see special aspects section]
- Completeness/timeliness of monthly reports

Neonatal tetanus (continued)

Case-based data:

- Unique identifier
- Geographical area (e.g. district and province) names
- Date of birth of baby
- Age (in days) of baby at onset
- Sex of baby
- Parity (number of deliveries including this most recent one) of mother
- Date of case investigation
- Location/type of birth:
  1=institution; 2=home with trained attendant; 3=home with untrained attendant; 4=home without attendant; 5=other; 9=unknown
- Tetanus immunization status of mother when she gave birth:
  1=up-to-date; 2=not up-to-date; 3=unimmunised; 9=unknown
- Final classification:
  1=confirmed; 2=suspected; 3=discarded
- Mother given protective TT dose within three months of report:
  1=yes; 2=no; 9=unknown
- Supplemental immunization conducted within same locality as the case:
  1=yes; 2=no; 9=unknown

Recommended data analyses, presentation, reports

Aggregated data (i.e. routine monthly reporting)

- Incidence rate per 1000 live births by geographic area, month, and year
- TT2+ (or PAB) by year and geographic area
- Completeness/timeliness of monthly reporting
- Geographic areas considered at high risk for NT compared to those where corrective actions were taken

Case-based data (i.e. from case investigations only) same as for aggregated data plus the following:

- Confirmed NT cases by delivery type, sex, TT2+ status of the mother
- % of confirmed cases for which the mother subsequently received a protective TT dose

Neonatal tetanus (continued)

Principle uses of data for decision-making/action

- Monitor progress towards achieving and sustaining high routine TT2+ (or PAB) coverage in all geographical areas
- Monitor progress towards eliminating NT in every geographical area
- Investigate suspect NT cases in areas not considered at risk for NT to confirm and determine cause
- Identify high risk geographical areas
- Monitor whether corrective actions were taken in those areas considered at high risk
- Periodically validate sensitivity of NT reporting by comparing number of reported cases with cases identified through active surveillance

Special aspects

"% protected at birth" (PAB) is an alternative method of determining coverage (particularly where TT2+ is unreliable). To monitor PAB, health workers record during DTP1 visits whether the infant was protected at birth by the mother's TT status and/or delivery status (clean/unclean). % PAB is then estimated as: number of infants protected/number of live births. If the child was unprotected, the mother should receive a dose of tetanus toxoid during the same visit and should be followed up with a subsequent TT dose if needed for protection.

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Pertussis (whooping cough)

Rationale for surveillance

Pertussis is a major cause of childhood morbidity and mortality. An estimated 45 million cases and 400 000 deaths occur annually. Case fatality rates in developing countries can reach 15%. High routine coverage with effective vaccine is the mainstay of prevention. Surveillance data on the disease can monitor the impact of immunization programmes as well as identify high risk areas and outbreaks.

Recommended case definition:

Clinical description

A person with a cough lasting at least two weeks **with at least one of the following:**

1. Paroxysms (i.e. fits) of coughing
2. Inspiratory "whooping"
3. Post-tussive vomiting (i.e. vomiting immediately after coughing) and without other apparent cause

Laboratory criteria for diagnosis

Isolation of *Bordetella pertussis* or detection of genomic sequences by polymerase chain reaction (PCR)

Case classification

Suspected: A case that meets the clinical description

Confirmed: A person with a cough that is laboratory confirmed

Recommended types of surveillance

- Routine monthly reporting of aggregated data of suspected and confirmed cases from peripheral level to intermediate and central levels. Zero reporting should be required at all levels
- All outbreaks should be investigated immediately and laboratory confirmed. During an outbreak, case-based data should be collected
- To describe the changing pertussis epidemiology in countries with low pertussis incidence (usually where coverage is >80%), additional information on age group and immunization status should be collected; or, as an alternative case-based surveillance, sentinel surveillance, active surveillance, and/or occasional surveys and laboratory confirmation of suspect cases should be considered

Recommended minimum data elements

Aggregated data:

- Number of cases
- Number of third doses of diphtheria-pertussis-tetanus vaccine (DTP3) administered to infants
- Completeness/timeliness of monthly reports

Pertussis (whooping cough) - (continued)

Case-based data:

- Unique identifier
- Geographical area (e.g. district and province) names
- Date of birth
- Date of onset
- Total pertussis vaccine doses:
  99=unknown
- Date of last pertussis vaccine dose:
- Outcome:
  1=alive; 2=dead; 9=unknown
- Classification:
  1=confirmed; 2=suspect; 3=discarded

Recommended data analyses, presentation, reports

Aggregated data:

- Incidence rate by month, year, and geographic area
- DTP3 coverage by year and geographic area
- Completeness/timeliness of monthly reporting
- Proportional morbidity (compared to other diseases of public health importance)

Case-based data: same as aggregated data plus the following:

- Age-specific incidence rate
- Immunization status of cases
- Case fatality rate
- Proportional mortality (compared to other diseases of public health importance)

Principle uses of data for decision-making

- Investigate outbreaks to understand epidemiology of pertussis in the country, why the outbreak occurred (e.g. failure to immunize, vaccine failure, accumulation of susceptibles/waning immunity), and to ensure proper case management
- Monitor case fatality rate. If high, determine cause (e.g. poor case management, lack of antibiotics/supportive care, patients not seeking treatment in time)
- Determine age-specific incidence rate, and incidence rate by geographical area to know risk groups/areas
- Monitor incidence rate to assess impact of control efforts

Pertussis (whooping cough) - (continued)

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Poliomyelitis

Rationale for surveillance

Poliomyelitis is targeted for **eradication** (9GPW 6.1). Highly sensitive surveillance for acute flaccid paralysis (AFP), including immediate case investigation, and specimen collection is critical to detect wild poliovirus circulation with the ultimate objective of polio eradication. AFP surveillance is also critical for documenting the absence of poliovirus circulation for polio-free certification.

Recommended case definition

Clinical case definition

Any child under fifteen years of age with acute, flaccid paralysis[1] **or** any person with paralytic illness at any age when polio is suspected.

[1] Including Guillain Barré syndrome

Case classification

Suspected case: A case that meets the clinical case definition

Confirmed case: See diagram in special aspects section

Recommended types of surveillance

- Aggregated data of AFP cases should be included in routine monthly surveillance reports
- Zero reporting should be required at all levels
- All outbreaks should be investigated immediately
- All AFP cases under 15 years of age or with paralytic illness at an age where polio is suspected, should be reported immediately, investigated within 48 hours and two stool specimens collected 24-48 hours apart and within 14 days of paralysis onset
- Active surveillance should be implemented in selected hospitals

Recommended minimum data elements

Aggregated data:

- Number of third doses of oral polio vaccine (OPV3) administered to infants
- Number of AFP cases

Poliomyelitis (continued)

Case-based data (to be linked to specimen-based data for analysis)

- Unique identifier
- Geographical area (e.g. district & province) names
- Date of birth
- Date of paralysis
- Date of notification
- Date of case investigation
- Total polio vaccine doses received:
  99=unknown
- Fever at onset of paralysis:
  1=yes; 2=no; 9=unknown
- Progression of paralysis within four days:
  1=yes; 2=no; 9=unknown
- Asymmetric paralysis:
  1=yes; 2=no; 9=unknown
- Date of 60-day follow-up exam
- Findings at 60-day follow-up:
  1=residual weakness; 2=no residual weakness; 3=lost to follow-up;
  4=death before follow-up
- Final classification:
  1=confirmed; 2=compatible; 3=discarded

Specimen-based data (to be linked to case-based data for analysis)

- Unique identifier
- Specimen number:
  1=first specimen; 2=second specimen; 3=other; 9=unknown
- Date of paralysis onset
- Date of last OPV
- Date of stool specimen collection
- Date stool specimen sent to lab
- Date stool specimen received in lab
- Condition of stool:
  1=good; 2=poor; 9=unknown
- Date final culture results sent from lab to EPI
- Date intratypic differentiation results sent from lab to EPI

Poliomyelitis (continued)

- **Results**
  - Polio type1 isolated?
    1=yes, wild; 2=yes, Sabin; 3=yes, pending intratypic differentiation; 4=yes, mixture of wild & Sabin; 5=no P1 isolated; 6=specimen not processed
  - Polio type 2 isolated?
    1=yes, wild; 2=yes, Sabin; 3=yes, pending intratypic differentiation; 4=yes, mixture of wild & Sabin; 5=no P2 isolated; 6=specimen not processed
  - Polio type 3 isolated?
    1=yes, wild; 2=yes, Sabin; 3=yes, pending intratypic differentiation; 4=yes, mixture of wild & Sabin; 5=no P3 isolated; 6=specimen not processed
  - Non-polio enterovirus (NPEV) isolated?
    1=yes; 2=no NPEV isolated; 3=specimen not processed

Recommended data analyses, presentation, reports

Aggregated data:

- Cases by month, year, and geographic area
- OPV3 coverage by year and geographic area
- Completeness/timeliness of monthly reporting

Case-based data: same as aggregated data plus the following:

- Confirmed cases by age group, immunization status, geographic area, month and year
- Confirmed cases from which wild poliovirus was isolated by geographic area, month, year
- Compatible cases by geographic area and month
- All suspect cases by final classification
- Non-polio enterovirus isolation rate
- **Indicators of surveillance performance** — **Target**
  - % of all expected monthly reports that were received — ≥ 90%
  - Annualized non-polio AFP rate per 100 000 children under 15 years of age — ≥ 1/100 000
  - % of AFP cases investigated within 48 hours — ≥ 80%
  - % of AFP cases with two adequate stool specimens collected 24-48 hours apart and ≤ 14 days of onset — ≥ 80%
  - % of specimens arriving at the laboratory in "good" condition — ≥ 80%
  - % of specimens arriving at a WHO-accredited laboratory within 3 days of being sent — ≥ 80%
  - % of specimens with laboratory results sent within 28 days of specimen receipt — ≥ 80%

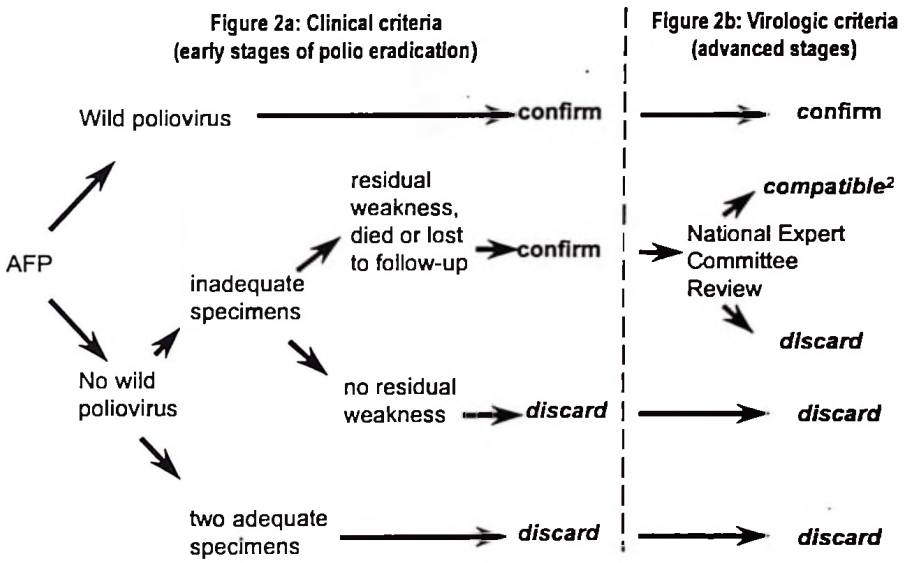
Poliomyelitis (continued)

Principle uses of data for decision-making

- Track wild poliovirus circulation
- Use data for classifying cases as confirmed, polio compatible or discarded (see special aspects section)
- Monitor routine coverage in all geographical areas and focus efforts in low performing geographical areas
- Monitor seasonality to determine low season of poliovirus transmission for National Immunization Day (NIDs) planning
- Identify high risk areas for planning mopping up immunization
- Monitor performance of surveillance using standard indicators listed above and focus efforts in low performing geographical areas
- Provide evidence to Certification Commissions of the interruption of wild poliovirus circulation

Special aspects

The scheme in the following illustration (Figure 1) should be used to classify AFP cases. A country should use the clinical classification until their surveillance performance meets the following three criteria: 1) a non-polio AFP rate of at least 1/100,000 children under 15 years of age; 2) two adequate specimens[1] collected from at least 60% of detected AFP cases; 3) all specimens processed in a WHO-accredited laboratory.



1 "Adequate specimens" means two specimens collected 24-48 hours apart and within 14 days of onset of paralysis. The specimen arriving at the laboratory must be of adequate volume (approximately 8-10 grams), have appropriate documentation (i.e. laboratory request form) and be in "good condition". "Good condition" = no leakage, no desiccation, and evidence that the reverse cold chain was maintained (based on presence of ice or temperature indicator).

2 "Compatible" cases indicate surveillance failures and should be monitored for clustering in space and time

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Yellow fever

Rationale for surveillance

This mosquito-borne virus disease occurs in tropical regions of Africa and South America and is maintained by sylvatic transmission of virus involving forest-dwelling mosquitoes and monkeys. Transmission to humans may occur in forest transition zones and subsequently may enter an urban cycle through the *Aedes aegypti* mosquito. Many cities are now threatened with major epidemics as yellow fever is undergoing a major resurgence especially in the African region. The strategies for yellow fever control are: control of *Aedes aegypti* in urban centres, infant immunization, immunization campaigns to prevent epidemics, epidemic detection and emergency immunization when an epidemic is confirmed. Surveillance data allows for monitoring disease incidence, the prediction and early detection of outbreaks and the monitoring of control measures. Case reporting of yellow fever is universally required by **International Health Regulations.**

Recommended case definition

Clinical description

An illness characterised by acute onset of fever followed by jaundice within two weeks of onset of first symptoms **AND** one of the following: 1) bleeding from nose, gum, skin, or GI tract; **or** 2) death within 3 weeks of illness onset.

Laboratory criteria for diagnosis

Isolation of yellow fever virus,
or presence of yellow fever specific IgM or a four-fold or greater rise in serum IgG levels (acute or convalescent)
or positive post-mortem liver histopathology
or detection of yellow fever antigen in tissues by immunohistochemistry
or detection of yellow fever virus genomic sequences in blood or organs by PCR.

Case classification

Suspected:	A case that is compatible with the clinical description
Probable:	Not applicable
Confirmed:	A suspected case that is laboratory confirmed or epidemiologically linked to a laboratory-confirmed case or outbreak

Recommended types of surveillance

- Routine weekly/monthly reporting of aggregated data on suspected and confirmed cases from peripheral level to intermediate and central levels. Zero reporting should be required at all levels.
- Immediate reporting of suspected cases from peripheral level to intermediate and central levels.
- All suspected cases and outbreaks should be investigated immediately and laboratory confirmed.
- Case-based surveillance should be implemented in countries identified by WHO as high risk for yellow fever. Specimens should be collected to confirm an epidemic as rapidly as possible. Then priority should be placed on collecting specimens from new or neighbouring areas (other than the area where the epidemic is already confirmed).

Yellow fever (continued)

Note: There is mandatory reporting to WHO of all suspected and confirmed yellow fever cases within 24 hours of detection.

Recommended minimum data elements

Aggregated data for reporting

- Number of cases
- Doses of yellow fever vaccine administered to infants by geographical area
- Completeness / timeliness of monthly reports

Case-based data for reporting and investigation

- Unique identifier
- Geographical area (e.g. district and province) names
- Date of birth
- Date of onset
- Date of notification
- Date of investigation
- Ever received a dose of yellow fever vaccine:
  1=yes; 2=no; 9=unknown
- Date acute blood specimen received in laboratory
- Date convalescent blood specimen received in laboratory (if applicable)
- Date histopathology specimen collected (if applicable)
- Depending on which laboratory tests used:
  - IgM results:
    1=positive; 2=negative; 3=no specimen processed; 9=unknown
  - Virus isolation results:
    1=positive; 2=negative; 3=no specimen processed; 9=unknown
  - IgG (4-fold rise) results:
    1=positive; 2=negative; 3=no specimen processed; 9=unknown
  - Liver histopathology:
    1=positive; 2=negative; 3=no specimen processed; 9=unknown
- Date IgM results first sent
- Date virus isolation results first sent
- Date IgG results first sent
- Date histopathology report first sent
- Final classification:
  1=confirmed; 2=suspected; 9=discarded
- Final outcome:
  1=alive; 2=dead; 9=unknown

Yellow fever (continued)

Recommended data analyses, presentation, reports

Aggregated data

- Incidence rate by month, year, and geographic area
- Yellow fever vaccine coverage by year and geographic area
- Completeness/timeliness of monthly reporting

Case-based data same as aggregated data plus the following:

- Confirmed cases by age group, immunization status, geographic area, month and year
- Case fatality rate
- Final classification of all suspect cases
- **Performance indicators of surveillance quality** — **Target**

Completeness of monthly reporting	> 90%
– Percent of all suspect cases for which specimens were collected	> 50%[1]
– For IgM test: Laboratory results sent < three days of receipt of acute blood specimen	> 80%
– For virus isolation: Laboratory results sent < 21 days of receipt of acute blood specimen	> 80%
– For IgG test: Lab results sent < three days of receipt of convalescent blood specimen	> 80%

[1] This is the target during non-outbreak periods. Once an outbreak is confirmed, the priority is to detect and laboratory-confirm outbreaks in neighbouring areas.

Principle uses of data for decision-making

- Investigate suspect cases and collect laboratory specimens to confirm an outbreak and mobilise emergency immunization activities
- Monitor yellow fever coverage by geographic region to assess progress towards outbreak prevention and identify areas of poor performance so that corrective actions can be taken
- Monitor incidence rate to assess impact of control efforts

Special aspects

The following 34 countries are at risk for yellow fever epidemics in Africa: Angola, Benin, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of Congo, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Kenya, Mali, Mauritania, Niger, Nigeria, Rwanda, Sao Tomé and Principe, Senegal, Sierra Leone, Somalia, Sudan, Tanzania, Togo, Uganda. The following countries are at risk for yellow fever in South America: Bolivia, Brazil, Colombia, Ecuador, Guyana, French Guyana, Panama, Peru, Suriname, Trinidad and Tobago, Venezuela.

Yellow fever (continued)

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The Global Programme for Vaccines and Immunization, established by the World Health Organization in 1994, defines its goal as "a world in which all people at risk are protected against vaccine-preventable diseases". The Programme comprises three units:

Expanded Programme on Immunization
Vaccine Research and Development
Vaccine Supply and Quality

The Expanded Programme on Immunization focuses on the prevention of selected childhood diseases and, through support to national immunization programmes, aims to achieve 90% immunization coverage of children born each year. Its goals are to eradicate poliomyelitis from the world by the year 2000, reduce measles deaths and incidence, eliminate neonatal tetanus as a public health problem and introduce hepatitis B vaccine in all countries.

Vaccine Research and Development supports and promotes research and development associated with the introduction of new vaccines into the Expanded Programme on Immunization. This includes research and development of new vaccines, improvement of immunization procedures and support to epidemiogical studies.

Vaccine Supply and Quality ensures adequate quantities of high quality, affordable vaccines for all the world's children, supports the efforts of governments to become self-reliant as regards their vaccine needs, and assists in the rapid introduction of new vaccines.

The Global Programme for Vaccines and Immunization produces a range of documents, audiovisual materials and software packages to disseminate information on its activities, programme policies, guidelines and recommendations. It also provides materials for group and/or individual training on topics ranging from repair of health centre equipment to curricula guidelines for medical schools, nursing colleges and training of vaccine quality control personnel.

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