INTEGRATED SURVEILLANCE PERFORMANCE INDICATORS | Chapter 6

The quality of surveillance may be assessed in a number of ways. Two categories of performance indicators are (1) indicators related to the quality of reporting and investigation procedures, and (2) indicators that compare the number of cases of a disease reported to the expected number of cases, which provide information on the sensitivity of the system. Some indicators are disease-specific, while some relate to the surveillance system as a whole. System-wide indicators will be discussed first, and then disease-specific indicators will be discussed.

I. Surveillance System Performance Indicators

Indicators for the completeness and timeliness of reporting have been well established for the AFP surveillance system. These also will reflect reporting performance for NT and measles because, during the initial stages of integrated surveillance, the same reporting sites will be used for all 3 conditions. Evaluation of the completeness of Weekly Zero Reporting and Active Surveillance site visits is very important to ensure that regular surveillance is functioning in every geopolitical unit of the country.

Assessment of Weekly Zero Reporting Sites

Weekly Zero Reporting sites are expected to complete VPD Form-2 for all cases of AFP, NT, and measles detected for each week of the year, even if they detected no cases. The reporting week is Sunday through Saturday. Both the number of units reporting and the timeliness of the reports should be monitored on a weekly basis. Records of timeliness and completeness of reporting are kept by the SMO using VPD Form-06 and VPD Form-07.

Definitions:

Report received on time: a completed weekly zero report is received by noon on the Wednesday following the end of the reporting week

Report received late: a completed weekly zero report is received after noon on the Wednesday following the end of the reporting week but before the next Monday.

Report not received: report either received after the "late" reporting period or never received.

Expected number of reports = number of weekly zero reporting sites in the district or region.

The following are computed on a weekly basis by the SMO, and are also computed on a national level for various intervals.

- Timeliness of Weekly Zero Reporting = $\frac{\text{Total \# reports rc'd on time x 100}}{\text{total \# expected}}$

- Completeness of Weekly Zero Reporting= $\frac{\text{Total reports rc'd on time + reports rc'd late x 100}}{\text{total \# expected}}$

Completeness should be at least 90% and timeliness should be at least 80%, even in the absence of cases.

Note: for sites which call in reports and follow up with a hard copy, timeliness will be based on the date of the phone call, and the report will be considered complete if the hard copy is received within 30 days of the phone call. If the hard copy is not received within the 30 days, then the report is neither timely nor complete.

Assessment of Active Surveillance Sites

SMOs are expected to visit every Active Surveillance Site weekly. After each visit the SMO should update VPD Form-04. This is used to track the percent of Active Surveillance Sites visited, by district. The performance indicator is:

- % of Active Surveillance sites visited by SMO = $\frac{\text{\# sites actually visited x 100}}{\text{\# sites expected to visit}}$

II. Disease-Specific Surveillance System Performance Indicators

A. Acute Flaccid Paralysis

The two most important surveillance performance indicators for AFP are 1) the rate of non-polio AFP cases per 100,000 children < 15 years of age, and 2) the percentage of AFP cases from which two adequate stool specimens are collected. Both of these indicators are standard performance indicators defined by WHO and used globally to monitor the quality of AFP surveillance. In addition, there are a number of indicators that monitor the quality of AFP surveillance procedures.

Rate of AFP: The most important measure of the sensitivity of AFP surveillance is the rate of non-polio AFP among children aged <15 years. One expects at least one case of AFP *that is not due to polio* to occur in every 100,000 children under the age of 15 years. Based on population data, the expected number of non-polio AFP cases that should be reported in each district can be calculated (Annex 2A). In Districts where the number of reported AFP cases is less than expected, then under-reporting is most likely occurring and the surveillance system may not be sensitive enough to detect a case of polio.

Non-polio AFP rate = $\frac{\text{total \# of non-polio AFP cases <15 years of age}}{\text{(population under 15 years of age x 100,000)}}$

The target non-polio AFP rate is 1 per 100,000. If the rate is lower than this, the surveillance system is not performing adequately.

Percentage of AFP cases with 2 stools specimens collected within 14 days after paralysis onset: This indicator monitors not only whether cases are investigated in a timely fashion, but also whether 2 stools are appropriately collected. Two adequate stool specimens should be collected from *at least* 80% of AFP cases. Adequate stool specimens are defined as: two 8-gram specimens collected within 14 days of paralysis onset, arriving at the laboratory with still frozen ice or icepacks, without evidence of leakage or desiccation, and with appropriate labeling and documentation. For purposes of wild poliovirus detection, this is one of the most important surveillance indicators to follow. Indeed, by knowing the AFP reporting rate and the percentage of cases with 2 stools taken within 2 weeks after paralysis onset, much can be said about the quality of surveillance in any particular area.

Monitoring reporting:

- Interval between case onset and notification to the public health system: all cases should come to the attention of health/medical workers within 7 days of the onset of paralysis.

Monitoring investigations:

- Interval between notification of a suspected case and investigation: at least 80% of cases should have been investigated within 48 hours of notification.
- Interval between specimen collection and receipt by WHO-IPD, Kathmandu and interval between specimen dispatch and receipt by laboratory in Thailand: at least 80% of specimens should be received within 72 hours (3 days) of dispatch.
- Follow-up of case - at least 80% of all AFP cases should be followed up at 60 days after paralysis onset to establish whether residual weakness is present.
- Case investigation form - 100% of cases should have a completed investigation form with demographic, clinical, and laboratory information.
- Critical clinical variables - the records on all cases should include the following variables: date of paralysis onset, time or period of progression (installation) of paralysis, presence of fever at onset of paralysis, residual weakness at 60-80 days after onset, location of paralysis (proximal or distal, symmetrical or asymmetrical), and final diagnosis.

Monitoring the laboratory:

- Condition of specimens: 100% of specimens received should be packaged in proper materials and be surrounded with ice.
- Interval between specimen receipt and results: at least 80% of results should be returned to the submitter within 28 days of specimen receipt at the lab.
- Recovery of virus: non-polio enterovirus (NPEV) should be isolated from at least 10% of the specimens processed.

Monitoring control response:

- For all AFP cases, outbreak response immunization (ORI) should begin after collection of the 2nd stool specimen, unless the cases is hospitalized, in which case ORI should begin within 72 hours of notification.

Monitoring surveillance system:

- Reporting units and AFP cases should be plotted on a map and analyzed to determine whether improvements in surveillance contacts are needed – e.g. look for silent areas that have no reporting units.

B. Neonatal tetanus

The incidence of reported NT cases reflect the sensitivity of surveillance for this disease. At this time, the standard for expected NT reporting in Nepal is unknown. However, a rough idea of the sensitivity of the system can be obtained by comparing the monthly or cumulative number of identified cases in each district to the projected number of cases likely to have occurred, as shown in the table in Annex 3B. In this table, the number of live births by district is used to calculate how many NT cases would occur at different NT incidence rates. The three columns on the right display these projections for incidence rates of 10/1000, 5/1000, and 1/1000. Since the true incidence of NT is unknown, the column showing the projected number of NT cases for an incidence of 5 per 1000 live births is probably a reasonable overall crude estimate to use for comparison in the early stages of NT surveillance. However, districts where three TT campaigns have already been completed may have achieved an NT incidence closer to 1/1000, or even less, while districts still awaiting the TT campaigns are more likely to have NT incidences in the 5-10/1000 range. The actual or proposed dates for implementation of 3-Round TT campaigns in each district are shown in Annex 3B. SMOs should evaluate the number of reported NT cases in their districts against the likely projected number of cases based on whether the districts have had TT Campaigns or not.

The number of projected NT cases by district in Annex 3B is the total for one year. To estimate the projected number of cases per month, the annual number should be divided by 12. If a cumulative number of reported NT cases is to be compared to the projected number for the same period of time, the projected monthly number should be multiplied by the number of months represented by the cumulative total. (For example, if the total number of NT cases reported over 3 months is to be assessed, the monthly projected number of cases should be multiplied by 3.)

- Calculate the total number of reported NT cases monthly for each district and follow over time.
- Compare the total reported number of cases to the projected number likely to have occurred in the same time period (see Annex 3B).

An additional NT-specific indicator will be added:

- % of identified NT cases that were investigated =

$$\frac{\textit{\# cases with a completed investigation form x 100}}{\textit{total \# of reported cases in the same geographic unit}}$$

C. Measles

There is no expected standard for measles incidence against which to measure the sensitivity of the surveillance system.

D. Japanese Encephalitis (JE) Surveillance Indicators

The JE Surveillance Indicators are used to:

1. Closely monitor the trend of JE epidemic.
2. Plan for appropriate interventions (medical management/control measures in timely manner).

3. Advise the policy makers about designing appropriate programs (Recommend appropriate preventive and control measures to authorities).

The following indicators will be used:

1. Timeliness of Report
2. Completeness of report
3. Case investigated within 7 days of notification
4. Samples collected from Acute Encephalitis Syndrome
5. Samples sent within 3 days of collection to the reference laboratories (NPHL or BPKHS) through IPD field offices.
6. Six-month follow up of cases for sequalae
7. Quality of sample (adequate/good quality)
8. Report received from JE Surveillance sites (within 14 days of onset)
9. Lab. Testing report available within 14 days of sample received (July-September and monthly in the rest months of the year)

The target for these indicators will be as follows

SN	Indicators	Target
1	Timeliness of Report	>=80%
2	Completeness of report	>=90%
3	Case investigated within 7 days of notification	>80%
4	Samples collected from AES	>80%
5	Samples sent within 3 days of collection to Reference laboratories	>80%
6	Lab. Test report available within 14 days of sample received (July-Sept and monthly in the rest of the year)	>80%
7	Quality of sample (adequate/good quality)	>80%
8	Report received at IPD from JE Surveillance sites (within 14 days of onset)	>90%
9	Six-month follow up of cases for disability/ sequalae	>80%

III. Immunization Programme Indicators

A number of indicators for evaluating the scope and effectiveness of immunization program activities and perinatal services are recommended by WHO and UNICEF. Most of the information required for these evaluations is collected by governmental health services and through special surveys. While SMOs are not responsible for the collection or analysis of this information, they should be familiar with the coverage estimates for their districts, and with the OPV1-OPV3 and DPT1-MSL or BCG-MSL drop-out rates for their districts. SMOs should examine these data critically, with an understanding of how they are collected, denominators used, and how they correlate with data collected by the SMOs themselves via surveillance activities.

Assignment of Case Identification (EPID) Numbers for AFP, NT, MSL and AES and Outbreak Codes for Measles Outbreaks

Every AFP case, NT case, measles and AES case must have a unique case investigation number that is used to follow the case and, if appropriate, to link laboratory data to the case. In addition, measles outbreaks must be assigned unique numbers. The SMO is responsible for assigning the case and outbreak identification numbers.

The routine cases, **case investigation number** (also called the "EPID" number) is comprised of 17 alphabetic characters and digits.

Example: AFP – NEP – AAA – BBB – # # – # # #
NNT – NEP – AAA – BBB – # # – # # #
MSL – NEP – AAA – BBB – # # – # # # #
AES – NEP – AAA – BBB – # # – # # # #

Characters	Purpose	Example	Meaning of example
1st 3	Identify the disease	AFP NT MSL AES	Acute Flaccid Paralysis Neonatal tetanus Measles Viral Encephalitis
Next 3 (NEP)	Identify the country, according to the UN code.	NEP	Nepal
Next 3 (AAA)	Identify the Region where the case was detected and investigated	EDR CDR WDR MWR FWR	Eastern Development Region Central Development Region Western Development Region Mid Western Development Region Far Western Development Region
Next 3 (BBB)	Identify the District where the case was detected and investigated (see Nepal Region and District Codes, Annex 6B)	MOR PBT	Morang District Parbat District
Next 2 (##)	Identify the year of disease onset, according to the Gregorian, not the Nepali, calendar. Note: a case with disease onset on 28 December 2002 & reported on 5 January 2003 is coded 02.	04 05	Disease onset in 2004 AD Disease onset in 2005 AD
Next 3 (###)	Number of the case detected in that SMO's area (all districts covered) in that calendar year.	001 002	First case of the disease detected for the year in the SMO's coverage area. Second case of the disease detected for the year the SMO's coverage area.

Examples of case identification numbers:

NNT NEP CDR RAU 04 005
This is a case of Neonatal Tetanus, which occurred in Nepal, Central Development Region, Rautahat district. The case was detected by SMO in 2004 and the case number is 005.

AFP NEP EDR BOJ 05 023
This is a case of Acute Flaccid Paralysis, which occurred in Nepal, Eastern Development Region, Bhojpur district. The case was detected by SMO in 2005 and the case number is 023.

MSL NEP WDR GOR 05 0002
This is a case of Measles, which occurred in Nepal, Western Development Region, Gorkha district. The case was detected by SMO in 2005 and the case number is 0002.

AES NEP MWR DNG 05 0011
This is a case of Acute Encephalitis Syndrome, which occurred in Nepal, Mid-Western Region, Dang district. The case was detected by SMO in 2005 and the case number is 0011.

For cases reported during outbreak of measles or AES, the following code will be used:

The **measles outbreak code** is comprised of 13 alphabetic characters and digits. First three for measles (MSL), second three to denote outbreak (OBR), third three characters to denote district (DDD) fourth two digit to denote year (##) and the last two digits to the number of outbreaks in the SMO's coverage area (##).

Example: MSL-OBR – DDD – ## – ##

Similarly, the AES outbreak will also be given EPID. The difference is only the first three characters, which will be AES.

Example: AES-OBR – DDD – ## – ##

Characters	**Purpose**	**Example**	**Meaning of example**
1st 3	Name of the disease causing outbreak	MSL AES	Measles AcuteEncephalitis Syndrome
2nd 3	Identifies it as an outbreak	OBR	Outbreak (used in all cases)
Next 3 (DDD)	Identify the District where the case was detected and investigated (see Nepal Region and District Codes, Annex 6B)	MOR PBT	Morang District Parbat District
Next 2 (##)	Identify the year of rash onset of the first known case in the outbreak, according to the Gregorian, not the Nepali, calendar.	04 05	Disease onset in 2004 AD Disease onset in 2005 AD
Next 2 (##)	Number of the outbreak detected in that SMO's area (all districts covered) in that calendar year.	001 002	First measles outbreak detected for the year in the SMO's coverage area. Second measles outbreak detected for the year the SMO's coverage area.

Example of measles outbreak code:

MSL-OBR-MKW-04-04

This is a measles outbreak, which occurred in Makwanpur district during 2004 and the outbreak number is 04.

AES-OBR-BDY-05-02

This is a AES outbreak, which occurred in Bardiya district during 2005 and the outbreak number is 02.

Annex 6 A

Data analysis methods

Definitions

Population at risk: the population that is at risk for a disease, used as the denominator for many calculations. The population may be the entire population, or may only be a part of the population, as defined by age, geographic location, or another factor. For example, for poliomyelitis the population at risk is children under the age of 15. For neonatal tetanus, the population at risk is the number of live births. In most analyses, "at risk" does not refer to vaccination status – in other words, everyone in a given age group or region is considered "at risk" for a particular disease, even if vaccinated against it.

Population of interest: the population you are interested in for the analysis, such as all children in Nepal under age 5, or all children under age 1 in Bara District. It must always be clear what the population of interest is. It may be the same as the *population at risk*, or may be a subset of this population.

Constant: a number by which a figure is multiplied in order to avoid small decimals. Usually the constant is usually 100,000 or 1,000.

Formulas

Incidence: incidence describes the proportion of a population that develop a disease or condition over a certain period of time. The *constant* is usually 100,000 or 1,000, so that incidence is expressed as # of cases per # of population, e.g. 2 cases AFP per 100,000 children under 15 per year. Whenever reporting incidence, the time period (month, year, etc.) must be indicated.

$$\text{Incidence} = \left(\frac{Number\_of\_cases}{total\_population\_at\_risk}\right) x (cons\tan t)$$

Attack rate (AR): Attack rate is used during outbreaks only. It indicates the proportion of the population at risk that developed the disease during the outbreak.

$$\text{Attack rate} = \frac{Number\_of\_cases}{total\_population\_at\_risk}$$

Age-specific attack rates can also be calculated, using population data for the geographic region.

$$\text{AR in age group} = \frac{Number\_of\_cases\_in\_age\_group}{total\_population\_in\_age\_group}$$

Hospitalization rate: hospitalization is an indicator of disease severity, and is expressed as the percentage of cases hospitalized.

$$\text{Hospitalization rate} = \frac{Number\_of\_cases\_hospitalized}{total\_number\_of\_cases}$$

Case fatality rate (CFR): case fatality is another indicator of disease severity, and is expressed as the percent of cases which resulted in death.

$$\text{Case fatality rate: } \frac{Number\_of\_deaths}{total\_number\_of\_cases}$$

Age-specific case-fatality rates can also be calculated:

$$\text{CFR in age group} = \frac{Number\_of\_deaths\_in\_age\_group}{total\_number\_of\_cases\_in\_age\_group}$$

Vaccine efficacy (VE): Vaccine efficacy is a measure of how effective a vaccine has been at preventing a disease.

To calculate VE, the vaccination coverage for the disease of interest in a population must be known, as well as the vaccination status of cases.

Step 1: Calculate the # of vaccinated and unvaccinated persons in the area and age group.

Total Vaccinated persons =

(vaccine coverage for population of interest) x (total population of interest)

e.g., 80% coverage x 1000 persons = 800 vaccinated persons

Total Unvaccinated persons =

(total population of interest) - (total vaccinated persons)

e.g., 1000 persons - 800 vaccinated persons = 200 unvaccinated persons

Step 2: For the disease of interest, calculate the Attack Rate in Unvaccinated persons (ARU):

$$ARU = \frac{Number\_of\_cases\_who\_are\_unvaccinated}{total\_unvaccinated\_persons}$$

Step 3: Calculate the Attack Rate in Vaccinated persons:

$$ARV = \frac{Number\_of\_cases\_who\_are\_vaccinated}{total\_vaccinated\_persons}$$

Step 4: Calculate vaccine efficacy: $VE = \frac{ARU - ARV}{ARU}$

Estimation of number of live births or pregnant women:

live births OR # pregnant women in 1 year = (total population) x (0.035)

Epidemic curve: an epidemic curve is a graphic representation of the progress of an outbreak. It is useful in determining the source of the outbreak, transmission, and progression. To construct an epidemic curve, create a bar graph with dates along the x-axis and number of cases along the y-axis. The dates can be single days, or grouped by week if the outbreak has been over a very long period of time. Then, for each date (day or week), construct a bar showing how many cases occurred for that date. Once constructed, it should be examined to determine if the outbreak is still increasing, has recently peaked, or appears to be ending. This helps to indicate whether more cases can be expected.

Example: