GUIDELINES ON VERIFICATION OF MEASLES ELIMINATION IN THE WESTERN PACIFIC REGION

2013
GUIDELINES ON VERIFICATION OF MEASLES ELIMINATION IN THE WESTERN PACIFIC REGION
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<th>Acronym</th>
<th>Description</th>
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<tr>
<td>cMYP</td>
<td>comprehensive multi-year plan</td>
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<tr>
<td>DHS</td>
<td>demographic and health survey</td>
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<tr>
<td>ELISA</td>
<td>enzyme-linked immunosorbent assay</td>
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<tr>
<td>EPI</td>
<td>Expanded Programme on Immunization</td>
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<tr>
<td>GSL</td>
<td>global specialized laboratory</td>
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<tr>
<td>IgG</td>
<td>immunoglobulin G</td>
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<tr>
<td>IgM</td>
<td>immunoglobulin M</td>
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<tr>
<td>JRF</td>
<td>joint reporting form</td>
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<tr>
<td>MCV</td>
<td>measles-containing vaccine</td>
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<tr>
<td>MCV1</td>
<td>first dose of measles-containing vaccine</td>
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<tr>
<td>MCV2</td>
<td>second dose of measles-containing vaccine</td>
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<tr>
<td>MICS</td>
<td>multiple indicator cluster survey</td>
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<tr>
<td>NIP</td>
<td>national immunization programme</td>
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<tr>
<td>NML</td>
<td>national measles laboratory</td>
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<tr>
<td>NVC</td>
<td>national verification committee</td>
</tr>
<tr>
<td>R</td>
<td>reproduction number</td>
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<tr>
<td>RCA</td>
<td>rapid coverage assessment</td>
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<tr>
<td>RRL</td>
<td>regional reference laboratory</td>
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<tr>
<td>RVC</td>
<td>Regional Verification Commission</td>
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<tr>
<td>SIA</td>
<td>supplementary immunization activity</td>
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<tr>
<td>SRVC</td>
<td>subregional verification committee</td>
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<tr>
<td>TAG</td>
<td>Technical Advisory Group</td>
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<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<td>VPD</td>
<td>vaccine-preventable disease</td>
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<td>WHO</td>
<td>World Health Organization</td>
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DEFINITIONS

- Measles eradication: worldwide interruption of measles virus transmission in the presence of a surveillance system that has been verified to be performing well.

- Measles elimination: the absence of endemic measles virus transmission in a defined geographical area (e.g., region or country) for ≥12 months in the presence of a well-performing surveillance system.

- Endemic measles transmission: the existence of continuous transmission of indigenous or imported measles virus that persists for ≥12 months in any defined geographical area.

- Endemic measles case: laboratory- or epidemiologically-linked confirmed cases of measles, resulting from endemic transmission of measles virus.

- Re-establishment of endemic transmission: occurs when epidemiological evidence, supported wherever possible by laboratory evidence, indicates the presence of a chain of transmission of a virus strain that continues uninterrupted for ≥12 months in a defined geographical area (region or country) where measles was previously eliminated.

- Measles outbreak in an elimination setting: a single laboratory-confirmed case.

- Suspected case of measles: a patient in whom a health-care worker suspects measles infection, or a patient with fever and maculopapular (non-vesicular) rash.

- Laboratory-confirmed measles case: a suspected case of measles that has been confirmed by a proficient laboratory.

- An epidemiologically-linked confirmed measles case: a suspected case of measles that has not been confirmed by a laboratory but was geographically and temporally related, with dates of rash onset occurring seven to 21 days apart to a laboratory-confirmed case or, in the event of a chain of transmission, to another epidemiologically-confirmed measles case.

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• Clinically measles compatible: a case with fever and maculopapular (non-vesicular) rash and one of cough, coryza or conjunctivitis, for which no adequate clinical specimen was taken and which has not been linked epidemiologically to a laboratory-confirmed case of measles or another laboratory-confirmed communicable disease.

• Non-measles non-rubella case: a suspected case that has been investigated and discarded as a non-measles and non-rubella case using (a) laboratory testing in a proficient laboratory or (b) epidemiological linkage to a laboratory-confirmed outbreak of another communicable disease that is neither measles nor rubella.

• Measles vaccine-associated rash illness: a person with all five of the following criteria: (i) the patient had a rash illness, with or without fever, but did not have cough or other respiratory symptoms related to the rash; (ii) the rash began seven to 14 days after vaccination with a measles-containing vaccine; (iii) the blood specimen, which was positive for measles immunoglobulin M (IgM), was collected eight to 56 days after vaccination; (iv) thorough field investigation did not identify any secondary cases; and (v) field and laboratory investigations failed to identify other causes. Alternatively, a suspected case from which virus was isolated and found on genotyping to be a vaccine strain (e.g. genotype A).

• Imported case of measles: a case exposed to measles outside the region or country during the seven to 21 days (12–23 days for rubella).

  *Note: For cases that were outside the region or country for only a part of the seven to 21 day interval prior to rash onset, additional evidence including a thorough investigation of contacts of the case is needed to exclude a local source of infection.*

• Import-related measles case: a locally acquired infection occurring as part of a chain of transmission originating from an imported case as supported by epidemiological or virological evidence, or both.

  *Note: If transmission of measles from cases related to importation persists for ≥ 12 months, cases are no longer considered import-related but endemic.*

• Unknown source measles case: a confirmed case for which an epidemiological or virological link to importation or to endemic transmission cannot be established after a thorough investigation.
EXECUTIVE SUMMARY

The Western Pacific Region has made remarkable progress towards measles elimination since establishing the goal in 2003. Concerted efforts around the Region have substantially reduced measles cases by 93% between 2008 and 2012. Measles incidence was at a historic low in 2012, with 5.9 cases per million population. As many as 33 countries and areas (including the 21 countries and areas of the Pacific islands) may have interrupted measles virus transmission, and many are likely ready for verification.

At its sixty-first session in 2010, the Regional Committee for the Western Pacific urged the Regional Director to establish independent regional verification mechanisms for measles elimination. Furthermore, in 2012, the Regional Committee requested Member States to establish national verification committees (NVCs) to develop regular progress reports for submission to the Regional Verification Commission (RVC). Regional verification mechanisms (including verification principles, processes, structure, criteria and lines of evidence) will enable acknowledgement of countries and areas that have eliminated measles and provide guidance to those that have not yet achieved the goal.

These guidelines were developed based on the shared experiences from and consultations with WHO Member States. A consultation on verification of measles elimination in the Western Pacific Region was held in Manila, Philippines, in June 2010, and another consultation between the Regional Verification Commission and Member States took place in April 2012 in Manila, Philippines. Definitions of measles elimination and other essential concepts are provided, and core principles are enumerated. The core principles include the independence of the verification process led by the RVC and NVCs at regional and national levels, respectively. The RVC has the discretion to apply alternative evidence of elimination in place of recommended evidence and indicators for countries that are unable to provide complete data to assess standard indicators.

Three criteria and five lines of evidence presented below form the basis of verification. The three criteria are:

1. documentation of the interruption of endemic measles virus transmission for a period of at least 36 months from the last known endemic case;
2. the presence of verification standard surveillance; and

3. genotyping evidence that supports the interruption of endemic transmission.

The five lines of evidence are:

1. a detailed description of the epidemiology of measles since the introduction of measles vaccine (and rubella vaccine where applicable) in the national immunization programme;

2. quality of epidemiological and laboratory surveillance systems for measles;

3. population immunity presented as a birth cohort analysis with the addition of evidence related to any marginalized and migrant groups;

4. sustainability of the national immunization programme including the resources for mass campaigns, where appropriate, in order to sustain measles elimination; and

5. genotyping evidence that supports interruption of measles virus transmission.

Specific indicators or types of evidence are suggested under each line of evidence. Progress towards elimination will be judged against these five lines of evidence.

The structures and membership of the RVC and NVCs are described, as well as standard mechanisms for verification of elimination through a description of RVC and NVC functions and terms of reference. These include normative, advisory and verification functions, and for the chair, management functions. Advocacy functions are also included in the terms of reference for the RVC and NVC.

NVCs will ensure the development of annual progress reports and coordinate submissions to the RVC so that the RVC may verify both progress towards measles elimination and continued achievements. The progress towards elimination should be verified using the same lines of evidence presented in this document. It should be noted that the verification of national measles elimination and progress towards elimination are to be conducted annually until global measles eradication is achieved.

For countries that have already achieved measles elimination, post-verification needs are described. These include maintaining high levels of population immunity, verification standard epidemiological and virological surveillance, and preparedness plans for outbreak response.
1.1 **INTRODUCTION**

In 2003, the WHO Regional Committee for the Western Pacific resolved to eliminate measles and achieve elimination to strengthen routine immunization (WPR/RC54.R3). In 2005, the Regional Committee established 2012 as the target year for measles elimination (WPR/RC56.R8). In 2010, the Regional Committee reaffirmed the 2012 measles elimination goal, urged the Regional Director to establish regional verification mechanisms, and requested Member States to establish an independent national verification process for measles elimination following the establishment of standardized regional verification mechanisms (WPR/RC61.R7). In 2012, the Regional Committee urged Member States to accelerate progress towards measles elimination and establish national verification committees (NVCs) to develop regular progress reports for submission to the Regional Verification Commission (RVC) (WPR/RC63.R5).

Establishing verification processes and criteria will enable countries and areas to confirm measles elimination and provide guidance to those that have not yet achieved elimination.

1.2 **STRATEGIES**

The key strategies for measles elimination include:

- achieving and maintaining high (≥ 95%) vaccination coverage with two doses of measles-containing vaccine (MCV) through routine immunization and, when required, supplementary immunization activities (SIAs);

- conducting high-quality case-based measles surveillance;

- ensuring high-quality laboratory contribution to surveillance through laboratories accredited to conduct timely and accurate testing of samples to confirm or discard suspected cases and detect measles virus for genotyping and molecular analysis;

- developing and maintaining outbreak preparedness; and

- rapidly responding to measles outbreaks and managing measles cases.
OVERVIEW

1.3 Progress toward measles elimination

The Western Pacific Region has made remarkable progress towards achieving its measles elimination goal. Concerted efforts throughout the Region have substantially reduced measles cases by 93% between 2008 and 2012. Measles incidence was 5.9 cases per million population in 2012, which was a historic low (Figure 1). Epidemiological and virological surveillance data suggest that endemic measles virus transmission may have been interrupted in as many as 33 countries and areas by the end of 2012. This includes the 21 Pacific island countries and areas which are considered as one epidemiologic block. Most countries and areas that were once highly endemic for measles reported few cases in 2012, and many of these cases may have been imported or import-related. However, as of March 2013, endemic measles virus transmission still continues in a few countries in the Region. Reported coverage of the first dose of measles-containing vaccine (MCV1) has trended upward since 2003, reaching 96% in 2011. A total of 33 countries and areas have introduced routine second dose of measles-containing vaccine (MCV2), with a reported coverage of 91% in 2011. Supplementary immunization activities (SIAs) for a wide range of ages

Figure 1. Measles cases by month of onset, Western Pacific Region, 2008-2012

Source: WHO
have been conducted to close immunity gaps. Over 300 million children have been vaccinated against measles during large-scale SIAs from 2003-2012.

All countries and areas of the Western Pacific Region conduct case-based, laboratory-supported surveillance for measles. Intensive efforts to improve case-based surveillance in the Region began in 2007. From 2007 to 2012, completeness of monthly reporting to the WHO Regional Office for the Western Pacific consistently increased from 51% to 99%, and timeliness of monthly reporting increased from 19% to 92%. In 2012, among the suspected cases reported to the Regional Office by 34 countries and areas, 2.4 suspected measles cases per 100 000 population were discarded as non-measles (target ≥ 2.0). Adequate blood specimens were collected from 91% of suspected measles cases (target ≥ 80%). These suggested that regionally, surveillance was sensitive in identifying and appropriately classifying suspected measles cases. However, not all countries achieved surveillance indicator targets. Among countries and areas that submitted sufficient data to calculate the indicators, nine (64%) out of 14 achieved the target discarded measles rate and 10 (83%) of 12 achieved the target adequate specimen collection rate.

The Western Pacific Region measles and rubella laboratory network has grown to include a total of 383 laboratories, including one WHO global specialized laboratory (GSL) in Japan, three WHO regional reference laboratories (RRLs) in Australia, China, and Hong Kong (China), 17 fully-functional national measles-rubella laboratories (NMLs) including the GSL and RRLs, and, in China, 31 provincial and approximately 331 prefecture laboratories. In 2012, the laboratory network tested specimens from 18 528 suspected measles and rubella cases.
2 CORE PRINCIPLES FOR VERIFICATION OF MEASLES ELIMINATION

- Attainment of measles elimination should be verified independently for individual countries and areas, and eventually for the Region as a whole, following standard process and criteria.

- Pacific island countries and areas, with a total population of 3.1 million, will be verified as one epidemiological block, as done for certification of polio-free status in the Pacific subregion.

- The Regional Verification Commission (RVC) for measles elimination in the Western Pacific will verify progress towards measles elimination and determine whether individual countries or areas, the Pacific subregion, and the Region as a whole have eliminated endemic measles virus transmission.

- National Verification Committees (NVCs) will be established to collect, analyse and validate the national data, and prepare and submit the necessary documentation to the RVC, on an annual basis, to report progress towards, achievement and maintenance of measles elimination. National secretariats may be formed to assist the NVCs in collecting data and preparing documentation.

- For countries with large populations such as China, NVCs may assess measles elimination by a second-level administrative unit, applying the standard criteria and processes applicable to countries. However, the RVC will determine whether measles elimination has been achieved by the country as a whole.

- National and regional elimination will require the interruption of endemic measles virus transmission for at least 36 months. This is to ensure that the achievement is sustainable and endemic transmission has not occurred.

- Documentation will address the three criteria and will be supported by indicators within five lines of evidence. The documentation process should be standardized to guide preparation work at both country and regional levels.
• The RVC may require alternative or complementary evidence as it deems appropriate to verify measles elimination. Countries unable to provide data satisfying one or more standard indicators may still be verified as having eliminated measles as long as the RVC is satisfied that there is sufficient evidence to justify verification.

• The verification process may involve field assessments by RVC or NVC members if additional information or validation of documentation is required.
STANDARD VERIFICATION CRITERIA, LINES OF EVIDENCE AND INDICATORS

Verification of measles elimination will address three criteria supported by indicators within five lines of evidence. This section describes the verification criteria, lines of evidences and relevant indicators under each line of evidence.

3.1 VERIFICATION CRITERIA
Based on a global standard, three essential criteria are required for verifying the progress, achievement and maintenance of measles elimination:

- documentation of the interruption of endemic measles virus transmission for a period of at least 36 months from the last known endemic case;
- the presence of verification standard surveillance; and
- genotyping evidence that supports the interruption of endemic measles virus transmission.

3.2 LINES OF EVIDENCE AND INDICATORS

3.2.1 A detailed description of the epidemiology of measles since the introduction of measles vaccine in the national immunization programme.

The country or area should be able to describe the incidence and epidemiology of measles within its borders over time, leading to a logical conclusion of the absence of endemic measles virus transmission. Ideally, the time period would begin prior to the year of measles vaccine introduction and conclude the year in which verification of elimination is being considered. The analysis should include the pre-interruption and post-interruption

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*Verification standard surveillance includes the following: 1) reporting rate of non-measles non-rubella cases at the national level of >2 cases per 100,000 population per year; 2) >80% of second administrative level reporting at least two non-measles non-rubella cases per 100,000 population per year; 3) >80% of suspected cases with adequate investigation initiated within 48 hours of notification; and 4) >80% of suspected cases with adequate specimen for detecting acute measles infection collected and tested in a proficient laboratory. For countries without systems in place to collect the data required to calculate the above indicators, additional evidence may be submitted to demonstrate measles surveillance sensitivity and quality.*
Verification of Measles Elimination

**Verification Criteria**

In describing incidence of measles, it is necessary to classify confirmed measles cases by source of infection and by method of confirmation. Source of infection may be endemic, imported, import-related or unknown. Method of confirmation may be by laboratory or epidemiological linkage (Table 1). Definitions of these terms are presented at the beginning of this document.

Every confirmed measles case should meet one of the cells in Table 1. Measles elimination status will be determined ultimately by the absence of endemic measles cases corresponding to cells A and B, depicted in red. However, as cases of unknown source may also result from endemic transmission, cases meeting cells C and D, depicted in yellow, may be considered as possibly endemic. A large number of confirmed cases of unknown origin (i.e. cells C and D), will raise questions regarding the quality of surveillance and the ability of a country to confidently determine the absence of endemic measles virus transmission. Imported and import-related cases are likely to continue to varying degrees after endemic measles virus has been eliminated, depending on migration patterns into and out of the country or area. Hence, cells E, F, G and H corresponding to these sources of infection and depicted in green, indicate a variable number of cases.

The number of clinically measles compatible cases should be documented. When measles surveillance performs well, i.e. adequate case investigations with contact tracing routinely
performed and adequate specimens routinely collected, the number of clinically-measles compatible cases should be small.

**Indicator:** Proportion of confirmed cases with known source of infection (target: ≥ 80%), which are imported or import-related.

This indicator is calculated as follows:

\[
\frac{(\text{total imported} + \text{total import-related})}{(\text{total confirmed cases})}, \text{ or } \frac{(E+F+G+H)}{(A+B+C+D+E+F+G+H)}
\]

**Note:** this indicator is only applicable once endemic transmission has ceased.

Descriptive epidemiological characteristics of measles cases corresponding to time, place and person should be considered. Changes in temporal, spatial, demographic characteristics (e.g. age distribution, vaccination status) and seasonality of measles cases over time may suggest achievement of measles elimination.

Epidemic curves of confirmed cases (reflecting source of infection) are a simple way to show the evolution of measles incidence. Epidemic curve features consistent with progress leading to elimination normally include increasing intervals between clusters/outbreaks, decreasing numbers of cases in clusters/outbreaks, decreasing duration of clusters/outbreaks, increases in percentage of sporadic cases and a loss of seasonality. Endemic, unknown, imported and import-related confirmed measles cases should be reflected into Table 1. Clinically-confirmed (before 2013) or clinically measles compatible (from 2013 onward) cases should also be reported.

Where appropriate, spot maps of outbreaks may be prepared, which indicate the index cases separately from secondary, tertiary and subsequent generations of cases as well as the source of infection. Consistent decreases in geographic spread of measles virus over consecutive time intervals can help confirm progress towards, and eventual achievement of measles elimination.

Tables and bar charts indicating age distribution and vaccination status of cases over time will also help determine progress towards elimination. As countries and areas near elimination, increasing percentages of cases are likely to occur among the extreme age groups (infants and older adults), and the percentage of cases that were previously vaccinated (usually with a single MCV dose) is likely to increase.
**Verification Criteria**

**Evidence:** Wide range and multiple years of epidemiological analysis with emphasis on the most recent five years in support of achievement of measles elimination.

### 3.2.2 Quality of epidemiological and laboratory surveillance systems for measles

In the setting of measles elimination, surveillance for measles must be sufficiently sensitive to detect endemic measles cases and imported/import-related chains of transmission. Surveillance must also have adequate capacity for timely and proper case investigation and laboratory analysis. The credibility of elimination depends on the quality of epidemiological and laboratory surveillance.

Indicators of surveillance performance described above include: (1) national and subnational reporting rates of at least two non-measles non-rubella cases per 100,000 population; (2) adequate investigation of at least 80% of suspected cases; (3) adequate specimen collection from at least 80% of suspected cases (excluding epidemiologically-linked cases); and (4) adequate specimens for virus detection from at least 80% of laboratory-confirmed chains of transmission.

- Countries without systems in place to collect the necessary data required for the above indicators may be asked to submit additional evidence to demonstrate measles surveillance sensitivity and quality.

- Countries where substantial numbers of measles cases are present in the private sector should/may be required to submit additional evidence to demonstrate that these cases are captured by the national surveillance systems and that laboratory results are confirmed by an accredited laboratory to the extent possible.

The measles laboratory network in the Western Pacific Region consists of 383 laboratories including one global specialized laboratory, three regional reference laboratories (RRLs), 17 national measles laboratories (NMLs) and, in China, 31 provincial and approximately 331 prefectural laboratories. The WHO Regional Office for the Western Pacific conducts accreditation of the RRLs, NMLs, and the 31 Chinese provincial laboratories. Almost all network laboratories were accredited as of March 2012. The network is critical for serologic (ELISA) testing for anti-measles and anti-rubella IgM, and also for genetic characterization of viruses detected from cases and outbreaks (see line of evidence below). WHO accredits network laboratories using well-established criteria.  

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3.2.2.1 Indicators and suggested targets for epidemiological surveillance quality

- proportion of surveillance units reporting measles data to the national level and on-time (target: ≥ 80%);
- reporting rate of non-measles non-rubella cases at national level (target: ≥ 2 per 100,000 population);
- proportion of second administrative level units reporting at least two non-measles non-rubella case per 100,000 (target: ≥ 80% of second-level administrative units);
- proportion of suspected cases with adequate investigation (target: ≥ 80% of suspected cases);
- proportion of suspected cases with adequate specimen collection (target: ≥ 80% of suspected cases, excluding epidemiologically-linked cases);
- proportion of specimens received at the laboratory within five days of collection (target: > 80%); and
- proportion of laboratory-confirmed chains of transmission (defined as two or more confirmed measles cases) with specimens adequate for detecting measles virus collected and tested in an accredited laboratory (target: ≥ 80%).

3.2.2.2 Indicators and suggested targets for laboratory performance

- proportion of measles network laboratories that are WHO-accredited for serological and, if relevant, for virological testing (target: 100% of laboratories);
- proportion of serological results reported by the laboratory within four days of receiving the specimen (target: > 80%);
- proportion of laboratories (government and private) that conduct measles diagnostic testing and have adequate quality assurance mechanisms in place (target: 100% of laboratories);
- proportion of virus detection and genotyping results (where appropriate) that are completed within two months of receipt of specimen (target: ≥ 80% of specimens received); and

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4. An adequate investigation includes collection of all the following data elements from each suspected measles case: case identification, date of birth/age, sex, place of residence, vaccination status or date of last vaccination, date of rash onset, date of notification, date of investigation, date of specimen collection, and place of infection or travel history.

5. Adequate specimens include: a blood sample by venipuncture in a sterile tube with a volume of 5 ml for older children and adults and 1 ml for infants and younger children; a dried blood sample, at least three fully-filled circles on a filter-paper collection device; an oral fluid sample sing a sponge collection device that is rubbed along the gums for >1 minute to ensure the device is thoroughly wet. Adequate samples for antibody detection are those collected within 28 days after onset of rash.

6. WHO measles laboratory accreditation criteria include (1) annual proficiency test results ≥ 90%; (2) at least 90% concordance of NML with RRL confirmatory testing; (3) passing on-site inspection.
• complementary evidence, particularly completeness and timeliness of reporting (including zero reporting) to the WHO Regional Office for specimens received for serological and virological testing (target: ≥ 80% of specimens received in the laboratory).

3.2.3 Population immunity presented as a birth cohort analysis with the addition of evidence related to any underserved and marginalized groups

Achieving and sustaining high levels of population immunity against measles in every district is a fundamental strategy to interrupt endemic measles virus transmission and to prevent re-establishment of measles virus transmission following importation of measles virus. Population immunity should be measured and presented by birth cohort, with additional evidence related to any marginalized and underserved population groups.

An accurate description of vaccine-induced and natural immunity by individual birth cohort beginning from the year when measles vaccine was first introduced into the country is useful to assess if there are potential immunity gaps. Such a description should consider changes in routine vaccination schedules and implementation of SIAs in specific years. Special additional analysis may also be completed for underserved population groups which potentially have less access to vaccination services, including migrants, urban or rural poor, and people in remote areas.

Experience in several countries in the Western Pacific, including Viet Nam and the Philippines, suggest that very high levels of protection may not be required among all adults to interrupt measles virus transmission if high coverage exists among children and adolescents, as these groups appear to be a critical link in sustaining chains of measles virus transmission. Cohorts with the year of birth prior to the year of measles vaccine introduction into the routine immunization programme can be assumed to be immune unless there is specific epidemiological data to suggest the contrary.

Population immunity may be assessed as follows:

3.2.3.1 Administrative coverage estimates: Annual administrative reports of routine vaccination coverage with first and second dose of measles-containing vaccines (MCV1 and MCV2) and SIA coverage as reported in the WHO/UNICEF Joint Reporting Form (JRF) on Immunization, as well as annual WHO/UNICEF estimates of national coverage that sometimes differ from reported administrative coverage. The analysis should be available to the third administrative level.
3.2.3.2 Population-based surveys: Population-based surveys of routine immunization and SIA coverage surveys are also useful and include WHO 30-cluster surveys, demographic and health surveys (DHS), and UNICEF-sponsored multiple indicator cluster surveys (MICS). However, limitations of population-based surveys may include lack of representativeness of all geographic areas (e.g. districts) and strata of society, as well as an inability to identify potentially large pockets of susceptible individuals. Data from rapid coverage assessments (RCAs) usually conducted following mass vaccination campaigns may be an additional source of information to assess local level coverage.

3.2.3.3 Serosurveys: Appropriately-designed and implemented sero-epidemiological surveys can provide detailed information about the serological immunity by birth cohort. Potential limitations include those related to the sensitivity, specificity and predictive value of the laboratory tests used to detect measles immunoglobulin G (IgG) when conducting the serosurvey.

3.2.3.4 The measles strategic planning tool may be used for estimating immunity by birth cohort.

3.2.3.5 Additional data such as distribution of outbreak duration, number of generations of transmission, proportion of imported and import-related cases, and sero-epidemiological survey data may feed into models that estimate effective reproduction numbers (R).

It is important that all evidence supporting levels of population immunity are provided, because all current methods for estimation have limitations.

3.2.3.6 Indicators of population immunity include:

- administrative reports of MCV1 coverage, national and by district *(target: ≥ 95% nationally and in every district)*;
- administrative reports of MCV2 coverage, national and by district *(target: ≥ 95% nationally and in every district)*;
- administrative reports of SIA coverage, national and by district *(target: ≥ 95% nationally and in every district)*; and
- additional evidence:
  - coverage survey data (e.g. DHS, MICS, WHO 0 cluster surveys, etc.);
  - sero-epidemiological data; and
  - descriptions of focused strategies and intensified efforts made to identify and reach high-risk communities and population groups (e.g. migrants, remote, poor, ethnic minorities, etc.) through routine and supplementary immunization.
3.2.4 Sustainability of national immunization programmes, including the resources for mass campaigns, where appropriate, in order to sustain measles elimination

Verification of measles elimination should include an assessment of whether elimination can be sustained. This line of evidence should:

- highlight strengths and weaknesses of national immunization programmes that are linked to maintaining very high and homogeneous routine and/or supplementary vaccination coverage of at least 95% at subnational levels and high-quality surveillance; and
- encourage the preparation of costed outbreak preparedness plans with appropriate budgets for needed responses to outbreaks resulting from measles virus importations.

This line of evidence is indicative of the role of measles elimination in strengthening the national immunization programmes and surveillance systems, and in ensuring equity in immunization service delivery. Such sustainability assessments should be further translated into national action plans outlining activities to overcome the identified programmatic gaps. This assessment may be incorporated into larger programme reviews and feasibility assessments of new immunization-related initiatives, and can be used to strengthen health systems overall.

Evidence:

a. Action plans and financing for achieving and sustaining measles elimination, including routine immunization, supplementary immunization activities (SIAs) when needed, and surveillance with laboratory confirmation, while fostering cooperation with other relevant sectors such as the community, health professionals, and the media.

b. Documented programmatic risk assessment: Identification and description of the risks, challenges and barriers to effective implementation of the following activities:

- data on unimmunized children with measles; and
- data on areas with measles cases.

c. Documented evidence of monitoring and reviewing progress of key action plans to mitigate risks, challenges, and barriers to achieving measles elimination.

d. Outbreak preparedness and response plans in place with specific budgets (including response to imported cases).
VERIFICATION CRITERIA

e. Political commitment and sufficient human, financial and technical resources that guarantee implementation and sustainability of these activities, such as:

- supportive policies;
- budget allocation from the government;
- annual immunization plan;
- multi-year plan for immunization (five-year plan); and
- training for subnational expanded programme on immunization (EPI) managers.

The sources of information for national immunization programme (NIP) sustainability can include JRF reports, cMYPs, national EPI reviews and other sources.

3.2.5 Genotyping evidence that supports measles virus transmission is interrupted

Genotype and genetic characteristics are important to verify the absence of endemic measles virus transmission. The absence of previously endemic measles virus strains for over 12 months is consistent with elimination of measles. Genotypes known to be endemic in the Western Pacific Region in 2012 included at a minimum D9 (Philippines, Malaysia) and H1 (China). However, other genotypes including D4 and D8 are frequently imported from the European and South-East Asia regions, respectively. Virological surveillance and genetic sequencing, together with good epidemiological investigations, are important to help differentiate endemic from imported and import-related cases and to determine if and when endemic transmission may be re-established.

Evidence: Wide range and multiple years of virological analysis with emphasis on the most recent five years in support of achievement of measles elimination.

3.2.6 Summary

The five lines of evidence, explained above, allow for a comprehensive evidence-based assessment of past programme performance and future capacity to sustain elimination. The individual lines of evidence should not be considered alone and should instead be evaluated together to establish the case for elimination of measles. The process of correlating and integrating the evidence from various sources of information will allow countries to determine whether the available data are valid, complete, representative and consistent. The work of the Regional Verification Commission is to correlate and integrate the information from each line of evidence and make an overall determination as to whether or not elimination has been achieved and maintained.
4 STRUCTURE OF VERIFICATION BODIES

4.1 RVC AND NVC STRUCTURE
The Regional Verification Commission (RVC), Subregional Verification Committee (SRVC) for the Pacific island countries and areas and the national verification committees (NVCs) will work together to verify measles elimination (Figure 2). The RVC is the only body authorized to verify measles elimination in countries and areas, as well as the Region as a whole. The SRVC and NVCs will determine when countries and areas are ready for verification, submit the necessary documentation to the RVC for its consideration, and oversee the collection of relevant data that demonstrate the attainment of measles elimination.

Figure 2. Organizational structure of RVC, SRVC and NVC

4.2 RVC, SRVC AND NVC MEMBERSHIP AND APPOINTMENT
RVC, SRVC and NVC members should be independent and objective and, therefore, preferably, should not be directly involved in the day-to-day management and operations of their respective NIPs or epidemiologic and laboratory-based vaccine-preventable disease surveillance. Members should be senior subject-matter experts with different areas of expertise such as epidemiology, paediatrics, public health practice, virology and molecular biology.
RVC members are appointed by and report to the WHO Regional Director for the Western Pacific. The RVC remains independent of the Technical Advisory Group (TAG) on immunization and vaccine-preventable diseases in the Western Pacific Region, although the RVC may share information and reports with the TAG. RVC members will serve terms of two years, with the possibility of renewal. To avoid any potential or perceived conflicts of interest, each RVC member will complete and sign a declaration of interest form prior to each RVC meeting.

NVC members will be appointed by their respective ministries of health and report to the RVC. A minimum of five members should be appointed to the NVC and, as with the RVC, should ideally represent different areas of expertise including epidemiology, paediatrics, public health practice, virology and molecular biology. NVC members should also provide periodic written declaration of interests to prevent potential conflicts of interest.

As the 21 Pacific island countries and areas are considered as one epidemiological block for the purpose of verification of measles elimination, a subregional verification committee (SRVC) will be formed in the same manner as that for the certification of polio-free status. SRVC members will be appointed by the WHO Regional Director for the Western Pacific and will serve in a similar way as an NVC for the Pacific with the same terms of reference.

It should be noted that identifying national experts without professional linkages to their respective NIPs or surveillance units, particularly in countries and areas with small populations, may be difficult. In such situations, the requirement for absolute independence of some NVC members may be waived on a case-by-case basis. However, the RVC will need to be satisfied that the NVC is sufficiently objective when controversial issues such as data quality arise.

4.3 SECRETARIAT SUPPORT TO RVC, SRVC AND NVCS
The WHO Regional Office for the Western Pacific will serve as the secretariat for the RVC. The SRVC and NVCs may establish their own secretariats, such as the NIP and vaccine-preventable disease surveillance units, to provide necessary evidence of measles elimination. In the countries with WHO country offices, WHO staff may provide technical and operational support to both the secretariats and the SRVC or NVCs. Countries and areas without WHO country offices are welcome to consult with the WHO Regional Office for the Western Pacific when necessary.
5 MECHANISM OF VERIFICATION

Authority to verify measles elimination will be vested solely in the RVC, which will annually review and when appropriate, verify progress towards, achievement of, and maintenance of measles elimination in countries and areas and eventually for the Region as a whole. The SRVC and NVCs will similarly assess measles elimination status within their borders, determine when a country or area is ready for verification, and assist their ministries of health to prepare the necessary evidentiary documentation for submission to the RVC. The RVC will guide the SRVC and NVCs, and the SRVC and NVCs will guide NIPs and vaccine-preventable diseases (VPD) surveillance units with respect to requirements to verify measles elimination. In this respect, the RVC, SRVC and NVCs will serve as de facto advisory bodies on fulfillment of verification criteria and the lines of evidence. The RVC should contribute its evolving knowledge to global measles eradication efforts. The RVC should evaluate updates and changes recommended by the Strategic Advisory Group of Experts (SAGE) on Immunization on verification criteria and may recommend changes based on the global strategy. Guidance provided by RVC, SRVC and NVC members should be consistent with recommendations from the Western Pacific Region Technical Advisory Group (TAG) on immunization and VPDs. The TAG should be consulted in the event of discrepant technical opinions by the RVC. The RVC should be consulted in the event of discrepant technical opinions by the SRVC or any NVC. In addition to their normative, verification and advisory functions, members of the RVC, SRVC and NVCs may also serve an advocacy role to promote measles elimination activities.

5.1 RVC FUNCTIONS AND TERMS OF REFERENCE
The following are the functions and objectives of the RVC:

- to serve in an honorary capacity and verify the progress, achievement, and maintenance of measles elimination first by country and/or area and eventually for the Region as a whole;
- to establish criteria and procedures required for the verification of measles elimination in the Western Pacific Region;
- to contribute to the formulation and endorsement of guidelines on verification on measles elimination in the Western Pacific Region;
MECHANISM

- to provide guidance to national and/or subnational verification committees of measles elimination, and conduct field visits when needed;
- to advise on various issues related to verifying measles elimination;
- to monitor progress towards rubella control and eventual elimination; and
- to advocate for measles elimination at the country and/or regional level.

5.1.1 Management function of RVC Chair

The RVC Chair serves a leadership and management function with the following objectives:

- to preside over RVC meetings to be held at least once a year;
- to define internal operating procedures and RVC member responsibilities;
- to supervise the documentation and verification process; and
- to prepare and submit annual meeting and/or verification reports to the Regional Director, who will then share those reports with Member States through appropriate channels.

5.2 SRVC AND NVC FUNCTIONS AND TERMS OF REFERENCE

The following are the functions and objectives of the SRVC and NVCs:

- to advise respective ministries of health, national immunization programmes, and the vaccine-preventable disease surveillance units on the requirements for verification of measles elimination;
- to compile or review and analyse relevant information to monitor progress towards measles elimination and assess if the country or area has eliminated endemic measles virus transmission in accordance with established criteria and components;
- to conduct field visits when needed to monitor progress, assess data quality and validate analyses and assessments;
- to ensure the development of the annual progress report at the country level for submission to the RVC and, if necessary, propose feasible alternative data when standard verification data are insufficient or inconsistent;
- to review and validate the report, providing conclusions and recommendations before submission of the report to the RVC;
- to monitor progress towards accelerated rubella control and congenital rubella syndrome prevention and, if established as a national or regional goal, rubella elimination;
- to provide programmatic guidance consistent with verification criteria and lines of evidence; and
- to advocate for measles elimination.
5.2.1 Management function of SRVC/NVC Chair

The chairs of the SRVC and NVCs serve to fulfill the following objectives:

- to define internal procedures and responsibilities of committee members in accordance with guidelines provided by the RVC;
- to prepare an SRVC/NVC plan including activities, timeline, expected outcomes, and human and financial resource requirements in collaboration with the NIP and ministry of health, and to present the plan to the RVC for approval;
- to preside over SRVC/NVC meetings, which are to be held at least twice per year; and
- to attend RVC or other regional meetings as needed.

5.3 ADVOCACY FUNCTION FOR BOTH RVC AND SRVC/NVCS

RVC, SRVC and NVCs can play active roles in raising awareness of and commitment to measles elimination, targeting high-ranking health officials, health professionals, partners and political leaders through multiple channels such as national health conferences, scientific seminars, media and personal networks.
6 DOCUMENTATION OF VERIFICATION

Documentation for verification of measles elimination aims to provide convincing and well-structured evidence to demonstrate that a country has met the verification criteria for measles elimination and the country is able to sustain their achievements. Countries must provide evidence that they have interrupted endemic measles virus transmission for a period of at least 36 months under conditions of verification standard surveillance.

6.1 ANNUAL PROGRESS REPORT

To document progress towards, achieving and sustaining measles elimination, every country should prepare an annual progress report to show their achievements and status against the standard performance indicators—current measles epidemiology, surveillance performance, population immunity, sustainability and genotyping (see 3.2), and provide additional evidence when required.

Pacific island countries and areas will be considered as one epidemiological block for verification of measles elimination and will prepare and submit one joint annual progress report, as followed for polio eradication.

Progress reports will be prepared by countries on an annual basis, regardless of whether or not a country is ready to be verified as having eliminated measles. The first annual progress reports are required to be submitted in the third quarter of 2013. Subsequent progress reports will be updates to the first reports.

When a country or area is confident that it has achieved the verification criteria for measles elimination, it may request official recognition of this achievement. The country’s or area’s various progress reports are official verification documents to be assessed by the Regional Verification Commission. Country visits by certain RVC members may be required.

6.2 CONTENTS OF THE ANNUAL PROGRESS REPORT

A progress report should include the following components:

a. background information (essential for the first report and included in subsequent reports only if there are relevant changes);
b. a detailed description of the epidemiology of measles since the introduction of
the measles vaccine (and rubella vaccine where applicable) in the national immunization
programme;

c. quality of epidemiological and laboratory surveillance systems for measles;

d. population immunity presented as a birth cohort analysis with the addition of evidence
related to any underserved or marginalized groups;

e. sustainability of the national immunization programme including the resources for mass
campaigns, where appropriate, in order to sustain measles elimination;

f. genotyping evidence that supports measles virus transmission is interrupted;

g. NVC plan; and

h. validation, comments, conclusions and recommendations provided by the NVC or SRVC.

6.3 SOURCES OF INFORMATION (LINES OF EVIDENCE)
FOR ANNUAL PROGRESS REPORTS
Countries can draw on the many existing sources of data from official reports and documents
for compiling annual progress reports, which may ease the burden of collecting
the information needed for an annual progress report. The sources available in individual
countries may vary, but examples may include the following:

• background and history of the NIP, which are included in comprehensive multi-year plan
(cMYP) of action on immunization;
• population data which are included in the annual WHO/UNICEF Joint Reporting Form
(JRF);
• epidemiology and laboratory data from national and regional measles-rubella bulletins;
• comprehensive information against the various lines of evidence, which are included in
the Measles Elimination Country Profiles, published by the WHO Regional Office for the
Western Pacific every six months;
• immunization data included in the JRF; and
• progress of achievements from national reports or presentations for TAG or other
meetings.
6.4 **DATA ANALYSIS BY SUBNATIONAL LEVELS**

The verification process will require analysis of data by second administrative level for measles epidemiology or surveillance performance or third administrative level for vaccination coverage.

To guide countries on presenting subnational data, the following WHO regional documents provide useful examples:

- *Measles–Rubella Bulletin*, issued every month by the Regional Office for the Western Pacific, includes epidemiological and laboratory data by country; and
- *Country Profiles: Measles Elimination*, published every six months by the Regional Office for the Western Pacific, include comprehensive information against the required verification components.

To facilitate the preparation of progress report, countries and areas can prepare a structured presentation which would provide essential information and analysis.

6.5 **DETAILS OF EACH COMPONENT OF THE ANNUAL PROGRESS REPORT**

6.5.1 **Background information**

The history of measles control in the country should be incorporated in the first progress report, including the years of introduction of MCV1 and MCV2, current immunization schedule for MCV and historic changes (if any), evolution of strategies for controlling and eliminating measles, relevant surveillance systems and establishment of case-based measles-related surveillance. The history and the available data will vary from country to country; therefore, no absolute number of years will be stipulated but the more information available will be useful. This information is often available from previous national plans.

Countries should provide description of high-risk population groups (e.g. migrants) or high-risk areas (e.g. border areas with measles endemic countries) as part of the background information.

6.5.2 **A detailed description of the epidemiology of measles since the introduction of measles vaccine in the national immunization programme**

This section requires graphs of measles cases and/or incidence since the year measles data became available, and immunization interventions undertaken at specific years (e.g. routine
immunization coverage, catch-up or follow-up SIAs). This information is already available from various measles presentations and will only need to be updated.

- A thorough analysis of recent measles epidemiology is critical. This can be presented using maps and graphs. The WHO measles elimination country profiles provides good examples.
- All countries are expected to provide second administrative level data.
- Some countries may even be able to provide third administrative level data.
- For countries with larger populations, there may be a need for analysis which groups provinces based on their similarities, e.g. measles-free status, measles epidemiology (e.g. age distribution), or performance of immunization systems.

### 6.5.2.1 Detailed description of characteristics of confirmed measles cases

Each country should provide a detailed description of confirmed measles cases for the current year of the report, or for the last year for which measles cases were reported. It would be helpful to display their location on maps as well as provide a description of the population demographics. For outbreaks, the map may include facilities or events determined to be related to measles virus transmission, such as hospitals or clinics where nosocomial transmission was identified or schools where outbreaks occurred. For hard-to-reach populations, the description should include steps taken to reach the population. An example is “The Face of Measles Transmission in High Risk Communities” in the Measles Elimination Field Guide.

### 6.5.2.2 High-quality information on measles outbreaks

Countries are expected to provide detailed descriptions of any recent measles outbreaks including response actions and outcomes of these responses, plus lessons learned, and plan to address programmatic gaps if identified. Tables 2 and 3 may be used with modifications.

### 6.5.2.3 Source of infection for measles cases

Analysis on the source and method of measles case confirmation, as summarized in Table 4, should be included. Epidemiological curves can be colour-coded based on cases that are endemic, unknown, imported and import-related.
6.5.2.4 Detailed description of the characteristics of clinically measles compatible cases

The following should be included:

- a map to show location and clustering if present;
- age and immunization status;
- clinical signs or symptoms consistent with measles or rubella (yes or no);
- other diseases as a likely cause; and
- cases discarded by Expert Review Committee.

6.5.3 Quality of epidemiological and laboratory surveillance systems for measles

Information on the quality of measles epidemiological and laboratory surveillance can be presented using a similar structure as seen in the Measles Elimination Country Profile.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of measles outbreaks</th>
<th>No. (%) of outbreak-related measles cases</th>
<th>Median number (range) of cases in outbreaks</th>
<th>Median (range) of duration of outbreaks (days)</th>
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</tbody>
</table>

Table 2. Description of measles outbreak

<table>
<thead>
<tr>
<th>No. outbreak</th>
<th>Date onset index case</th>
<th>Age groups and # cases</th>
<th>Total cases</th>
<th>Routine catch up age and # children</th>
<th>SIA target age and # children</th>
<th>Results total immunized</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>0-1m 1-4y 5-15y &gt;15y</td>
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Table 3. Description of measles outbreak response
A complete list of surveillance and laboratory performance indicators is presented under 3.2.2. Analysis at the subnational level (e.g. province) against standard epidemiological surveillance performance indicators should be included.

It is proposed that countries provide additional evidence or analysis if they are unable to meet the required surveillance standards (e.g. for small populations) or if there are some gaps in data availability for calculation of required indicators.

If there are surveillance and laboratory gaps, the report should include information on actions to identify and address them.

### 6.5.4 Population immunity presented as a birth cohort analysis with the addition of evidence related to any underserved or marginalized groups

A detailed analysis demonstrating that high immunity levels have been achieved is one of the critical elements of information presented in the report. These national data are already available in the WHO country profiles, but will need to be provided by third administrative level by each country. The following should be included:

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<thead>
<tr>
<th>SOURC</th>
<th>NUMBER CONFIRMED</th>
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<tr>
<td></td>
<td>Laboratry</td>
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<tr>
<td>Endemic</td>
<td>A</td>
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<tr>
<td>Unknown</td>
<td>C</td>
</tr>
<tr>
<td>Imported</td>
<td>E</td>
</tr>
<tr>
<td>Import-Related</td>
<td>G</td>
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</table>

(Annex 1.)
• a graph showing national MCV coverage, measles cases and timing and SIAs over a period of time (the graph should show trends over a number of years, e.g. 10 years, if available);
• maps showing district MCV coverage over a number of years for which the data are available;
• progress towards improving MCV coverage over time;
• a summary of SIAs should be presented, including target population, target age group, geographic areas (national or subnational), implementation dates, implementation status (number of people immunized, reported coverage);
• results of coverage surveys conducted to assess routine or supplemental immunization including serosurveys to assess population immunity; and
• if feasible, analysis on immunity level by birth cohort is encouraged; an example can be found in the country profile.

6.5.5 Sustainability of the national immunization programme including the resources for mass campaigns, where appropriate, in order to sustain measles elimination

This section of the report should provide the national action plans and financing for achieving and sustaining measles elimination, and evidence of monitoring and reviewing progress against plans.

a. Action plans and financing for achieving and sustaining measles elimination, including routine immunization, supplementary immunization activities (SIAs) when needed, and surveillance with laboratory confirmation, while fostering cooperation with other relevant sectors such as the community, health professionals and media, should be included. A method for conducting a situation analysis for guiding preparation of a country action plan is included in the Measles Elimination Field Guide (2013 version), developed by the WHO Regional Office for the Western Pacific. A simple template for a country action plan is provided in Annex 2.

b. A documented programmatic risk assessment is needed to identify and describe the risks, challenges and barriers to effective implementation of these activities. The programmatic risk assessment should be described as a basis for developing and updating the national action plans to:

• close immunity gaps;
• conduct adequate outbreak preparedness and response;
• improve surveillance performance;
• describe the main risks and challenges for the country to achieve or maintain measles-free status;
• take key actions proposed to mitigate risks; and
• describe intensified efforts made to identify and reach high-risk communities (migrants, remote, poor, and ethnic minorities) through routine and supplementary immunization.

c. Documented evidence of monitoring and reviewing progress of key action plans to mitigate risks and overcome barriers to achieving measles elimination should be included.

d. Outbreak preparedness and response plans with specific budgets should be in place (including imported cases).

e. Political commitment and sufficient human, financial and technical resources that guarantee implementation and sustainability of these activities are necessary. Examples are:

• supportive policies;
• budget allocation from the government;
• annual immunization plan;
• multi-year plan for immunization (five-year plan); and
• training for subnational EPI managers.

f. The sources of information for NIP sustainability can include JRF reports, cMYPs, national EPI reviews and other sources.

6.5.6 Genotyping evidence that supports interruption of measles virus transmission

Since genotype and genetic characteristics are important to verify the absence of endemic measles virus transmission, countries are expected to provide measles virus genotyping information, including historic endemic measles virus strains, and recent measles virus strains. This information can also be presented in a table similar to Table 5, describing genotype and number of measles virus strains identified by year and month, for all years since genotyping became available.

In addition to the table, other information such as genotyping for cases by date of onset, and phylogenetic trees should be included when available.
6.5.7 NVC plan

Each country should develop the NVC plan to include the following items, as well as proposed timelines for each:

- roster of members of the national verification committees;
- orientation organized for NVC members;
- chairs to brief all NVC members, with support from NIP and WHO;
- annual review meetings with NIP;
- review of all relevant data to track current measles situation;
- field visits when required, particularly for advocacy purposes in high-risk or outbreak areas;
- preparation of annual progress reports, with support from NIP (and WHO secretariat);
- attendance at RVC meetings;
- delivery of reports and presentations during annual RVC meetings;
- implementation of RVC recommendations; and
- feedback to NIP for action on RVC recommendations.

6.5.8 Validation, comments, conclusions and recommendations provided by the NVC

This section will provide a summary of the outcomes from the report review by the NVC, including validation, comments, conclusions and recommendations. This may be in the form of a cover letter with signatures of all NVC members.
7 POST-VERIFICATION NEEDS

After verification of measles elimination, countries and areas will need to sustain measles elimination and prevent re-establishment of endemic measles virus transmission by continuing the same strategies recommended to eliminate measles:

a. achieving and maintaining high (≥ 95%) vaccination coverage with two doses of measles-containing vaccine (MCV) through routine immunization and adding supplementary immunization activities (SIAs), when required;

b. conducting high-quality case-based measles surveillance;

c. ensuring high-quality laboratory contribution to surveillance through accredited laboratories that are able to conduct timely and accurate testing of samples to confirm or discard suspected cases and detect measles virus for genotyping and molecular analysis; and

d. developing and maintaining outbreak preparedness, and rapidly responding to measles outbreaks and managing measles cases. Annual assessments should be conducted by governments with SRVC or NVC assistance, and annual progress reports should be submitted to the RVC. The RVC will in turn review annual country progress reports and conduct field visits when necessary, and provide feedback and recommendations to governments through the SRVC or NVCs.
Measles Elimination Status, Current and Proposed Plans

Country Name

Outline

- Measles elimination status
  - History
  - Incidence and epidemiology
  - Virus detection and identification
  - Epidemiologic and laboratory surveillance performance
  - Immunity profile
  - Sustainability
- Risks to achieving or maintaining measles elimination
- Current and proposed plans through 2013 and beyond
ANNEX 1

History of Measles Elimination, Country X, 19XX - 2012

- Routine and supplementary immunization
  - Year MCV1 and MCV2 introduced
  - Schedule
  - SIAs, by year
- Surveillance
  - Year case-based surveillance started
  - Year when mandatory reporting started
  - Year lab was accredited by WHO
  - Genotype data available from what year
- Recent activities to interrupt measles virus transmission

Measles Incidence, Epidemiology and Virus Detection

INCIDENCE, BY YEAR, SINCE 2000, VIRUS DETECTION
- Genotype data, by year
- Description of measles virus importations

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<td>Genotypes and no. detected</td>
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<td>No. importations and import-related</td>
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</table>
Measles Incidence, Epidemiology and Virus Detection

Epidemiology (Confirmed Cases Only)
- Epidemic curve: 2008 - 2012 (March)
- Spot map (2011, 2012)
- Age distribution, stacked by immunization status (0, 1, 2+ Unknown)
  - Age group or by year of age
- Other analysis

3-4 slides - WPRO will provide based on data sent to us – MAA example follows

Confirmed Measles Cases, by Month of Onset, Malaysia, 2008-2012*

- Source: WPRO measles-rubella monthly country reports, data through February 2012
ANNEX 1

Confirmed Measles Cases, by State, Malaysia, 2011-2012*

1 dot = 1 case

Discarded measles per 100K population:
- ≥ 2
- 1.0 - 1.9
- < 1
- No suspected measles cases

* Source: WPRO measles-rubella monthly country reports, data through February 2012

Lab-confirmed and epi-linked measles cases, by age group and vaccination status, Malaysia, January 2011-February 2012

Schedule: MCV1 @ 12m; MCV2 @ 7y

Source: National surveillance report as of 26 March 2012

Verification of Measles Elimination
ANNEX 1

Verification of Measles Elimination

Lab-confirmed and epi-linked measles cases, by year of age and vaccination status, Malaysia, January 2011-February 2012

Source: National surveillance report as of 26 March 2012

Surveillance Performance

- Epidemiology
  - Discarded non-measles rate (national, subnational)
  - Adequate investigation
  - Adequate sample collection rate
  - ....

- Lab
  - Accreditation status – since what year
  - Percent of specimens with results within 7 days of receipt in lab
  - Percent of outbreaks with specimens for virus detection
  - Genotype data available from what year

References:
1. Measles and Rubella Bulletin, published by WHO Regional Office on a monthly basis
2. Weekly Epidemiological Record, No. 49, 2010, 85:489-496

See next slide for suggested template
## Surveillance Performance Indicators, Country X, 2007-2012*

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>Target</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012*</th>
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<tbody>
<tr>
<td><strong>EPIDEMIOLOGIC SURVEILLANCE INDICATORS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National reporting of discarded measles cases</td>
<td>≥ 2 per 100,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of 2nd level admin units reporting ≥ 1/100,000 discarded measles cases</td>
<td>≥ 80%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of suspected cases with adequate investigation</td>
<td>&gt; 80%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of suspected cases with adequate blood specimens</td>
<td>&gt; 80%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion of clinically-confirmed measles cases</td>
<td>≤ 10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LABORATORY INDICATORS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NML accredited?</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% specimens with results within 7 days of receipt</td>
<td>&gt; 90%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of outbreaks with specimens for virus detection</td>
<td>&gt; 80%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Data as of March 2012

---

## Immunity Profile

**ROUTINE IMMUNIZATION COVERAGE (LAST FIVE YEARS)**
- Administrative reports of MCV1, MCV2
- Surveys

**SIA COVERAGE (SINCE 1995)**
- Year, target age group, geographic scope, # immunized, coverage

See next slide for suggested template

**OTHER IMMUNITY PROFILE DATA**
- Seroprevalence surveys
- Magnitude and duration of outbreaks, percent imported cases
- Reproductive numbers based on models using above data

Provide additional slides
### Immunity Profile, Country X, 2007-2011

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>Target</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>National admin coverage - MCV1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCV2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. and % districts with ≥ 90% MCV1 coverage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survey coverage - MCV1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCV2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIA target age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of country targeted (national=100%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIA coverage (No., %)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Sustainability

- Is there a school entry requirement for measles immunization status?
- Is measles elimination reflected in costed multi-year plans? Does it have a budget?
- Total current and future NIP Budget, % committed by government and donors, shortfall
- Total current and future measles budget, % committed by government and donors, shortfall
Challenges to Achieving and Sustaining Measles Elimination, Country X

WHAT ARE THE CHALLENGES FOR
• Achieving and sustaining adequate population immunity
• Achieving and maintaining adequate surveillance to detect and classify imported, import-related and endemic transmission
  · Epidemiologic surveillance
  · Laboratory/virologic surveillance
• Outbreak preparedness and response
• Other issues?

Current & Proposed Measles Elimination Plans, 2012-2013 Country X

• Immunity profile
• Sensitivity and representativeness of epidemiologic and virologic surveillance and discern endemic from import-related transmission
• Prepare for and respond to outbreaks
• Verify measles elimination

See next page for suggested template; suggest to write current plans in black proposed plans in red
### Current & Proposed Measles Elimination Plans, Country X Immunity Profile

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Activity</th>
<th>Timeframe</th>
<th>Budget</th>
<th>Funding Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gov’t</td>
</tr>
</tbody>
</table>

### Current & Proposed Measles Elimination Plans, Country X Epidemiologic and Lab Surveillance

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Activity</th>
<th>Timeframe</th>
<th>Budget</th>
<th>Funding Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gov’t</td>
</tr>
</tbody>
</table>

## Current & Proposed Measles Elimination Plans, Country X Outbreak Preparedness & Response

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Activity</th>
<th>Timeframe</th>
<th>Budget</th>
<th>Funding Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gov’t</td>
</tr>
</tbody>
</table>

## Current & Proposed Measles Elimination Plans, Country X Verification

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Activity</th>
<th>Timeframe</th>
<th>Budget</th>
<th>Funding Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gov’t</td>
</tr>
</tbody>
</table>
Verification of Measles Elimination

Current & Proposed Measles Elimination Plans, Country X Other

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Activity</th>
<th>Timeframe</th>
<th>Budget</th>
<th>Funding Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gov’t</td>
</tr>
</tbody>
</table>

Summary

• Summary of measles situation (extent of endemic measles virus transmission)
• Major challenges to achieve and sustain measles elimination
• Major current and additional actions needed in 2012-2013 to address challenges
SECTION 1. Demographic Information (data for 2011)

<table>
<thead>
<tr>
<th>Year</th>
<th>Suspected measles cases</th>
<th>Confirmed measles cases</th>
<th>Discharged as non-measles</th>
<th>Pending classification</th>
<th>Deaths due to measles</th>
<th>Measles incidence</th>
<th>Detected genotypes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laboratory</td>
<td>Epi-linked</td>
<td>Clinically</td>
<td>Total</td>
<td></td>
<td></td>
<td>H1</td>
</tr>
<tr>
<td>2008</td>
<td>1872</td>
<td>185</td>
<td>73</td>
<td>1</td>
<td>259</td>
<td>1337</td>
<td>2.9</td>
</tr>
<tr>
<td>2009</td>
<td>9549</td>
<td>2063</td>
<td>2275</td>
<td>264</td>
<td>5222</td>
<td>3973</td>
<td>59.0</td>
</tr>
<tr>
<td>2010</td>
<td>6428</td>
<td>757</td>
<td>90</td>
<td>1826</td>
<td>2919</td>
<td>1683</td>
<td>23</td>
</tr>
<tr>
<td>2011</td>
<td>14 954</td>
<td>22</td>
<td>81</td>
<td>642</td>
<td>745</td>
<td>14 208</td>
<td>2</td>
</tr>
<tr>
<td>2012</td>
<td>1423</td>
<td>6</td>
<td>0</td>
<td>631</td>
<td>637</td>
<td>765</td>
<td>5.9</td>
</tr>
</tbody>
</table>

*per 1 million population

SECTION 2. Measles incidence, epidemiologic and virologic characteristic

CONFIRMED MEASLES CASES BY MONTH OF ONSET, 2008-2013

LAB-CONFIRMED AND EPI-LINKED MEASLES CASES BY DISTRICT, 2012-2013

LAB-CONFIRMED AND EPI-LINKED MEASLES CASES, BY AGE GROUP AND VACCINATION STATUS

SECTION 3. Surveillance and laboratory performance

<table>
<thead>
<tr>
<th>Year</th>
<th>Discarded non-measles rate</th>
<th>% second level units with ≥1 discharged cases</th>
<th>% suspected cases with adequate investigation</th>
<th>% suspected cases with adequate blood specimens</th>
<th>% clinically confirmed cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1.5</td>
<td>31.3%</td>
<td>29.1%</td>
<td>78.4%</td>
<td>4%</td>
</tr>
<tr>
<td>2009</td>
<td>4.5</td>
<td>78.1%</td>
<td>27.5%</td>
<td>72.4%</td>
<td>5.1%</td>
</tr>
<tr>
<td>2010</td>
<td>3.3</td>
<td>53.1%</td>
<td>43.4%</td>
<td>71.3%</td>
<td>53.6%</td>
</tr>
<tr>
<td>2011</td>
<td>16.0</td>
<td>84.4%</td>
<td>20.0%</td>
<td>33.3%</td>
<td>86.2%</td>
</tr>
<tr>
<td>2012</td>
<td>0.9</td>
<td>25.0%</td>
<td>44.3%</td>
<td>56.0%</td>
<td>99.1%</td>
</tr>
</tbody>
</table>

*For 100,000 population

*For Viet Nam, province level is used (N = 64)
ANNEX 2
COUNTRY PROFILE-MEASLES ELIMINATION
VIET NAM

SECTION 4. Immunity against measles

Measles immunization

<table>
<thead>
<tr>
<th>Year</th>
<th>Vaccine type</th>
<th>Schedule</th>
<th>School entry requirement for measles?</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCV1</td>
<td>1981</td>
<td>M 9m</td>
<td>No</td>
</tr>
<tr>
<td>MCV2</td>
<td>2006</td>
<td>M 6y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>M 18m</td>
<td></td>
</tr>
</tbody>
</table>

Supplementary immunization activities (SIAs)

<table>
<thead>
<tr>
<th>Year</th>
<th>Age</th>
<th>Vaccine type</th>
<th>No. vaccinated</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-03</td>
<td>9m-10y</td>
<td>M</td>
<td>15 326 123</td>
<td>99%</td>
</tr>
<tr>
<td>2004</td>
<td>12y-18y</td>
<td>M</td>
<td>1 544 001</td>
<td>99%</td>
</tr>
<tr>
<td>2007</td>
<td>1y-20y</td>
<td>M</td>
<td>3 729 848</td>
<td>97%</td>
</tr>
<tr>
<td>2008</td>
<td>7y-20y</td>
<td>M</td>
<td>1 008 690</td>
<td>97%</td>
</tr>
<tr>
<td>2010</td>
<td>9m-71m</td>
<td>M</td>
<td>6 982 749</td>
<td>96%</td>
</tr>
</tbody>
</table>

Immunity profile, 2012

<table>
<thead>
<tr>
<th>Age (in years)</th>
<th>Susceptible</th>
<th>Protected by MCV1</th>
<th>Protected by MCV2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2-5</td>
<td>25%</td>
<td>75%</td>
<td>0%</td>
</tr>
<tr>
<td>6-11</td>
<td>10%</td>
<td>90%</td>
<td>0%</td>
</tr>
<tr>
<td>12-17</td>
<td>1%</td>
<td>99%</td>
<td>0%</td>
</tr>
<tr>
<td>18-24</td>
<td>1%</td>
<td>99%</td>
<td>0%</td>
</tr>
<tr>
<td>25-34</td>
<td>1%</td>
<td>99%</td>
<td>0%</td>
</tr>
<tr>
<td>35-44</td>
<td>1%</td>
<td>99%</td>
<td>0%</td>
</tr>
<tr>
<td>45-54</td>
<td>1%</td>
<td>99%</td>
<td>0%</td>
</tr>
<tr>
<td>55-64</td>
<td>1%</td>
<td>99%</td>
<td>0%</td>
</tr>
<tr>
<td>65-74</td>
<td>1%</td>
<td>99%</td>
<td>0%</td>
</tr>
<tr>
<td>75+</td>
<td>1%</td>
<td>99%</td>
<td>0%</td>
</tr>
</tbody>
</table>

SECTION 5. Sustainability

<table>
<thead>
<tr>
<th>Does country have multi-year plan?</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are measles elimination activities included?</td>
<td>Yes, without budget line item</td>
</tr>
<tr>
<td>Does country have annual workplan in 2011?</td>
<td>Yes</td>
</tr>
<tr>
<td>Are measles elimination activities included?</td>
<td>Yes, without budget line item</td>
</tr>
<tr>
<td>% of expenditure on vaccines used in routine immunization funded by government</td>
<td>30%</td>
</tr>
<tr>
<td>% of expenditure on routine immunization funded by government</td>
<td>33%</td>
</tr>
<tr>
<td>Does national health plan include budget for measles elimination activities through 2012?</td>
<td>Yes</td>
</tr>
<tr>
<td>Amount required through 2012</td>
<td>US$ 10 million</td>
</tr>
<tr>
<td>Amount committed by government through 2012</td>
<td>US$ 4 million</td>
</tr>
</tbody>
</table>

Data Sources
1. WHO-UNICEF Joint Reporting Forms (JRF) for Immunization
2. Measles and rubella monthly country and laboratory reports to WHO – data through December 2012, as of March 2013
4. Measles Strategic Planning (MSP) Tool version 2.0
5. Measles Nucleotide Surveillance (MeaNS)
6. Measles Laboratory Accreditation Checklist

Please visit our website: www.wpro.who.int/immunization
Please send your comments to: WPR_EPIdata@wpro.who.int

REPORTED MEASLES CASES AND IMMUNIZATION COVERAGE

<table>
<thead>
<tr>
<th>Year</th>
<th>MCV1 Coverage</th>
<th>MCV2 Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td>1981</td>
<td>30%</td>
<td>40%</td>
</tr>
<tr>
<td>1982</td>
<td>50%</td>
<td>60%</td>
</tr>
<tr>
<td>1983</td>
<td>70%</td>
<td>80%</td>
</tr>
<tr>
<td>1984</td>
<td>90%</td>
<td>100%</td>
</tr>
</tbody>
</table>

DISCLAIMER: The boundaries and names shown and the designations used on the maps do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

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## Verification of Measles Elimination

### Objectives:
- Improve immunity profile against measles
- Strengthen epidemiologic and virologic surveillance
- Outbreak preparedness and response
- Verification
- Improve immunity profile

### Activity Title

<table>
<thead>
<tr>
<th>Activity Title</th>
<th>SI</th>
<th>Activity description</th>
<th>Expected outcome</th>
<th>Timeframe</th>
<th>Monitoring indicators</th>
<th>Estimated budget</th>
<th>Government Parts</th>
<th>Partners</th>
<th>Need for external TA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IMPROVING IMMUNITY PROFILE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2. STRENGTHENING EPIDEMIOLOGIC AND VIROLOGIC SURVEILLANCE</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3. OUTBREAK PREPAREDNESS AND RESPONSE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. VERIFICATION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. OTHER</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Funding and Gaps
- 
- 
- 
- 
-