Guidelines on Verification of Measles and Rubella Elimination in the Western Pacific Region

SECOND EDITION


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<td>CRS</td>
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<td>GSL</td>
<td>global specialized laboratory</td>
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**Definitions**

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

- **Disease elimination:**
  - measles – the absence of endemic measles virus transmission in a defined geographical area (for example, region or country) for ≥ 12 months, in the presence of a well performing surveillance system.
  - rubella – the absence of endemic rubella virus transmission in a defined geographical area (for example, region or country) for ≥ 12 months and the absence of congenital rubella syndrome (CRS) cases associated with endemic transmission, in the presence of a well performing surveillance system.

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

- **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 (for example, region or country) where measles or rubella was previously eliminated.

- **Measles or rubella outbreak:** Two or more measles or rubella cases that are temporally related and epidemiologically or virologically linked, or both. However, rigorous case and contact investigation should be initiated at confirmation of first measles or rubella case.

**CLASSIFICATION OF CASES**

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

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

- **An epidemiologically linked confirmed measles or rubella case:** a suspected case of measles or rubella that has not been confirmed by a laboratory but was geographically and temporally related, with dates of rash onset occurring 7–21 days apart for measles (or 12–23 days for rubella), to a laboratory-confirmed case or, in the event of a chain of transmission, to another epidemiologically confirmed measles or rubella case.

For example: A health-care worker suspects a case of measles, but the person does not receive adequate laboratory testing to confirm either positive or negative results. However, epidemiological investigation reveals that the person was in contact with a laboratory-confirmed measles case 12 days before onset of rash. This person would be classified as an confirmed case by epidemiological linkage measles case. If this was in an outbreak setting, the person could also be considered an epidemiologically confirmed measles case even if contact (within similar time frame) was only established with 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.

• Clinically rubella compatible: a case with maculopapular (non-vesicular) rash and fever (if measured) and one of arthritis/arthralgia or lymphadenopathy, for which no adequate clinical specimen was taken and which has not been linked epidemiologically to a laboratory-confirmed case of rubella or another laboratory-confirmed communicable disease.

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

• Imported case of measles or rubella: a case exposed to measles or rubella outside the country during the 7–21 days for measles (or 12–23 days for rubella) prior to rash onset and supported by epidemiological or virological evidence, or both.

Note: For cases that were outside the country for only a part of the 7–21-day interval (or 12–23-day interval for rubella) prior to rash onset, additional evidence including a thorough investigation of local contacts of the case is needed to exclude a local source of infection.

• Import-related measles or rubella 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: Classification of a case as import-related can be based on genotyping data alone (that is, in the absence of supportive epidemiological data). If transmission of measles or rubella from cases related to importation persists for ≥12 months, cases are no longer considered import-related but endemic.

• Unknown source measles or rubella case: a confirmed case for which an epidemiological or virological link to importation or to endemic transmission cannot be established.

• Non-measles non-rubella discarded case: a suspected case that has been investigated and discarded as a non-measles, non-rubella case using: (i) laboratory testing in a proficient laboratory; or (ii) 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 a cough or other respiratory symptoms related to the rash; (ii) the rash began 7–14 days after vaccination with a measles-containing vaccine; (iii) the blood specimen, which was positive for measles immunoglobulin M (IgM), was collected 8–56 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 (for example, genotype A).

• Suspected CRS case: any infant less than 1 year of age in whom a health worker suspects CRS, usually in an infant 0–11 months old who presents with heart disease and/or suspicion of hearing impairment and/or one or more of the following eye signs (cataracts, congenital
glaucoma, pigmentary retinopathy) or if infant’s mother has a history of suspected or confirmed rubella during pregnancy, even when the infant shows no signs of CRS.

- Laboratory-confirmed CRS case: A suspected case with at least one condition from group A (cataracts, congenital glaucoma, congenital heart disease, hearing impairment, pigmentary retinopathy) and meets the laboratory criteria for CRS laboratory confirmation.

- Clinically confirmed CRS case: A case in which no adequate clinical specimen was taken but in whom a health worker detects at least two of the complications listed in group A (cataracts, congenital glaucoma, congenital heart disease, hearing impairment, pigmentary retinopathy) or one in group A and one in group B (purpura, splenomegaly, microcephaly, developmental delay, meningoencephalitis, radiolucent bone disease, jaundice that begins within 24 hours after birth).

**MOLECULAR GENOTYPING**

- Genotype: Operational taxonomic unit defined on the basis of nucleotide variation between viral strains. Measles virus genotypes are defined on the genetic analysis of the N-450 sequence, which is the most variable region of the measles virus genome. Rubella virus genotypes are defined on genetic analysis of the E1-739 sequence.

- Variant lineage or sequence (measles only): Measles variants defined on the basis of the N-450 sequence identity but not included in the list of named strains (see below), allowing variation within a single genotype to be described. The World Health Organization (WHO) name assigned to the sequence will provide the identifier for the sequence variant.

- Named strain (measles only): Measles virus variant specifically identified in MeaNS as a representative N-450 sequence due to its important prevalence within the database (associated with widespread transmission).

- MeaNS: WHO Measles Nucleotide Surveillance online database (http://www.who-measles.org)

- RubeNS: WHO Rubella Nucleotide Surveillance online database (http://www.who-rubella.org)
Executive summary

The Western Pacific Region has made remarkable progress towards achieving its measles elimination goal; however, recently there has been a resurgence of measles in the Region. Measles incidence was 5.9 cases per million population in 2012, which was a historic low, but increased to 17.7 in 2013 and 44.0 in 2014. Intensive efforts to improve case-based surveillance in the Region began in 2007, and the surveillance activities required for measles elimination have continued to improve across the Region. As of September 2017, the Regional Verification Commission (RVC) has verified eight countries or areas as having achieved measles elimination and two as having achieved rubella elimination. Progress reports are reviewed annually to verify that elimination has been maintained.

In 2005, the WHO Regional Committee for the Western Pacific established 2012 as the target year for measles elimination (resolution WPR/RC56.R8). At its sixty-third session 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 RVC (WPR/RC63.R5). In October 2014, a regional rubella elimination goal was endorsed by the Regional Committee, as one of eight regional immunization goals specified by the Regional Framework for Implementation of the Global Vaccine Action Plan in the Western Pacific (WPR/RC65.R5). Activities towards rubella control have been in place in the Region since 2003. The target date for rubella elimination has yet to be set by the Regional Committee.

Establishing verification processes and criteria for measles has progressed well, and all countries and areas have a national or subregional verification committee (SRVC) and have submitted progress reports to the RVC. Given that all countries in the Western Pacific Region have already incorporated the combined measles- and rubella-containing vaccine (MRCV) into their vaccination schedules and that rubella is less contagious than measles, rubella elimination is feasible within the framework of the regional measles elimination strategies.

Three criteria and five lines of evidence presented below form the basis for verification.

The three criteria are:
1. documentation of the interruption of endemic measles and rubella 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 and rubella since the introduction of measles and rubella vaccines in the national immunization programme;
2. quality of epidemiological and laboratory surveillance systems for measles and rubella;
3. population immunity high enough to achieve and maintain elimination of measles and rubella presented as a birth cohort analysis with the addition of evidence related to the quality of data and data at the subnational level, especially for any marginalized and migrant groups;
4. sustainability of the national immunization programme, including updated strategies and plans of action addressing critical issues to sustain measles and rubella elimination; and
5. genotyping evidence that supports interruption of measles and rubella virus transmission.
With the addition of rubella elimination to the verification process, the criteria and lines of evidence have been updated to include rubella and congenital rubella syndrome (CRS). The structures and functions of the verification bodies (RVC, NVC, SRVC) have been noted, and the advocacy roles of the RVC and NVC have been highlighted. Epidemiological and laboratory surveillance performance criteria have been detailed with definitions and targets, highlighting the inclusion of rubella and CRS indicators for surveillance performance going forward. Of increasing importance is the need to document virus transmission pathways, report genomic sequence data to the global online databases, and effectively link laboratory and epidemiological surveillance data in order to better understand patterns of transmission as the Region moves towards measles and rubella elimination.

NVCs will continue to ensure the development of annual progress reports and coordinate submissions to the RVC so that the RVC may verify progress towards both measles and rubella elimination. For countries that will be achieving verification elimination for both measles and rubella, post-verification considerations have been described and a new more concise reporting form for country submissions have been presented.
Overview of measles and rubella elimination in the Western Pacific Region

1.1 INTRODUCTION

In 2003, the World Health Organization (WHO) Regional Committee for the Western Pacific resolved to eliminate measles and concurrently strengthen routine immunization (resolution WPR/RC54.R3) by urging Member States to offer all children two doses of measles vaccine to achieve and maintain 95% population immunity of each birth cohort in every district. 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 WHO Regional Director for the Western Pacific 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).

In October 2014, a regional rubella elimination goal was endorsed by the Regional Committee, as one of eight regional immunization goals specified by the Regional Framework for Implementation of the Global Vaccine Action Plan in the Western Pacific (WPR/RC65.R5). Activities toward rubella control have been in place in the Western Pacific Region since 2003. Recognizing the urgency of eliminating rubella as well as the wide range of Member State contexts in the Region, the Regional Committee in 2017 decided that all Member States in the Region set a goal of eliminating rubella “as soon as possible”. The RVC also endorsed the Regional Strategy and Plan of Action for Measles and Rubella Elimination.

Establishing verification processes and criteria for measles has progressed well, and all countries and areas have established national or subregional verification committees (SRVCs) and have submitted progress reports to the RVC. Inclusion of rubella elimination verification into the process will enable countries and areas to confirm both measles and rubella elimination and provides guidance to those that have not yet achieved elimination.
1.2 STRATEGIES

The key strategies and activities for measles and rubella elimination described by the *Regional Strategy and Plan of Action for Measles and Rubella Elimination* fall within eight strategic areas:¹

- Overall planning and immunization system
- Immunization
- Epidemiologic surveillance
- Laboratory support
- Programme review and risk assessment
- Outbreak preparedness and response
- Partnership, advocacy, information, education and communications (IEC), and social mobilization
- Progress monitoring and verification of elimination.

**Figure 1.** Confirmed and compatible measles cases by month of rash onset, WHO Western Pacific Region, 2012–2017

Source: Measles and rubella monthly country reports to WHO by 20 September 2017
Includes laboratory confirmed, epi-linked and clinically confirmed cases for 2012

1.3 PROGRESS TOWARDS MEASLES AND RUBELLA ELIMINATION

MEASLES. The Western Pacific Region has made remarkable progress towards achieving its measles elimination goal; however, from 2013 to 2014 there was a resurgence of measles in the Region (Figure 1). Measles incidence was 5.9 cases per million population in 2012, which was a historic low, but increased to 17.7 in 2013 and 44.0 in 2014. The increase in measles cases can be attributed mainly to resurgence of disease in endemic countries and multiple importations (sometimes resulting in large-scale outbreaks) in countries previously with low or no transmission. In several countries, a change in the age distribution of measles cases has been observed, with increases among infants too young to receive the first measles vaccine doses, adolescents and adults. As of September 2016, the RVC has verified seven countries and areas as having achieved measles elimination.

Reported coverage of the first dose of measles-containing vaccine (MCV1) has trended upward since 2003, reaching 96% in 2014, with consistently high coverage (over 95%) since 2009. A total of 35 countries and areas have introduced a routine second dose of measles-containing vaccine (MCV2), increasing since 2011 with a reported coverage of 95% in 2014. All countries in the Region, except Vanuatu, are expected to introduce MCV2 by 2018; the Lao People’s Democratic Republic and Solomon Islands have plans to introduce the vaccine by 2018. Supplementary immunization activities (SIAs) for a wide range of ages have been conducted to close immunity gaps. Over 300 million children have been vaccinated against measles during large-scale SIAs from 2003 to 2015.

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, and the surveillance activities required for measles elimination have continued to improve across the Region through 2014. In 2014, among the suspected cases reported to the WHO Regional
Office for the Western Pacific by 34 countries and areas, 4.2 suspected measles cases per 100,000 population were discarded as non-measles (target ≥ 2.0). In 2014, adequate blood specimens were collected from 84% of suspected measles cases (target ≥ 80%). These results suggested that for the Region, surveillance was sensitive in identifying and appropriately classifying suspected measles cases. However, not all countries achieved the surveillance indicator targets. In 2014, among countries and areas that submitted sufficient data to calculate the indicators, 13 (87%) of 15 achieved the target discarded measles rate and 9 (69%) of 13 achieved the target for adequate specimen collection rate.

**RUBELLA.** Many countries in the Region have made significant progress towards rubella elimination recently and set their own target years for elimination. Since 2010, Japan and Viet Nam have reported the second-largest number of rubella cases in the Region, following China (Figure 2).

All countries in the Region have introduced rubella-containing vaccine (RCV) into their national immunization programmes (NIPs) since 2016; Papua New Guinea, Vanuatu and Viet Nam introduced RCV in 2015. Countries with long-standing RCV programmes have been utilizing the measles elimination platform and provide rubella vaccine in combination with measles vaccine. Among the five countries that have more recently introduced RCV (since 2007), all provide or are in the process of transitioning their programmes to provide combined MRCV. Since 2007, wide age-range catch-up campaigns for measles–rubella have been conducted in seven countries in the Western Pacific Region, in order to quickly increase population immunity.

All countries and areas of the Western Pacific Region conduct case-based, laboratory-supported surveillance for rubella (most as part of integrated measles-rubella surveillance), but one country (China) does not report case-based data to the WHO Regional Office. Only 14 countries and areas reported in their 2015 WHO-UNICEF Joint Reporting Forms (JRFs) that they have CRS surveillance.

Given that most countries in the Region have already incorporated combined MRCV into their vaccination schedules and that rubella is less contagious than measles, rubella elimination is feasible within the framework of the regional measles elimination strategies.

**LABORATORY NETWORK.** The Western Pacific Region measles and rubella laboratory network has grown to include 383 laboratories, including one WHO Global Specialized Laboratory (GSL) in Japan, three WHO regional reference laboratories (RRLs) in Australia, China and Hong Kong SAR (China), 17 fully functional national measles–rubella laboratories including the GSL and RRLs, and, in China, 31 provincial and 331 prefecture laboratories. Almost all network laboratories are accredited.

The capacity to document virus transmission pathways, report genomic sequence data to the global online databases (that is, MeaNS, RubeNS), and effectively link laboratory and epidemiological surveillance data is of growing importance as the Region moves towards measles and rubella elimination.
Core principles for verification of measles and rubella elimination

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

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

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

- National verification committees (NVCs) and the Subregional Verification Committee (SRVC) for the Pacific island countries and areas will collect, analyse and validate national data and also endorse and submit the necessary documentation to the RVC on an annual basis to report progress towards achievement and maintenance of measles and rubella elimination. National secretariats may be formed to assist the NVCs in collecting data and preparing documentation.

- For countries with large populations and decentralized administration of immunization programmes, such as China, the Philippines and Viet Nam, NVCs may assess measles and rubella elimination by a second-level administrative unit, applying the standard criteria and processes applicable to countries. However, since the RVC will determine whether measles and rubella elimination has been achieved or not by the country as a whole, the detailed provincial reports should also be shared with the RVC.

- National and regional elimination will require the interruption of endemic measles and rubella virus transmission for at least 36 months. This is to ensure that the achievement is sustainable and endemic transmission has not occurred. The elimination of measles and rubella may occur at different times, which is likely. As such, the two events will be verified separately and with different time frames.

- Documentation will address the three verification criteria and will be supported by achievement against the indicators within the 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 and rubella elimination. Countries unable to provide data satisfying one or more standard indicators may still be verified as having eliminated measles and rubella as long as the RVC is satisfied that there is sufficient evidence to justify verification.
Standard verification criteria, lines of evidence and indicators

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

3.1 VERIFICATION CRITERIA

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

- documentation of the interruption of endemic measles and rubella virus transmission for a period of at least 36 months from the last known endemic case;
- the presence of verification standard surveillance;2 and
- genotyping evidence that supports the interruption of endemic measles and rubella virus transmission.

3.2 LINES OF EVIDENCE AND INDICATORS

3.2.1 A detailed description of the epidemiology of measles, rubella and CRS since the introduction of measles and rubella vaccines in the National Immunization Programme

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

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

In the setting of measles and rubella elimination, surveillance for measles and rubella must be sufficiently sensitive to detect endemic measles and rubella 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.

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2 Verification standard surveillance includes the following: (i) reporting rate of non-measles, non-rubella cases at the national level of ≥ 2 cases per 100,000 population per year; (ii) > 80% of second administrative level reporting at least two non-measles, non-rubella cases per 100,000 population per year; (iii) > 80% of suspected cases with adequate investigation initiated within 48 hours of notification; and (iv) > 80% of suspected cases with adequate specimen for detecting acute measles and rubella 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 and rubella surveillance sensitivity and quality.
To assist in documenting rubella elimination, evaluating the epidemiology of CRS is critical. Surveillance for CRS complements rubella surveillance, which cannot capture every case due to the frequently mild or asymptomatic presentation. The goals of CRS surveillance are to supplement rubella surveillance to monitor progress to achieve and maintain rubella elimination, and to monitor the impact of immunization programme interventions such as recent introduction of RCV.

A system that includes case-based CRS surveillance with laboratory confirmation, rather than aggregate reporting, is needed to achieve these goals and document rubella elimination. The most common approach used is sentinel-site surveillance; however, enhanced birth defect surveillance, cataract-only surveillance, or national passive surveillance (notification) are alternative approaches that may be more appropriate based on local context. These considerations may include the local rubella epidemiology, immunization history and known population immunity gaps, duration and strength of existing rubella surveillance capacity, as well as other factors, such as the availability of functioning sentinel birth defect-reporting systems that could be leveraged to capture CRS cases. The CRS system must be evaluated (for example, using periodic retrospective medical record review for case finding) to demonstrate that it is well functioning.

Rubella in pregnancy registries complement CRS surveillance systems, but by themselves are insufficient for identifying the majority of CRS cases, as rubella generally causes a mild or asymptomatic clinical illness.

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 and rubella in every district is a fundamental strategy to interrupt endemic measles and rubella virus transmission and to prevent re-establishment of virus transmission following importation of measles or rubella virus. The contributions to population immunity are vaccination coverage (multiplied by vaccine efficacy), natural immunity, maternally acquired immunity and population movements (that is inward or outward migration) from a country or area. Population immunity should be measured and presented by birth cohort and district, with additional evidence related to the quality of vaccination coverage, especially among any marginalized and underserved population groups. In some countries, data quality on cases and coverage will be too poor to enable assessment of the immunity profile.

The quality of information used to determine the susceptibility profile by birth cohort should be assessed or, as much as possible, corroborated by other evidence. An accurate description of vaccine-induced and natural immunity, with the addition of data from special studies if available (for example, coverage or serological surveys), is necessary to assess if there are potential immunity gaps.

3.2.4 Sustainability of NIPs, including the resources for mass campaigns, where appropriate, in order to sustain measles and rubella elimination

An assessment of the sustainability of NIPs is necessary. Political commitment at all levels, efficient programme management, and a favourable economic and legal environment are fundamental requirements to ensure that NIPs are successful. In order to achieve and sustain measles and rubella elimination, the NIP should conduct an annual risk assessment, which should include a review of outbreak epidemiology and an evaluation of population immunity in each district, and should initiate immunization activities to close immunity gaps and/or update the outbreak response plan, as necessary.
### 3.2.5 Genotyping evidence that supports interruption of measles and rubella virus transmission

The genetic characteristics of wild-type viruses are important to verify the absence of endemic measles and rubella virus transmission. The absence of previously endemic measles and rubella viruses for over 12 months is consistent with elimination of measles and rubella. Virological surveillance (genetic sequencing), together with good epidemiological investigations, is important to help differentiate endemic from imported and import-related cases and to determine if and when endemic transmission may be re-established.

### 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 achieve and 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 and rubella. 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 RVC is to correlate and integrate the information from each line of evidence and make an overall determination as to the state of progress towards achieving elimination, whether or not elimination has actually been achieved, and once achieved, whether it was maintained in subsequent annual evaluations.
4.1 RVC AND NVC STRUCTURE

The Regional Verification Commission (RVC), the Subregional Verification Committee (SRVC) for the Pacific island countries and areas, and the national verification committees (NVCs) will work together to verify measles and rubella elimination (Figure 3). The RVC is the only body authorized to verify measles and rubella 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, oversee the collection of relevant data that demonstrate the attainment of measles and rubella elimination, and submit the necessary documentation to the RVC for its consideration.

Figure 3. 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 NIP or epidemiologic and laboratory-based, vaccine-preventable disease (VPD) surveillance. In addition, the individuals should not have any direct responsibility in connection with achieving the goal at the national or regional levels. Members should be senior subject-matter experts with different areas of expertise such as epidemiology, paediatrics, public health practice or virology.

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 serve a term of two years, with 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 are appointed by their respective ministries of health in accordance with official national procedures. 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 or virology. NVC members should also periodically provide signed declaration of interest form to prevent potential conflicts of interest.
As the 21 Pacific island countries and areas are considered one epidemiological block for the purpose of verification of measles and rubella elimination, an SRVC has been formed in the same manner as that for the certification of polio-free status. SRVC members are appointed by the WHO Regional Director for the Western Pacific and 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 links 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 VPD surveillance units, to provide necessary evidence of measles and rubella 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, for assistance in drafting or presubmission reviews of reports.
Mechanism of verification

The authority to verify measles and rubella elimination is vested solely in the RVC, which will annually review and verify progress towards, achievement of, and maintenance of measles and rubella elimination in countries and areas, the Pacific subregion and eventually for the Region as a whole.

The SRVC and NVCs will similarly assess measles and rubella 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 VPD surveillance units with respect to requirements to verify measles and rubella elimination. In this respect, the RVC, SRVC and NVCs will serve as de facto advisory bodies on fulfilling verification criteria and the lines of evidence. The RVC will contribute its evolving knowledge to global measles and rubella eradication efforts. The RVC evaluates updates and changes recommended by the Strategic Advisory Group of Experts on Immunization on verification criteria and recommends changes to the regional process based on the global strategy. Guidance provided by RVC, SRVC and NVC members should be consistent with the recommendations of the WHO Western Pacific Region TAG on immunization and VPDs. The TAG should be consulted by the RVC in the event of discrepant technical opinions while the RVC should be consulted by the SRVC or any NVC in the event of discrepant technical opinions. In addition to their normative, verification and advisory functions, members of the RVC, SRVC and NVCs may also serve an advocacy role to strengthen measles and rubella elimination activities and promote the documentation and verification process.

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 and rubella elimination first by country or area, the Pacific subregion and eventually for the Region as a whole;
- to establish criteria and procedures required for the verification of measles and rubella elimination in the Region;
- to contribute to the formulation and endorsement of guidelines on verification of measles and rubella elimination in the Region;
- to provide guidance to national and/or subnational measles and rubella elimination verification committees and conduct field visits when needed, in close consultation with the Secretariat (WHO Regional Office);
- to advise the NVCs on various issues related to verifying measles and rubella elimination and to provide feedback about RVC conclusions and recommendations; and
- to advocate measles and rubella elimination in collaboration with WHO, NVCs and the SRVC.
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 in 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 then shares the 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, NIPs and VDP surveillance units on the requirements for verification of measles and rubella elimination;
- to compile or review and analyse relevant information to monitor progress towards measles and rubella elimination and assess if the country, area or subregion has eliminated endemic measles and rubella 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/area/subregion 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 provide programmatic guidance consistent with verification criteria and lines of evidence; and
- to advocate for measles and rubella elimination in collaboration with the RVC and WHO.

5.2.1 Management function of SRVC/NVC chairs

The chairs of the SRVC and NVCs serve to fulfil 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 ensure preparation of reports for submission to the RVC;
- to preside over SRVC/NVC meetings, which are to be held at least once 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 play active roles in raising awareness of and demonstrating commitment to measles and rubella 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. Advocating for and participating in a national measles and rubella elimination review may contribute in raising awareness of and commitment to measles and rubella elimination.
Documentation of verification

Documentation of verification of measles and rubella elimination aims to provide convincing and well structured evidence to demonstrate that a country has met the verification criteria for measles and rubella elimination and the country is able to sustain their achievements. Countries must provide evidence that they have interrupted endemic measles and rubella 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 and rubella elimination, each country’s NVC or the SRVC should prepare an annual progress report to show their achievements and status against the essential criteria and lines of evidence to support elimination—current measles, rubella and CRS epidemiology, surveillance performance, population immunity, sustainability and genotyping (see Section 3.2), and provide additional evidence when required.

Pacific island countries and areas will be considered one epidemiological block for verification of measles and rubella elimination, and will prepare and submit one joint annual progress report, as was done for certification of polio-free status in the Pacific subregion.

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 or rubella. The first annual progress reports were submitted during the third quarter of 2013. Subsequent progress reports should provide updates to the first reports on the progress towards, achievement of or maintenance of elimination, but should be complete and include all relevant information and supplements.

When a country, area or the Pacific subregion is confident that it has achieved the verification criteria for measles or rubella elimination, it may request official recognition of this achievement. The country or subregion’s progress reports are official verification documents to be assessed by the RVC.

The level of detail and focus of attention in each annual NVC report should change from year to year, depending on the respective status of measles and rubella elimination in a given country and area. A reporting template with specific guidance on reporting requirements will be updated and provided annually to NVCs by the WHO Secretariat. The report is meant to ease the burden of reporting by NVCs or the SRVC and allow the RVC to more efficiently monitor maintenance of elimination status in countries in the Region. If transmission of measles or rubella becomes re-established, a complete pre-verification progress report, and not the shortened post-verification report, must be submitted for that disease.

During annual meetings, the RVC will review all reports and provide feedback and recommendations to governments through the SRVC or NVCs.

6.1.1 Contents of the annual progress report

An annual progress report should include the following components:

- NVC/SRVC or NIP response to the recommendations provided by the RVC;
- background information, including a summary of basic relevant programme information, including vaccine schedule and history;
• detailed description of the epidemiology of measles, rubella and CRS since the introduction of the measles and rubella vaccines in the NIP;
• quality of epidemiological and laboratory surveillance systems for measles and rubella, including the standard surveillance performance indicators;
• population immunity presented as a birth cohort analysis at the subnational level, when available, with the addition of evidence related to any underserved or marginalized groups (methodology for calculating vaccination coverage and an evaluation of quality of coverage data should be included);
• sustainability of the NIP including the resources for mass campaigns, where appropriate, in order to close known immunity gaps and sustain measles and rubella elimination;
• genotyping evidence that supports measles and rubella virus transmission is interrupted;
• NVC/SRVC plan including activities, timeline and expected outcomes; and
• validation, comments, conclusions and recommendations provided by the NVC/SRVC.

6.1.2 Data analysis by subnational levels

The verification process will require analysis of data for measles and rubella epidemiology and surveillance performance at the second administrative level and for vaccination coverage at the third administrative level.

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

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

To facilitate the preparation of the annual progress report, the components outlined in the following section (6.2) should be reviewed and followed when compiling the report.

6.2 DETAILS OF EACH COMPONENT OF THE ANNUAL PROGRESS REPORT

6.2.1 Summary of response to recommendations by the previous RVC meeting

A point-by-point description that summarizes how the recommendations from the last RVC meeting were implemented by the NIP, or by the NVC in preparing the current year’s report should be submitted.

6.2.2 Background information

The following information is valuable for assessing the epidemic risks: (1) geography, and (2) demography: population size/density, age distribution and migration statistics.

The annual progress report should aim to include background information of measles and rubella control/elimination in the country. This should include the years of introduction of MCV1, MCV2, RCV1 and RCV2, the current immunization schedule for MCV and RCV and historic changes (if any, including vaccination of adolescent and adult females), evolution of strategies for controlling and eliminating measles and rubella, relevant surveillance systems and establishment of case-based measles and rubella-related surveillance. If available, the structure and function of CRS surveillance in the country should also be well described and information from any special studies (for example, identifying CRS cases through review of rubella in pregnancy registries or retrospective medical record searches for CRS cases) should be included in the report. 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 the more useful it will be.
Countries should provide a description of high-risk population groups (for example, migrants) or high-risk areas (for example, border areas with measles and rubella endemic countries) as part of the background information.

6.2.3  A detailed description of the epidemiology of measles and rubella since the introduction of measles and rubella vaccine in the NIP

This section requires graphs of measles and rubella cases and/or incidence (in cases per million population) since the year measles and rubella data became available, and immunization interventions undertaken at specific years, for example, routine immunization coverage, catch-up or follow-up SIAs. This information is already available for measles from various presentations or reports, but full details on rubella should be included and this will need to be updated annually, as appropriate.

The following should be included:

- A thorough analysis of recent measles and rubella epidemiology is critical. This can be presented using maps and graphs. The WHO Measles Elimination Country Profiles provide good examples.
- Detailed descriptions should be provided of all cases by case classification and source of infection, and detailed information on measles and rubella outbreaks and their underlying causes are essential.
- Information on CRS cases and epidemiology should be included. CRS-specific data elements consist of the following: number of CRS cases over the time period of evaluation; annual incidence per 10,000 live births if available; final case classification; demographic characteristics of mothers; number of cases by year of birth; and importation status of cases.
- All countries are expected to provide data from the second administrative level.
- Some countries may even be able to provide data from the third administrative level.
- For countries with larger populations, there may be a need for analysis that groups provinces based on their similarities, for example measles- and rubella-free status, measles and rubella epidemiology, such as age distribution, or performance of immunization systems.

Additional guidance on describing cases and outbreaks:

- Detailed description of characteristics of measles and rubella cases by classification, for example laboratory-confirmed, epidemiologically linked and clinically compatible. Each country should provide a detailed description of measles and rubella cases by classification that is laboratory-confirmed, epidemiologically linked and clinically compatible for the current year of the report, or for the last year for which measles and rubella cases were reported. In describing incidence, it is necessary to classify confirmed measles and rubella cases by source of infection and by method of confirmation (Table 1). Every confirmed measles and rubella case should meet one of the cells in Table 1. Definitions of these terms are presented at the beginning of this document.
- Measles and rubella elimination status will be determined ultimately by the absence of endemic measles and rubella 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 possibly endemic. When the number of confirmed cases of unknown origin (that is, cells C and D) is greater than 20%, the quality of surveillance and the ability of a country to confidently determine the absence of endemic measles and rubella virus transmission may be questioned. 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. Thus, cells E, F, G and H, corresponding to these sources of infection and depicted in green, indicate a variable number of cases.
- In addition to maps showing location (province, district or more precise locality) of confirmed cases, tables and bar charts indicating age distribution and vaccination status of cases by year
of birth 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, such as infants and older adults, and the percentage of cases that were previously vaccinated, usually with a single measles-containing vaccine (MCV) dose, is likely to increase.

• For high-quality information on measles and rubella outbreaks, countries are expected to provide detailed descriptions of any recent measles and rubella outbreaks including response actions and outcomes to these responses, as well as lessons learnt, and plans to address programmatic gaps, if identified. At a minimum, the following information should be included by year for outbreaks: number of outbreaks, number of outbreak-related cases, median number (or range) of cases in the outbreaks, genotypes identified, and median (or range) duration of the outbreaks. Date of rash onset is the only appropriate date to illustrate the timeline of cases and should be used in all tables and figures. For outbreak response, the following information should be included: date of rash onset for the index case, age groups affected, SIA target age and number of children, and number vaccinated by age group. In addition, information on the method of measurement of SIA coverage should also be included (reported, rapid convenience monitoring or representative post-SIA survey).

• Where appropriate, spot maps of outbreaks may be prepared that indicate the index cases separately from secondary, tertiary and subsequent generations of cases, as well as the source of infection. Mapping activities should carefully consider the data shown; consider presenting both place of residence and probable site of infection. Consistent decreases in case numbers and geographic spread of measles and rubella virus over consecutive time intervals can help confirm progress towards, and eventual achievement of, measles and rubella elimination. For outbreaks, the map may include facilities or events determined to be related to measles and rubella 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 populations. An example is “The Face of Measles Transmission in High-Risk Communities” in the Measles Elimination Field Guide.

• For the source of infection for measles, rubella and CRS cases, analysis on the source and method of measles, rubella and CRS case confirmation, as summarized in Table 1, should be included. Epidemiological curves can be colour-coded based on cases that are endemic, unknown, imported and import related; by genotype; or by cluster.

• To prove the independence of disease events, one relies on detailed epidemiologic investigation. Cases of the same genotype with a gap of two or three incubations periods cannot be considered separate events without documented evidence of importation (epidemiologic history or genotype). If such a gap occurs additional fieldwork and case finding are required to determine whether any cases were overlooked or misclassified. Further investigation of known and newly identified suspected cases with clinically-compatible disease should attempt to link with known cases. A second specimen sample should be collected, if the first specimen was taken within the first four days of rash onset, as IgM tests are often negative during this time.

• Detailed description of the characteristics of clinically measles compatible and clinically rubella compatible cases. When countries are approaching elimination and measles and rubella
surveillance performs well, that is, adequate case investigations with contact tracing routinely performed and adequate specimens routinely collected, the number of clinically measles- and rubella-compatible cases should be small. It should be remembered that clinically measles-compatible cases were reported from 2013 onward (clinically confirmed cases before 2013).

The following should be described:

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

Additional tips on presenting interpreting measles epidemiology as elimination is approached or achieved are available at: http://www.sciencedirect.com/science/article/pii/S0264410X14014510

Durrheim DN, Crowcroft NS, Strebel PM. Measles – the epidemiology of elimination.

Table 1. Classification of measles, rubella and CRS cases

<table>
<thead>
<tr>
<th>Source</th>
<th>Number Confirmed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Laboratory</strong></td>
<td><strong>Epidemiological linkage</strong></td>
</tr>
<tr>
<td>Endemic</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Unknown</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>Imported</td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td>Imported-related</td>
<td>G</td>
<td>H</td>
</tr>
</tbody>
</table>

Please note:
- When graphing, that the y-axis should preferrable be the number of cases.
- Do NOT use cumulative number of cases or incidence rates.
- All cases should be categorized as per final classification (laboratory confirmed, epi-linked confirmed, clinically measles compatible or discarded) and by source of infection (imported, import related, endemic or unknown).
Example Figures A and B. Summarizing epidemiology of measles over time, two country examples

1971 - Measles vaccine (MV) widely available
1982 - MV to MM
1989 - MM to MMR
1993 - 2nd dose of MMR introduced for 10-14-year-olds
1998 - Measles Control Campaign
2nd dose of MMR lowered to 4-5 years of age
2001 - Catch-Up Programme for adolescents and adults
2nd dose of MMR lowered to 4 years of age
2004 - Measles national case definition adopted

Before 1990, one dose MCV at 9 months
1990-1994, 2 doses MCV at 9 months and 15 months
1994-2003, 3 doses MCV at 9m, 15m and Pre-school
From 2003, 2 doses MCV at 12 months and 18 months
Tables showing cases classified as per final classification and origin of infection by year, two country examples:

**Example Table A.** Measles notifications by confirmation method and detected genotype, 2008-2012

<table>
<thead>
<tr>
<th>Year</th>
<th>Laboratory</th>
<th>Epi-linked</th>
<th>Total</th>
<th>Measles Rate per 1 000 000 population</th>
<th>Detected Genotypes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>B3</td>
<td>D4</td>
</tr>
<tr>
<td>2008</td>
<td>60</td>
<td>5</td>
<td>65</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>90</td>
<td>15</td>
<td>105</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>62</td>
<td>7</td>
<td>69</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>2011</td>
<td>164</td>
<td>30</td>
<td>194</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>179</td>
<td>20</td>
<td>199</td>
<td>9</td>
<td>5</td>
</tr>
</tbody>
</table>

**Example Table B.** Measles notifications by source of infection and confirmation method, 2009-2012

<table>
<thead>
<tr>
<th>Source of Infection</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lab</td>
<td>Epi-linked</td>
<td>Lab</td>
<td>Epi-linked</td>
</tr>
<tr>
<td>Endemic</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unknown</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Imported</td>
<td>34</td>
<td>2</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>Import-related</td>
<td>51</td>
<td>13</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>Total cases</td>
<td>105</td>
<td>69</td>
<td>194</td>
<td>157</td>
</tr>
<tr>
<td>Total imported and import-related cases [% of total cases]</td>
<td>100 (95%)</td>
<td>67 (97%)</td>
<td>115 (59%)</td>
<td>198 (99%)</td>
</tr>
</tbody>
</table>

**Example Table C.** Classification of sources of infection for measles cases, 2008–September 2013

<table>
<thead>
<tr>
<th>Source of Infection</th>
<th>Endemic</th>
<th>Imported</th>
<th>Import-related</th>
<th>Unknown</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1 (50.0)</td>
<td>1 (50.0)</td>
<td>-</td>
<td>-</td>
<td>2 (100.0)</td>
</tr>
<tr>
<td>2009</td>
<td>15 (88.2)</td>
<td>2 (11.8)</td>
<td>-</td>
<td>-</td>
<td>17 (100.0)</td>
</tr>
<tr>
<td>2010</td>
<td>94 (82.4)</td>
<td>1 (0.9)</td>
<td>-</td>
<td>19 (16.7)</td>
<td>114 (100.0)</td>
</tr>
<tr>
<td>2011</td>
<td>-</td>
<td>3 (7.0)</td>
<td>32 (74.4)</td>
<td>8 (18.6)</td>
<td>43 (100.0)</td>
</tr>
<tr>
<td>2012</td>
<td>-</td>
<td>2 (100.0)</td>
<td>-</td>
<td>-</td>
<td>2 (100.0)</td>
</tr>
<tr>
<td>2013</td>
<td>-</td>
<td>2 (2.3)</td>
<td>84 (96.6)</td>
<td>1 (1.1)</td>
<td>87 (100.0)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>110 (41.5)</td>
<td>11 (4.2)</td>
<td>116 (43.8)</td>
<td>28 (10.5)</td>
<td>265 (100.0)</td>
</tr>
</tbody>
</table>
**Example Figure C.** Graphics displaying details by time, space and genotype for outbreak-related cases and for those with unknown source, to provide evidence that there is no endemic or re-established transmission.

**Example Table D.** Measles cases with an unknown source of infection by geographical area and year of diagnosis.

<table>
<thead>
<tr>
<th>State</th>
<th>Statistical Division (SD)</th>
<th>Statistical Sub-division (SSD)</th>
<th>Local Government Area (LGA)</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013*</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW</td>
<td>Sydney</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inner Sydney</td>
<td>Sydney (C)</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Marrickville (A)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eastern Suburbs</td>
<td>Woollahra (A)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Randwick (C)</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>St. George-Sutherland</td>
<td>Rockdale (C)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hurstville (C)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inner Western Sydney</td>
<td>Ashfield (A)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central Western Sydney</td>
<td>Holroyd (C)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Parramatta (C)</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blacktown</td>
<td>Blacktown (C)</td>
<td></td>
<td></td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outer South</td>
<td>Campbelltown (C)</td>
<td></td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Western Sydney</td>
<td>Camden (A)</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Canterbury-Bankstown</td>
<td>Canterbury (C)</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Northern Beaches</td>
<td>Manly (A)</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central Northern Sydney</td>
<td>Hornsby (A)</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central Coast</td>
<td>Gosford (C)</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example Figure D. Measles cases of unknown source by infectious period by local government area, 1 June - 30 November 2011

Example Figure E. Epidemic curve of measles cases, by epidemiologic cluster and importation status.
Figures displaying province-specific case counts and per cent of total cases by age group:

**Example Figure F.** Case number and proportion by age group by province, 2014–2015

6.2.4 Quality of epidemiological and laboratory surveillance systems for measles, rubella and CRS

In order to verify measles and rubella elimination, it will be necessary to determine whether the national surveillance system provides timely and sufficient information based on pre-established quality criteria. It is essential that all countries carry out complete and timely monthly reporting and share case-based measles, rubella and CRS surveillance data with the WHO Regional Office for the Western Pacific. Countries should demonstrate a functional CRS surveillance system. If there is no surveillance in place, countries should first establish CRS surveillance at sentinel sites. Such facilities will generally be secondary- or tertiary-care facilities (that is, most likely to treat infants with cataracts, heart defects or hearing impairment). CRS surveillance allows for detection of infants with clinically apparent manifestations and can be standardized for regional and global reporting and comparison.

The following should be included:

- A detailed description of the design and extent of case-based surveillance for measles and rubella, in terms of specific population covered, representativeness, and sources of case reporting.
- Epidemiological and laboratory surveillance quality-performance indicators for measles and rubella, as shown in Table 2.
- Analysis at the subnational level, for example, the provincial level, against standard epidemiological surveillance performance indicators.
• A detailed description of the CRS surveillance system, including how cases are identified, confirmed and reported:
  - A list of suspected CRS cases, as well as their final classification (confirmed, suspected or discarded), supports the sensitivity of the surveillance system.
  - Periodic retrospective searches for suspected CRS cases should be conducted when the standard surveillance system does not detect many suspect cases. Here record review and alternative sources of information are helpful to provide evidence that if there were suspected cases they would have been reported.
• Description of the algorithm for testing of laboratory specimens (see additional guidance below).
• If there are surveillance and laboratory gaps, the report should include information on actions taken to identify and address them.
• Information on the quality of measles and rubella epidemiological and laboratory surveillance can be presented using a similar structure to that in the Measles Elimination Country Profile.

Table 2. Measles and rubella surveillance performance indicators

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>TARGET</th>
<th>YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EPIDEMIOLOGIC SURVEILLANCE INDICATORS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timeliness of reporting (to national level)</td>
<td>≥ 80%</td>
<td></td>
</tr>
<tr>
<td>National reporting of discarded measles or rubella cases</td>
<td>≥ 2 per 100 000</td>
<td></td>
</tr>
<tr>
<td>% of second-level administrative units reporting ≥ 2/100 000 discarded measles or rubella cases</td>
<td>≥ 80%</td>
<td></td>
</tr>
<tr>
<td>% of suspected cases with adequate investigation*</td>
<td>≥ 80%</td>
<td></td>
</tr>
<tr>
<td>% of suspected cases with adequate blood specimens~</td>
<td>≥ 80%</td>
<td></td>
</tr>
<tr>
<td>% of specimens received at laboratory within five days of collection</td>
<td>≥ 80%</td>
<td></td>
</tr>
<tr>
<td>% of outbreaks with specimens for virus detection</td>
<td>≥ 80%</td>
<td></td>
</tr>
<tr>
<td><strong>LABORATORY INDICATORS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of national measles-rubella laboratories (NMLs) that are WHO-accredited***</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>% of laboratories (government and private) that conduct diagnostic testing and are quality-accredited</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>% of specimens with results within four days of receipt</td>
<td>≥ 80%</td>
<td></td>
</tr>
<tr>
<td>% of virus detection and genotyping completed within two months of receipt</td>
<td>≥ 80%</td>
<td></td>
</tr>
</tbody>
</table>

* 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.

~ Adequate specimens include: a blood sample by venipuncture in a sterile tube with a volume of 5 millilitres (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 using 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.

*** WHO measles laboratory accreditation criteria include (i) and annual proficiency test results ≥ 90%; (ii) at least 90% concordance of NML with RRL confirmatory testing; (iii) passing on-site inspection.
Additional guidance on describing surveillance quality:

- 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 and rubella surveillance sensitivity and quality.
- Countries where substantial numbers of measles or rubella cases present in the private sector 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 allow the RVC to interpret more accurately the reported data on surveillance performance, a description of the algorithm for testing of laboratory specimens should be noted in the report. For example, in most countries, sera will be taken and tested for measles immunoglobulin M (IgM) first and then for rubella IgM if negative for measles IgM. However, some countries do parallel testing for measles and rubella (testing specimens for both viruses) or the testing protocol may be modified if there is an ongoing rubella outbreak.
- Based on global guidance, verification standard surveillance (see Section 3.1) consists of indicators that are a subset of the surveillance indicators recommended by the WHO Regional Office for the Western Pacific (see Section 3.1) and consist of: (i) national and subnational reporting rates of at least two non-measles, non-rubella cases per 100 000 population; (ii) adequate investigation of at least 80% of suspected cases; (iii) adequate specimen collection from at least 80% of suspected cases (excluding epidemiologically linked cases); and (iv) adequate specimens for virus detection from at least 80% of laboratory-confirmed chains of transmission.

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

The estimation of population immunity depends on methodologies for calculating and determining the quality of the target population, vaccinated population and vaccination coverage; vaccine efficacy; natural immunity; maternally acquired immunity; and population movements (that is, inward or outward migration) from a country or area (the latter two usually are not available). Successful elimination requires ensuring adequate immunity in all people within a country’s borders. It is important to include all people in the denominators of these analyses.

A detailed analysis demonstrating that high immunity levels have been achieved is one of the critical elements of information presented in the report. These data will need to be provided by third administrative level by each country. Estimates of population immunity may be available from administrative vaccination coverage, using the measles strategic planning (MSP) tool, or results of national or subnational serosurveys. When using the MSP tool, the parameters used for modelling should take into account methodologies for calculating vaccination coverage, quality of administrative coverage in terms of numerator and denominator, availability of coverage survey data, and availability of estimates that account for correction of the reported coverage based on surveys and studies and/or known factors that could cause over- or under-reporting of coverage. MSP modelling could be conducted using different sources of coverage data and the model that best fits the observed age distribution of cases should be selected. It is important that all evidence supporting levels of population immunity is provided because all current methods for estimation have limitations.

An accurate description of vaccine-induced and natural immunity by individual birth cohort and sex beginning from the year when measles (or rubella) 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 that potentially have less access to vaccination.
services, including migrants, urban or rural poor, and people in remote areas. 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. For countries that are being verified for measles elimination despite presence of immunity gaps, the population immunity profile should be used to elaborate on the “risk of measles reintroduction”. The following should be included:

- methodologies for calculating target population, vaccinated population and vaccination coverage by each level (health centre, district, province and country);
- detailed information on domestic and international migration;
- consideration/evaluation of quality of vaccination coverage at each level and the representativeness of the reported vaccination coverage to population immunity by level;
- a graph (or graphs) showing national MCV and RCV coverage, measles and rubella cases, and timing of SIAs over a period of time (the graph should show trends over a number of years, for example, 10 years, if available;
- a graph (or graphs) showing number and percent vaccinated with MCV1, MCV2, MCV-SIA and RCV and RCV-SIA by the year of birth, and by sex if previous vaccination policies were sex-specific;
- maps showing district MCV and RCV coverage over a number of years for which the data are available;
- a summary of SIAs should be presented, including target population, target age group, geographic areas (national or subnational), implementation dates and implementation status (number of people immunized, reported coverage);
- number of children without vaccination history who were vaccinated in each MCV-SIA.
- results of coverage surveys conducted to assess routine or supplemental immunization, including serosurveys to assess population immunity;
- if available, results of coverage surveys, serosurveys and registries to assess RCV coverage among women of reproductive age;
- if feasible, analysis on immunity level by birth cohort and sex is encouraged; an example can be found in the country profiles;
- vaccination activities for protecting adolescents and adults against measles and rubella infection, for example, number of adolescents and adults vaccinated with measles- and rubella-containing vaccines by year of birth; and
- assessment or consideration on the risk of large-scale outbreaks following importation, which may include assessment of the infrastructure for maintaining vaccine potency as well as an analysis of any gaps that may have compromised population immunity.

Additional guidance on assessing population immunity by data source:

- Administrative coverage estimates: Annual administrative reports of routine vaccination coverage with MCV1 and MCV2 and SIA coverage as reported in the WHO/United Nations Children’s Fund (UNICEF) Joint Reporting Form (JRF) on Immunization, as well as annual WHO/UNICEF estimates of national coverage that sometimes differ from reported administrative coverage, as well as other estimates of coverage based on assumptions available at the country level. The analysis should be available to the third administrative level.
- Population-based surveys: Population-based surveys of routine immunization and SIA coverage surveys are also useful and include WHO 30×7-cluster surveys, surveys conducted with the updated WHO methodology, demographic and health surveys, and UNICEF-sponsored multiple indicator cluster surveys. However, limitations of population-based surveys may include lack of representativeness of all geographic areas (for example, districts) and strata of society, as well as an inability to definitively identify all large pockets of susceptible individuals. Data
from rapid coverage assessments, usually conducted following mass vaccination campaigns, may be an additional source of information to assess local-level coverage.

- 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, the precision of the age and gender-specific estimates and the representativeness of the survey if it is dependent on opportunistic laboratory specimens.

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

**EXAMPLES**

Displaying population immunity by birth cohort, three country examples:

**Example Table E.** Routine vaccination coverage of MCV, 2006-2012

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of birth cohorts</th>
<th>No. of targeted</th>
<th>No. of vaccinated</th>
<th>Reported coverage</th>
<th>Estimated coverage</th>
<th>No. of targeted</th>
<th>No. of vaccinated</th>
<th>Reported coverage</th>
<th>Estimated coverage</th>
<th>Notes on changes of immunization schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>47376</td>
<td>44690</td>
<td>44218</td>
<td>98.9%</td>
<td>-</td>
<td>43628</td>
<td>41829</td>
<td>95.9%</td>
<td>-</td>
<td>Measles</td>
</tr>
<tr>
<td>2007</td>
<td>55774</td>
<td>47218</td>
<td>46445</td>
<td>98.4%</td>
<td>-</td>
<td>44370</td>
<td>42972</td>
<td>96.8%</td>
<td>-</td>
<td>2009</td>
</tr>
<tr>
<td>2008</td>
<td>63262</td>
<td>57844</td>
<td>56076</td>
<td>96.9%</td>
<td>-</td>
<td>49276</td>
<td>47450</td>
<td>96.3%</td>
<td>-</td>
<td>2009</td>
</tr>
<tr>
<td>2009</td>
<td>68762</td>
<td>15124</td>
<td>14524</td>
<td>96.0%</td>
<td>-</td>
<td>15482</td>
<td>14920</td>
<td>96.4%</td>
<td>-</td>
<td>2009</td>
</tr>
<tr>
<td>2010</td>
<td>65889</td>
<td>65993</td>
<td>63946</td>
<td>96.9%</td>
<td>-</td>
<td>55157</td>
<td>52345</td>
<td>94.9%</td>
<td>-</td>
<td>2010</td>
</tr>
<tr>
<td>2011</td>
<td>70576</td>
<td>62061</td>
<td>60866</td>
<td>98.1%</td>
<td>-</td>
<td>60433</td>
<td>59448</td>
<td>98.4%</td>
<td>-</td>
<td>2011</td>
</tr>
<tr>
<td>2012</td>
<td>74778</td>
<td>67924</td>
<td>67130</td>
<td>98.8%</td>
<td>-</td>
<td>57177</td>
<td>56208</td>
<td>98.3%</td>
<td>-</td>
<td>2012</td>
</tr>
</tbody>
</table>
Example Figure G. Population immunity by birth cohort, by source of immunity

Example Figure H. Sera with positive or equivocal results, by birth cohort and serosurvey
6.2.6  **Sustainability of the NIP, including the resources for mass campaigns, where appropriate, in order to sustain measles and rubella elimination**

Although previous country progress reports have focused on sustainability of measles elimination, in the 2016 and subsequent annual progress reports it is important to describe sustainability in the context of an integrated national programme for elimination of both measles and rubella.

This section of the report should provide the national action plans and financing for achieving and sustaining measles and rubella elimination, and evidence of monitoring and reviewing progress against plans. The objective of this part of the report is to highlight that the NIP will contribute to the essential elements of achieving the verification of measles and rubella elimination, as well as to maintaining elimination.

Examples of indicators for NIP sustainability include:

- NIP strategic plan updated and disseminated;
- provincial strategic plan for measles and rubella elimination (countries with large populations, for example, > 50 million);
- standard operating procedures written and disseminated;
- annual risk assessments at the subnational level for larger countries;
- details on outbreak response plans and preparedness;
- details on immunization strategies for adolescents and adults, and any other identified immunity gaps;
- details on strategies/national policies that will accelerate/sustain measles elimination and their implementation, for example reducing nosocomial infection and transmission;
- zero stock-outs of MCV and RCV at the peripheral level;
- 100% of funding for MCV and RCV secured by government; and
- monitoring systems for measuring public acceptance of vaccination.

6.2.7  **Genotyping evidence that supports interruption of measles and rubella virus transmission**

Since genetic characteristics are used to verify the absence of endemic measles and rubella virus transmission, countries are expected to provide measles and rubella virus genotyping information, including historically endemic and recent measles and rubella virus strains. The molecular data can help to provide an understanding as to whether elimination has been achieved by documenting the interruption of transmission of endemic viruses, provided that they are fully integrated with epidemiological case-based data.

The following should be included:

- Genotype and number of measles and rubella virus strains identified by year and month, for all years since genotyping became available, but with a focus on the most recent five years in support of achieving measles and rubella elimination.
- Other information such as genotyping of cases by date of onset, location and importation history should be included, when available.
- Provide the sequence name of matches in the MeaNS or RubeNS database, using the exact match strain, or if available, the named strains for measles.
- For measles only, the detection of variant lineages within a genotype should be described and the sequence differences presented as a phylogenetic tree or distance table. Sequence variants should be linked to closely related sequences in MeaNS.

National reference laboratories should report all genomic sequence data to the global online databases:

- MeaNS: WHO Measles Nucleotide Surveillance online database (http://www.who-measles.org)
- RubeNS: WHO Rubella Nucleotide Surveillance online database (http://www.who-rubella.org)
EXAMPLES

Displaying genotyping data on a timeline:

Example Figure I. Weekly distribution of measles genotype B3, D4, D5, G3 and H1, 2008-2012

[Bar chart showing weekly distribution of measles genotypes over years 2008 to 2012]

Example Figure J. Displaying genotyping data on maps to show the physical locations of various outbreaks and/or correlated with data from phylogenetic trees (for countries that have access to laboratories with this capacity), 2006–2013

[Map showing physical locations of outbreaks with different colored dots for each genotype]
Example Figure K. Phylogenetic tree of measles virus isolated, 2006-2013
**Example Figure L.** Measles cases caused by genotype D9 virus by month

[Image of a graph showing measles cases by month for 2013 and 2014.]

**Example Figure F.** Lineages of measles viruses detected in a single country during 2014. Strains from the United State of America are listed in the left column. Strains with exact matches in N-450 are listed on the right column. Named lineages (from MeaNS) are shown in red. NEM refers to no exact match.

<table>
<thead>
<tr>
<th>Measles Representative Strain</th>
<th>Gen.</th>
<th>Number of Strains</th>
<th>MeaNS Exact Match</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVs/New York.USA/15.14/2</td>
<td>B3</td>
<td>+4 identical strains</td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/Missouri.USA/22.14</td>
<td>B3</td>
<td>+4 identical strains</td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/Michigan.USA/48.14/1</td>
<td>B3</td>
<td>+4 identical strains</td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/Alaska.USA/37.14/ (CDC_COE-2014-173)</td>
<td>B3</td>
<td></td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/California.USA/4.14/ (CDC_COE-2014-3)</td>
<td>B3</td>
<td></td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/California.USA/6.14/1 (CDC_COE-2014-9)</td>
<td>B3</td>
<td></td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/California.USA/8.14/3 (CDC_COE-2014-18)</td>
<td>B3</td>
<td>+2 identical strains</td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/New York.USA/8.14/6 (CDC_COE-2014-24)</td>
<td>B3</td>
<td></td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/California.USA/5.14/ (CDC_COE-2014-7)</td>
<td>B3</td>
<td>+81 identical strains</td>
<td>MVi/Harare.ZWE/38.09/</td>
</tr>
<tr>
<td>MVs/Kosrae.FSM/21.14/2</td>
<td>B3</td>
<td>+69 identical strains</td>
<td>MVi/Harare.ZWE/38.09/</td>
</tr>
<tr>
<td>MVs/Kosrae.FSM/21.14/4</td>
<td>B3</td>
<td></td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/Pohnpei.FSM/28.14/2</td>
<td>B3</td>
<td></td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/Chuuk.FSM/34.14</td>
<td>B3</td>
<td></td>
<td>NEM</td>
</tr>
<tr>
<td>Measles Representative Strain</td>
<td>Gen.</td>
<td>Number of Strains</td>
<td>MeaNS Exact Match</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------</td>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>MVs/Indiana.USA/30.14/</td>
<td>H1</td>
<td>+1 identical strains</td>
<td>MVs/Liaoning.CHN/23.14/2, MVs/Hong Kong.CHN/49.12</td>
</tr>
<tr>
<td>MVs/California.USA/1.14/</td>
<td>H1</td>
<td></td>
<td>MVs/Tianjin.CHN/22.14/4, MVs/Shanghai.CHN/20.14/6, MVs/Anhui.CHN/19.14/8</td>
</tr>
<tr>
<td>MVs/Texas.USA/26.14/</td>
<td>H1</td>
<td></td>
<td>MVs/Hong Kong.CHN/42.11/</td>
</tr>
<tr>
<td>MVs/Ohio.USA/28.14</td>
<td>D9</td>
<td></td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/Ohio.USA/16.14/1</td>
<td>D9</td>
<td>+37 identical strains</td>
<td>MVs/Hong Kong.CHN/08.14/2</td>
</tr>
<tr>
<td>MVs/Washington.USA/12.14/5</td>
<td>D8</td>
<td>+2 identical strains</td>
<td>MVs/Taunton.GBR/27.12/</td>
</tr>
<tr>
<td>MVs/California.USA/4.14/2</td>
<td>D8</td>
<td></td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/California.USA/8.14/</td>
<td>D8</td>
<td></td>
<td>NEM</td>
</tr>
<tr>
<td>MVs/Hawaii.USA/43.14/3</td>
<td>D8</td>
<td>+2 identical strains</td>
<td>MVs/Queensland.AUS/45.14/1, MVs/London.GBR/30.14/6, MVs/NewSouthWales.AUS/27.14/2, MVs/WesternAustralia.AUS/23.14/1</td>
</tr>
<tr>
<td>MVs/Massachusetts.USA/14.14</td>
<td>D8</td>
<td></td>
<td>MVs/London.GBR/22.12/3, MVs/Victoria.AUS/6.11/MVs/Ludwigsburg.DEU/13.10/3</td>
</tr>
<tr>
<td>MVs/Virginia.USA/19.14</td>
<td>D8</td>
<td></td>
<td>MVs/Maastricht.NLD/14.14, MVs/Pune.IND/38.13/MVs/WesternAustralia.AUS/53.13</td>
</tr>
<tr>
<td>MVs/Massachusetts.USA/19.14</td>
<td>D8</td>
<td>+2 identical strains</td>
<td>MVs/Heidelberg.DEU/45.13</td>
</tr>
<tr>
<td>MVs/California.USA/20.14/7</td>
<td>D8</td>
<td></td>
<td>MVs/HuluLangat.MYS/26.11</td>
</tr>
<tr>
<td>MVs/California.USA/8.14/2</td>
<td>D8</td>
<td></td>
<td>MVs/FrankfurtMair.DEU/17.11/4</td>
</tr>
<tr>
<td>MVs/California.USA/12.14/8</td>
<td>D8</td>
<td>+4 identical strains</td>
<td>MVs/WesternAustralia.AUS/12.14/2, MVs/London.GBR/9.14/2, MVs/Singapore.SGP/13.14/3</td>
</tr>
</tbody>
</table>

6.2.8 NVC: general information and activities

The description and activities of the NVC should be noted, including the following with regard to key issues and concerns that may have arisen:

- list of members of the NVC;
- dates of NVC meetings;
- preparation of annual progress reports, with support from NIP (and the WHO Secretariat); and
- other activities, as applicable, such as attendance at RVC meetings, feedback to NIP for action on RVC recommendations, or field visits when required, particularly for advocacy purposes in high-risk or outbreak areas.

6.2.9 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.
After verification of measles and rubella elimination, countries and areas will need to sustain efforts and prevent re-establishment of endemic measles and rubella virus transmission. In addition to continuing the same strategies recommended to achieve elimination of these diseases (see Section 1.2), following verification there are a number of other issues that the country will need to consider:

- Maintaining political will and commitment from national authorities, partners and stakeholders to ensure that resources continue to be available to sustain elimination efforts.
- Ensuring that surveillance systems for adverse events following immunization (AEFI) are in place, adequately maintained and capable of responding to suspected AEFI in a timely manner. Responding to alleged AEFI, as part of an overall media and communications package, will become more important as disease incidence decreases and there is less perceived threat of disease by the public.
- Providing evidence-based and user-friendly communication materials for health workers to ensure that there is continued public interest and demand for vaccination.
- Ensuring that outbreak investigation and emergency response capacity is sufficient to quickly detect, characterize in detail, and respond to outbreaks of measles and rubella. This is especially important after elimination so that (1) importation-related outbreaks can be contained before broader spread can occur among the accumulated susceptible population; and (2) outbreaks related to multiple importations can be convincingly characterized as distinct events rather than an extended period of continuous transmission.
- Maintaining verification standard surveillance including molecular genotyping of all cases (sporadic and outbreak) and timely reporting of these data to global online databases (that is, MeaNS and RubeNS). Especially in an elimination setting, genetic information provides an essential tool for documenting the transmission patterns of circulating strains of measles and rubella.

Post-verification annual risk assessments should be conducted by governments with SRVC or NVC assistance, and annual progress reports should continue to be submitted to the RVC. The level of detail and focus of attention in each annual NVC report should change from year to year, depending on the respective status of measles and rubella elimination in a given country and area. A reporting template with specific guidance on reporting requirements will be updated and provided annually to NVCs by the WHO Secretariat.