MEASLES ELIMINATION

The Regional Committee for the Western Pacific reaffirmed its commitment to measles elimination and accelerating rubella control in 2010 through resolution WPR/RC61.R7 on Vaccine Preventable Diseases: Measles Elimination, Hepatitis B Control, and Poliomyelitis Eradication.

Regional progress in eliminating measles resulted in a dramatic decline in the annualized incidence of measles to 4.8 cases per million population as of 31 May 2012, down from 11.6 in 2011 and 27.0 in 2010. Surveillance data suggest that as many as 31 countries and areas likely have eliminated the endemic measles virus. Additional commitment and further action are needed to urgently interrupt endemic transmission in remaining areas; identify and reach high-risk populations and communities; improve the sensitivity and performance of surveillance; prevent, prepare for and respond to measles outbreaks; and distinguish importations from endemic transmission.

Member States are urged to establish national verification committees and, through those committees, submit initial reports on measles elimination progress and status. All countries and areas plan to use rubella-containing vaccine by 2015, and several will conduct campaigns against measles and rubella for a wide range of age groups.

The Regional Committee is requested to note this report and continue its commitment to measles elimination and accelerating the control of rubella and the prevention of congenital rubella syndrome.
1. CURRENT SITUATION

In 2003, the Regional Committee for the Western Pacific adopted resolution WPR/RC54.R3, establishing the regional goal of measles elimination. This was followed in 2005 by adoption of resolution WPR/RC56.R8, establishing 2012 as the target for measles elimination. In 2010, the Regional Committee adopted resolution WPR/RC61.R7, reaffirming the 2012 measles elimination goal, requesting the Regional Director to establish a regional verification mechanism and urging Member States to establish independent national verification processes following the establishment of a regional verification mechanism. The 2010 resolution also urged Member States to accelerate the control of rubella and the prevention of congenital rubella syndrome.

1.1 Measles elimination, rubella control and prevention of congenital rubella syndrome

The Western Pacific Region has made remarkable progress towards measles elimination since establishing the goal in 2003. As of 31 May 2012, there were only two reported measles deaths, compared with 240 deaths documented in 2003, declining by 99%.

Member States have made tremendous efforts to achieve the goal. In 2010–2011, 94 million children received measles vaccine through routine immunization systems and 134 million more people through supplementary immunization activities (SIAs). Measles incidence fell from 27 cases per million population in 2010 to 11.6 in 2011, and it is just 4.8 per million population at an annualized rate as of 31 May 2012 (Annexes 1–3).

China conducted an historic national SIA in 2010, with 103 million children immunized, and also carried out intensified immunization activities in about 400 high-risk counties in 2011, reducing measles cases by 74% in 2011 compared with 2010, and by a further 76% in the first quarter of 2012 compared with the same period in 2011. Following large measles outbreaks in 2007–2008, Japan implemented an innovative five-year measles elimination plan with great success, setting a model for developed countries to eliminate measles, as noted during the Global Measles and Rubella Management Meeting in March 2012.

The Philippines immunized 16 million children during its national measles and rubella SIA in 2011 and has largely contained measles transmission since then. In Viet Nam, 7 million children were reached through a national measles SIA in 2011. Cambodia has made strategic efforts to close immunity gaps, focusing on underserved populations by implementing a “High-Risk Community” strategy and conducting two rounds of measles SIAs. The Lao People’s Democratic Republic conducted a measles and rubella vaccination campaign in November 2011, vaccinating 97% of people
up to 19 years of age. Papua New Guinea has been implementing multi-antigen campaigns every two years to reach the “unreached”. Mongolia has effectively implemented its “Reaching Every District” strategy to ensure universally high routine immunization coverage. Laboratory-confirmed measles cases have not been reported in Mongolia and Papua New Guinea for over two years and in Cambodia and Viet Nam for six months, as of 31 May 2012. Australia, Brunei Darussalam, Hong Kong (China), Macao (China) and the Republic of Korea have made persistent efforts to ensure high routine immunization coverage and have experienced only low levels of measles transmission that are likely caused by importation. All 21 Pacific island countries and areas—considered as an epidemiological block for verification of measles elimination—remain measles free.

As of 31 May 2012, epidemiological and virological surveillance data suggest that endemic measles virus transmission has likely been eliminated in as many as 31 countries and areas in the Region. Many countries and areas that were once highly endemic for measles now report small numbers of cases, many of which may be imported or import-related.

The reduction in measles incidence and improved measles and rubella surveillance have led to more attention being given to the large numbers of reported rubella cases in many countries and areas in the Region. In both Cambodia and Viet Nam, many cases of congenital rubella syndrome (CRS) were identified in 2011 through newly established CRS sentinel surveillance systems, and rubella-containing vaccine (RCV) is being used routinely in 31 countries and areas. All countries that have not introduced routine RCV will do so in 2012–2015 with support from GAVI or other sources for both campaigns and routine introduction.

1.2 Verification of measles elimination

The Regional Director in January 2012 selected, from candidates proposed by Member States, 14 members to serve on the Western Pacific Regional Verification Commission for Measles Elimination (RVC). The RVC convened its first meeting in April, followed by a high-level consultation on measles elimination. RVC members and managers from national immunization programmes and vaccine-preventable disease surveillance programmes, as well as officials from ministries of health, agreed in general terms on verification criteria and mechanisms and reviewed regional and country measles elimination action plans. They also recommended the establishment of Independent National Verification Committees (NVCs). Draft Guidelines on Verification of Measles Elimination in the Western Pacific Region, agreed upon at the consultation, are attached for information (see Annex 4).
The main task of the RVC is to verify progress towards and achievement and maintenance of measles elimination in countries and areas and in the Region as a whole. NVCs would provide advice and technical support for assessment and documentation of national or subnational measles elimination progress and status. Countries and areas would submit annual reports to the RVC through their respective NVCs. As with the certification of polio eradication, Pacific island countries and areas would be considered one epidemiological block, represented by a subregional verification committee.

Verification criteria for measles elimination include two key elements: (1) no endemic measles cases for three years, nationally and eventually in the Region, in the presence of high-quality surveillance; and (2) genotype analysis supporting the interruption of endemic measles virus transmission.

According to the guidelines, documentation of progress towards and achievement and maintenance of measles elimination would be categorized according to four components: (1) incidence, epidemiological and virological characteristics over time; (2) performance of epidemiological surveillance and laboratory performance; (3) population immunity; and (4) the sustainability of measles elimination.

Indicators related to each of the four components would guide the RVC in its verification assessments. For countries and areas unable to provide the data needed to calculate indicators, alternative evidence related to the verification components would be considered. For countries with large populations, such as China, NVCs could verify measles elimination by province. As the absence of endemic measles virus transmission must be demonstrated for three years, countries and areas that report the interruption of transmission by 2012 would not be able to be verified until 2015.

The draft verification guidelines were presented again to the officials from ministries of health during the 21st Meeting of the Technical Advisory Group on Immunization and Vaccine Preventable Diseases in August 2012 for final comments from governments, technical experts and partners.

2. ISSUES

2.1 Countries with measles virus transmission

As of 31 May 2012, China, Malaysia and the Philippines had ongoing endemic transmission, albeit with different intensities of transmission. China reported 1309 confirmed measles cases, accounting for 48% of regional measles cases. Malaysia's incidence increased from 54.4 cases per
million population in 2011 to 77.1 cases per million population on an annualized basis in 2012. In the Philippines, measles virus was circulating in a few provinces, with an annualized measles incidence of 13.6 per million population in 2012. Each of these countries is developing an intensified plan of action for 2012 and beyond to definitively interrupt endemic transmission as soon as possible. High measles incidence in New Zealand and Singapore in 2011 (135.7 and 27.6 cases per million people, respectively) indicated the existence of measles immunity gaps among certain population groups, requiring action to address the concern.

### 2.2 Immunity gaps and outbreaks

Measles virus, as one of the most contagious viruses, always seeks out unimmunized populations and vulnerable communities. In high-risk areas—usually remote and poor or with socially or culturally marginalized population groups—the existence of immunity gaps against measles poses a risk of re-emerging measles transmission or outbreaks due to continued circulation of endemic measles virus or importations. Therefore, all areas concerned need to implement effective immunization strategies to identify and reach underserved communities in both rural and urban settings.

Adequate outbreak preparedness and response are imperative for all countries and areas, although it may be a challenge in some areas due to the lack of either technical capacity or financial and human resources.

### 2.3 Importations

Measles cases and outbreaks continue to occur in several countries as a result of measles virus importations from other countries in the Western Pacific or other WHO regions. Reports from Australia, Japan and Singapore in 2011 indicate that among 111 cases with reported source countries of origin, 52 (46.8%) were imported from the South-East Asia Region, 41 (36.9%) from the Western Pacific Region, 17 (15.3%) from the European Region and one (0.9%) from the African Region. Among the 41 importations from within the Western Pacific Region, 18 (43.9%) originated in the Philippines, eight (19.5%) in New Zealand, five (12.2%) in Singapore, four (9.8%) in Malaysia, two (4.9%) each in Cambodia and Viet Nam, and one (2.4%) each in Australia and China. Importations from the Western Pacific and South-East Asia Regions—and the costs such importations incur—are expected to decrease as these regions make further progress in preventing measles virus transmission.
2.4 Surveillance supported by the WHO-accredited laboratory network

Although surveillance performance for the Region continues to improve, individual country performance varies considerably. Of greatest concern is that in 2011 only 52% of provincial units reported at least one non-measles discarded case per 100,000 population, an indicator of the uniformity of surveillance sensitivity at the subnational level. This suggests that many areas may not have sensitive measles surveillance. In addition, the source of infection—imported, import-related or endemic—is not routinely reported from most countries, although such data are important to determine whether endemic measles virus transmission has been eliminated.

3. ACTIONS PROPOSED

The Regional Committee is requested to note this report and consider for adoption a draft resolution reaffirming its commitment to measles elimination and accelerated rubella control.
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<td>59.3</td>
<td>2</td>
<td>1826</td>
<td>20.8</td>
<td>1</td>
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<td>8.4</td>
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<td>0</td>
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<td>61291</td>
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<td>53</td>
<td>48513</td>
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<td>80</td>
<td>21054</td>
<td>11.6</td>
<td>47</td>
<td>2909</td>
<td>4.8</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: Measles and Rubella Surveillance monthly reports

*January – April monthly reports
Annex 2. Measles in WHO, Western Pacific Region (WPR)

Measles cases by month of onset, 2008–2012*

* Source: Measles and Rubella Surveillance monthly reports as of May 2012

Measles cases and immunization coverage, 1980–2011

* Source: WHO-UNICEF Joint Reporting Forms (JRF) for Immunization
Annex 3. Measles, by Country and Area in WHO WPR

Australia

Reported measles cases and immunization coverage, 1980–2011

Measles cases by month of onset, 2008–2012

Source: WHO-UNICEF Joint Reporting Forms (JRF) for Immunization

Brunei Darussalam

Reported measles cases and immunization coverage, 1980–2011

Measles cases by month of onset, 2008–2012

Source: WHO-UNICEF Joint Reporting Forms (JRF) for Immunization

Cambodia

Reported measles cases and immunization coverage, 1980–2011

Measles cases by month of onset, 2008–2012

Source: WHO-UNICEF Joint Reporting Forms (JRF) for Immunization

N = Number of cases
Source: Measles and Rubella Surveillance monthly reports as of May 2012

SIA = Supplementary Immunization Activities
Source: Measles and Rubella Surveillance monthly reports as of May 2012
Annex 3

China

Reported measles cases and immunization coverage, 1980–2011

Measles cases by month of onset, 2008–2012

Source: WHO-UNICEF Joint Reporting Forms (JRF) for Immunization

Hong Kong (China)

Reported measles cases and immunization coverage, 1980–2011

Measles cases by month of onset, 2008–2012

Source: WHO-UNICEF Joint Reporting Forms (JRF) for Immunization

Japan

Reported measles cases and immunization coverage, 1980–2011

Measles cases by month of onset, 2008–2012

Source: WHO-UNICEF Joint Reporting Forms (JRF) for Immunization

Rolling SIA for 13 & 18 years olds each year from 2008 – 2012; Improving routine MCV1 and MCV2 coverage

N = Number of cases
SIA = Supplementary Immunization Activities
Source: Measles and Rubella Surveillance monthly reports as of May 2012
Lao People's Democratic Republic

Reported measles cases and immunization coverage, 1980–2011

Measles cases by month of onset, 2006–2012

Source: WHO–UNICEF Joint Reporting Forms (JRF) for Immunization

Macao (China)

Reported measles cases and immunization coverage, 1980–2011

Measles cases by month of onset, 2008–2012

Source: WHO–UNICEF Joint Reporting Forms (JRF) for Immunization

Malaysia

Reported measles cases and immunization coverage, 1980–2011

Measles cases by month of onset, 2008–2012

Source: WHO–UNICEF Joint Reporting Forms (JRF) for Immunization
Mongolia

Reported measles cases and immunization coverage, 1980–2011

Measles cases by month of onset, 2008–2012

Source: WHO–UNICEF Joint Reporting Forms (JRF) for Immunization

New Zealand

Reported measles cases and immunization coverage, 1980–2011

Measles cases by month of onset, 2008–2012

N = Number of cases
Source: Measles and Rubella Surveillance monthly reports as of May 2012

Source: WHO–UNICEF Joint Reporting Forms (JRF) for Immunization

Papua New Guinea

Reported measles cases and immunization coverage, 1980–2011

Measles cases by month of onset, 2008–2012

N = Number of cases
SIA = Supplementary Immunization Activities
Source: Measles and Rubella Surveillance monthly reports as of May 2012

Source: WHO–UNICEF Joint Reporting Forms (JRF) for Immunization
**Philippines**

**Reported measles cases and immunization coverage, 1980–2011**

Source: WHO-UNICEF Joint Reporting Forms (JRF) for Immunization

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**Republic of Korea**

**Reported measles cases and immunization coverage, 1980–2011**

Source: WHO-UNICEF Joint Reporting Forms (JRF) for Immunization

---

**Singapore**

**Reported measles cases and immunization coverage, 1980–2011**

Source: WHO-UNICEF Joint Reporting Forms (JRF) for Immunization

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**Annex 3**

**Measles cases by month of onset, 2008–2012**

Source: Measles and Rubella Surveillance monthly reports as of May 2012

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**Measles cases by month of onset, 2008–2012**

Source: Measles and Rubella Surveillance monthly reports as of May 2012

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Annex 3

 Viet Nam

Reported measles cases and immunization coverage, 1980–2011

Source: WHO–UNICEF Joint Reporting Forms (JRF) for Immunization

Measles cases by month of onset, 2008–2012

Source: Measles and Rubella Surveillance monthly reports as of May 2012

Pacific Island Countries and Areas: for measles verification purposes, considered as one epidemiological block

Reported measles cases and immunization coverage, 1980–2011

Source: WHO–UNICEF Joint Reporting Forms (JRF) for Immunization

Measles cases by month of onset, 2008–2012

Source: Measles and Rubella Surveillance monthly reports as of May 2012

- In recent years, the WHO Western Pacific Region has made remarkable and accelerated progress towards measles elimination. The number of cases declined by 86% between 2008 and 2011.
- As of 31 May 2012, annualized measles incidence in WPR was 4.8 per million population – historic low.
- The number of measles cases has dramatically declined in populous countries where measles previously had been highly endemic, such as China, Japan, the Philippines and Viet Nam.
- The 2012 annualized measles incidence (per million population) is highest in Malaysia (77.1), New Zealand (29.6), the Philippines (13.6) and Singapore (9.1).
- Low levels of transmission have been experienced in Australia, Brunei Darussalam, Hong Kong (China), Macao (China) and Republic of Korea, likely caused by importation.
- Mongolia and Papua New Guinea have not seen measles cases for two and three years, respectively.

All 21 Pacific island countries and areas remain measles free.
Draft Guidelines for Verification of Measles Elimination in the Western Pacific Region

WHO Regional Office for the Western Pacific
Manila, Philippines

April 2012
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Executive summary

The Western Pacific Region has made substantial progress towards measles elimination since establishing the goal in 2003. Concerted efforts around the Region had reduced measles incidence to less than 11.6 cases per million of population by 2011 and 4.3 cases per million, at an annualized rate, during the first quarter of 2012. As many as 32 countries and areas in the Region may have eliminated measles, and 26 are likely ready for verification. At its 2010 meeting, the WHO Regional Committee for the Western Pacific reaffirmed the 2012 measles elimination goal, urged the Regional Director to establish a regional verification mechanism and requested Member States to establish independent national verification processes for measles elimination following the establishment of a regional verification mechanism. Establishing verification processes and criteria will enable acknowledgement of countries and areas that have eliminated measles and provide guidance for those that have not yet achieved elimination.

These guidelines are based on shared experiences and consultations with other WHO regions; a consultation among Member States on the verification of measles elimination in the Western Pacific Region, held in Manila, Philippines, in June 2010; and a consultation among Regional Verification Commission members and Member States in April 2012. Definitions of measles elimination and other essential concepts are provided and core principles enumerated. The core principles include the independence of the verification process led by the Regional Verification Commission (RVC) and National Verification Committees (NVCs), with the RVC having the discretion to apply alternative evidence for elimination in place of recommended evidence and indicators for countries unable to provide data to assess standard indicators.

Two criteria and four verification components are presented that will form the basis of verification. The two criteria include absence of endemic measles virus transmission for three years in the presence of high-quality surveillance for both national and regional elimination, and the absence of an endemic genotype or genotypes. The four components of evidence include incidence, epidemiological and virological characteristics; epidemiological surveillance and laboratory performance; population immunity; and sustainability of measles elimination in the context of national immunization programme sustainability. Specific indicators are suggested under each component.

The structure and membership of the RVC and NVCs are described, as well as standard mechanisms for verification through a description of RVC and NVC functions and terms of reference.
Annex 4

These include normative, advisory and verification functions and, for the chairperson, management functions. An advocacy function is also included in the RVC and NVC terms of reference.

Finally, post-verification needs are described. These include the need to maintain high levels of population immunity, verification-standard epidemiological and virological surveillance, and preparedness plans for outbreak response. NVCs will coordinate the submission of annual reports to the RVC so that the RVC may verify progress towards measles elimination.
Definitions

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

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

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

4. Re-establishment of endemic transmission: occurs when epidemiological and 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 where measles had previously been eliminated.

5. Measles outbreak in countries with an elimination goal: when ≥2 confirmed cases are temporally related (with dates of rash onset occurring between 7 and 21 days apart) and are epidemiologically or virologically linked, or both.

6. A clinical measles case: any case with fever and maculopapular rash (i.e. non-vesicular) and any of the following: cough, coryza (i.e. runny nose) or conjunctivitis (i.e. red eyes).

7. A laboratory-confirmed measles case: a case that meets the clinical definition for measles and has been confirmed by a laboratory.

8. An epidemiologically linked confirmed measles case: a clinical case of measles that has not been confirmed by a laboratory but that is geographically and temporally related (with dates of rash onset occurring between 7 and 21 days apart) to a laboratory-confirmed case or (in the event of an outbreak) to another epidemiologically confirmed measles case.

9. A clinically compatible measles case: a case that meets the clinical case definition for measles but for which no adequate blood specimen was taken and that has not been linked epidemiologically to another case positive for measles immunoglobulin M (IgM) or another laboratory-confirmed communicable disease.

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2 A proposal to use the term “eradication” at regional and country levels was proposed by participants at the Ernst Strüngmann Forum on Disease Eradication in the context of Global Health in the 21st Century, held in Frankfurt, Germany, in August 2010.
3 A virus strain comprises viruses with N gene (450) sequences that are at least 99.7% identical (1 nt change).
4 This definition may vary across countries.
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10. A discarded measles case: a case that meets the clinical case definition for measles and that has been investigated and discarded as a non-measles case using: (a) laboratory testing in a proficient laboratory\(^6\) or; (b) epidemiological linkage to an outbreak that has been confirmed by a laboratory not to be measles.

11. A vaccine-associated measles case: a suspected case that meets all five of the following criteria: (a) the patient had a rash illness, with or without fever, but did not have cough or other respiratory symptoms related to the rash; (b) the rash began 7–14 days after vaccination with a measles-containing vaccine; (c) the blood specimen, which was positive for measles IgM, was collected 8–56 days after vaccination; (d) thorough field investigation did not identify any secondary cases; and (e) field and laboratory investigations failed to identify other causes.

12. An endemic measles case: a case of measles confirmed by laboratory testing or epidemiological linkage resulting from endemic transmission of measles virus.

13. An imported case of measles: a case with virological or epidemiological evidence, or both, of exposure outside the Region or country during the 7–21 days prior to rash onset.

14. An import-related measles case: a locally acquired infection occurring as part of a chain of transmission originated by an imported case as supported by epidemiological or virological evidence, or both. (Note: if transmission of measles cases related to importation persists for ≥12 months, cases are no longer considered to be import-related, they are considered to be endemic.)

\(^6\) A proficient laboratory is a WHO network laboratory that uses a validated assay and has passed the annual WHO proficiency test or one that follows national standards and successfully participates in an approved external quality-assurance programme.
1. Overview of measles elimination in the Western Pacific Region

1.1 Introduction

In 2003, the WHO Regional Committee for the Western Pacific resolved to eliminate measles and control hepatitis B, and to use activities for achieving these to also strengthen routine immunization (WPR/RC54.R3). In 2005, the Regional Committee established 2012 as the target year for measles elimination (WPR/RC56.R8). In 2010, the Regional Committee reaffirmed the 2012 goal, urged the Regional Director to establish a regional verification mechanism and requested Member States to establish independent national verification processes for measles elimination following the establishment by the WHO Regional Office for the Western Pacific of a standardized regional verification mechanism. Establishing verification processes and criteria will enable acknowledgement of countries and areas that have eliminated measles and provide guidance for those that have not yet achieved elimination.

1.2 Strategies

The key strategies for measles elimination include: (1) achieving high (≥ 95%) vaccination coverage with two doses of measles-containing vaccine (MCV), administered through either routine or supplementary immunization activities (SIAs); (2) developing and sustaining sensitive and timely case-based measles surveillance; and (3) developing and maintaining access to an accredited measles laboratory network to confirm or discard suspected measles cases and detect measles virus for genotyping and molecular analysis.

1.3 Progress towards measles elimination

The Western Pacific Region has made substantial progress towards measles elimination since establishing the goal in 2003. Concerted efforts around the Region had reduced measles incidence to 11.6 cases per million population by 2011 and to 4.3 cases per million, at an annualized rate, in the first quarter of 2012. Epidemiological and virological surveillance data suggest that endemic measles virus transmission already may have been eliminated in as many as 31 countries and areas in the Region. Most countries and areas that were once highly endemic for measles have reported very few cases in 2012 as of the end of April, and many of these may be imported or import-related (Figure 1).
Figure 1. Confirmed measles cases, by month of onset and country. Western Pacific Region 2007–2012

Reported coverage with first-dose measles-containing vaccine (MCV1) has trended upwards in the Region since 2003, reaching 96.5% in 2010. A total of 32 countries and areas have introduced a routine second-dose measles-containing vaccine (MCV2) dose, with reported coverage of 91%. SIAs have been used to ensure uniformly high MCV coverage, targeting children of a wide age range. Over 300 million children were vaccinated against measles during large-scale SIAs conducted from 2003 to 2011.

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. Between 2007 and 2011, the completeness of monthly reporting to the WHO Regional Office for the Western Pacific increased consistently from 51% to 95%, and the timeliness of monthly reporting from 19% to 89%. Among 32 countries and areas reporting suspected cases to the Regional Office, 2.8 suspected measles cases per 100 000 of population were discarded as non-measles (target ≥ 2.0), and adequate blood specimens were collected from 74% of suspected measles cases (target ≥
80%), suggesting that, on a regional basis, surveillance is sensitive in identifying and appropriately classifying suspected measles cases. However, not all countries have achieved surveillance indicator targets. Among 14 countries and areas submitting sufficient data to calculate the indicators (21 Pacific island countries and areas are considered as one epidemiological block), only nine (64%) have achieved the target discarded measles rate and nine (64%) have achieved the target adequate specimen collection rate.

The Western Pacific Region measles and rubella laboratory network (LabNet) has grown to include a total of 383 laboratories including: one WHO global specialized laboratory (GSL); three WHO regional reference laboratories (RRLs), in Australia, China and Hong Kong (China); 17 fully functional national measles-rubella laboratories (NMLs), including the GSL and RRLs; and, in China, 31 provincial and 331 prefecture laboratories. In 2011, LabNet tested specimens from 23,557 suspected measles and rubella cases.

2. Core principles for verification of measles elimination

2.1 Attainment of measles elimination should be verified independently for individual countries and areas, and eventually for the Region, following standard procedures and criteria;

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

2.3 The regional verification commission (RVC) will determine whether individual countries, the Pacific subregion and the Region as a whole have eliminated endemic measles virus transmission;

2.4 National verification committees (NVCs) will be established to collect relevant evidence of national elimination and submit corresponding documentation to the RVC on an annual basis to report progress towards or achievement of measles elimination. National secretariats may be formed to assist NVCs in collecting data and preparing documentation;

2.5 For large countries, such as China, NVCs may also verify measles elimination for each second-level administrative unit, applying the same general criteria and processes as applied for the country;

2.6 National and regional elimination will require an absence of endemic measles cases for at least 36 months. This is to ensure that re-established endemic transmission has not occurred;

2.7 Documentation will address two major criteria, supported by indicators within four components;
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2.8 The RVC may apply complimentary or alternative evidence as it deems appropriate to make a final determination of verification. Countries unable to provide data satisfying one or more component indicators may still be verified as having eliminated measles as long as the RVC is satisfied that available evidence is sufficient to justify verification;

2.9 The verification process may involve field assessments by the RVC or NVC members if additional information or validation of documentation is required.

3. Standard verification criteria, components and indicators

Verification of elimination will address two criteria supported by indicators within four components, as noted above. This section describes the criteria, components and component indicators.

3.1 Verification criteria

3.1.1 No endemic measles virus infection for three years nationally and for the Region, in the presence of high-quality surveillance;

3.1.2 Genotype analysis supporting the interruption of endemic measles virus transmission.

3.2 Components and component indicators

3.2.1 Evolution of incidence, epidemiological and virological characteristics.

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

Incidence

In describing the incidence of measles, it is necessary to classify confirmed measles by source of infection and by method of confirmation. Source of infection may be endemic, imported, import-related or unknown. Method of confirmation may be by laboratory, epidemiological linkage or clinical criteria (see Table 1). Definitions of these terms are listed at the beginning of these draft Guidelines for Verification of Measles Elimination in the Western Pacific Region.
Table 1. Source and method of measles case confirmation*

<table>
<thead>
<tr>
<th>Method confirmed →</th>
<th>CONFIRMED</th>
<th>Epidemiological linkage</th>
<th>Clinically compatible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source of infection</td>
<td>Labor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endemic</td>
<td>A</td>
<td>B</td>
<td>I</td>
</tr>
<tr>
<td>Unknown</td>
<td>C</td>
<td>D</td>
<td>J</td>
</tr>
<tr>
<td>Imported</td>
<td>E</td>
<td>F</td>
<td>K</td>
</tr>
<tr>
<td>Import-related</td>
<td>G</td>
<td>H</td>
<td>L</td>
</tr>
</tbody>
</table>

Every confirmed or clinically compatible case of measles may be represented in one of the cells in Table 1. When measles surveillance performs well, i.e., adequate case investigations with contact tracing are routinely performed and adequate specimens are routinely collected, the numbers of clinically compatible cases populating cells I, J, K and L, depicted in brown, should be small. Measles elimination status will be determined ultimately by the absence of endemic cases corresponding to cells A and B, depicted in red. However, as cases of unknown source may also result from endemic transmission, cases populating cells C and D, depicted in yellow, may be considered as possibly endemic. Imported and import-related cases are likely to continue to varying degrees after endemic measles virus has been eliminated, depending on migration patterns into and out of the country or area. Hence, cells E, F, G and H, corresponding to these sources of infection and depicted in green, would be expected to be populated by a variable number of cases. A large number of confirmed cases of unknown origin (i.e., cells C and D), raise questions regarding the quality of surveillance and the ability of a country to confidently determine the absence of endemic measles virus transmission.

**Indicator:** Proportion of confirmed and clinically compatible cases of known source of infection (target: ≥ 80%).

**Epidemiological and virological characteristics**

Descriptive epidemiological characteristics of measles cases corresponding to time, place and person are important indicators of measles elimination. Demonstrating changes in the spatial and personal characteristics of measles cases (e.g., age distribution, vaccination status) over time may be suggestive of achievement of measles elimination.

Genotype and genetic characteristics also are important to verify the absence of endemic measles virus transmission. Genotypes known to be endemic in the Western Pacific Region in 2011 included, at a minimum, D9 (Cambodia, Malaysia and the Philippines) and H1 (China, the Lao People's Democratic Republic and Viet Nam). However, other genotypes, including D4 and D8, are
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frequently imported from the European Region and South-East Asia Region, respectively. Virological surveillance and genetic sequencing, together with good epidemiological investigations, are important to help differentiate endemic from imported and import-related cases and to determine if and when endemic transmission may be re-established.

Epidemic curves of confirmed cases (regardless of source) are a simple way to show the evolution of measles incidence. Epidemic curve features consistent with progress leading to elimination normally include increasing intervals between clusters/outbreaks, decreasing numbers of cases in clusters/outbreaks, decreasing duration of clusters/outbreaks, increases in the percentage of sporadic cases and a loss of seasonality. If many clinically confirmed cases are reported, it is often helpful to stack bars by method of confirmation.

Spot maps may be prepared, indicating index cases separately from secondary, tertiary and subsequent generations of cases, as well as indicating source. Consistent decreases in the geographical spread of measles virus over consecutive time intervals can help confirm progress towards and eventual achievement of measles elimination.

Tables and bar charts indicating the age distribution and vaccination status of cases over time may also suggest progress toward elimination. As countries and areas near elimination, an increasing percentage of cases were likely to occur at the extremes of age (infants and adults), and the percentage of cases that were previously vaccinated (usually with a single MCV dose) is likely to increase.

Indicator: Wide range and multiple years of epidemiological and virological analysis in support of achievement of elimination of endemic measles virus.

3.3 Epidemiological surveillance and laboratory performance

In the setting of elimination, surveillance for measles must be sufficiently sensitive to detect any suspected measles cases and have adequate capacity for timely and proper case investigation and laboratory analysis. The credibility of elimination depends on epidemiological and laboratory surveillance quality. Standard indicators of surveillance performance include: (1) national and subnational reporting rates of at least two discarded measles cases per 100 000 population; (2) adequate specimen collection from at least 80% of suspected measles cases; (3) adequate specimens for virus detection from at least 80% of laboratory-confirmed outbreaks; and (4) adequate investigations of at least 80% of suspected cases.

The measles laboratory network in the Western Pacific Region consists of 383 laboratories including: one global specialized laboratory; three regional reference laboratories (RRLs); 17 national
measles laboratories (NMLs); and, in China, 31 provincial and 331 prefectural laboratories. The WHO Regional Office of the Western Pacific conducts accreditation of RRLs, NMLs and the 31 Chinese provincial laboratories; almost all network laboratories were accredited as of March 2012. The network is critical for serological (ELISA) testing for anti-measles and anti-rubella IgM, and also for virological surveillance of virus detected from cases. WHO accredits network laboratories using well-established criteria.

3.3.1 Indicators and suggested targets for epidemiologic surveillance quality:

1. Percentage of suspected cases with adequate investigation (target: ≥ 80% of suspected cases);

2. Percentage of suspected cases with adequate specimen collection (target: ≥ 80% of suspected cases, excluding epidemiologically linked cases);

3. Discarded measles rate at national level (target: ≥ 2 per 100 000 population);

4. Discarded measles rate at subnational level (target: ≥ 2 per 100 000 population for ≥ 80% of second-level administrative units);

5. Specimens for genotypic analysis are available from cases associated with outbreaks (or chains of transmission) (target: ≥ 80% of outbreaks or chains of transmission);

6. Additional evidence:

(a) For countries without systems in place to collect the data required to calculate the four indicators above, additional evidence may be submitted to demonstrate the sensitivity and quality of measles surveillance;

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7 An adequate investigation includes, at a minimum, collection of all of the following data from each suspected case of measles: name or identifiers, place of residence, place of infection (at least to district level), age (or date of birth), sex, date of rash onset, date of specimen collection, vaccination status, date of last vaccination, date of notification and date of investigation (excluding cases that are either confirmed as measles by epidemiological linkage or discarded as non-measles by being epidemiologically linked to another laboratory-confirmed case of communicable disease or by epidemiological linkage to a case negative for measles IgM), and travel history.

8 Adequate specimens for serology are those collected within 28 days after rash onset that consist of ≥ 0.5 ml serum of ≥ 3 fully filled circles of dried blood on a filter-paper, or oral fluid. For oral fluid samples, the sponge-collection device should be rubbed for about 1 minute along the gum until the device is thoroughly wet; epidemiologically linked cases should be excluded from the denominator.

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(b) For countries where substantial numbers of measles cases present to the private sector, additional evidence should be submitted to demonstrate that cases identified by the private sector are captured by national surveillance systems.

3.3.2 Indicators of laboratory performance:

(1) Measles network laboratories that are WHO-accredited\(^{10}\) for serological and, if relevant, for virological work (target: 100% of laboratories);

(2) Proportion of laboratories (government and private) that conduct measles diagnostic testing that have adequate quality-assurance mechanisms in place (target: 100% of laboratories);

(3) Proportion of virus detection and genotyping results (where appropriate) that are completed within two months of receipt of specimen. (target: \(\geq 80\%\) of specimens received);

(4) Complementary evidence: completeness and timeliness of monthly reporting (including zero reporting) to the WHO Regional Office for specimens received for serological and virological testing (target: \(\geq 80\%\) of specimens received in the laboratory).

3.4 High population immunity

Achieving and sustaining high levels of population immunity against measles in every district is a fundamental strategy to interrupt endemic measles virus transmission and prevent the re-establishment of measles virus transmission when imported cases are introduced.

Population immunity may be measured by annual administrative reports of routine vaccination coverage with first- and second-dose measles-containing vaccine (MCV1 and MCV2) at the national and subnational levels and SIA coverage as reported in the WHO and UNICEF Joint Reporting Form (JRF), as well as annual WHO-UNICEF estimates of national coverage, which sometimes differ from reported coverage. Population-based surveys of routine and SIA coverage also can be useful and include WHO 30-cluster surveys, USAID-sponsored demographic and health surveys (DHS), and UNICEF-sponsored multiple indicator cluster surveys (MICS). However, the limitations of population-based surveys may include a lack of representativeness of all geographical areas (e.g., districts) and strata of society, and an inability to identify potentially large pockets of susceptible individuals. Seroepidemiological surveys are also useful, but suffer from the same potential

\(^{10}\) WHO measles laboratory accreditation criteria include: (1) annual proficiency test results \(\geq 90\%\); (2) at least 90% concordance of NML with RRL confirmatory testing; and (3) passing on-site inspection.
limitations as coverage surveys and also the potential limitations of sensitivity, specificity and predictive value of the laboratory tests for anti-measles Immunoglobulin G (IgG) as correlates of immunity. Finally, data from rapid coverage assessments (RCAs) may be an additional source of information to assess local-level coverage.

An indirect method for estimating population immunity relies on measles surveillance using the distribution of outbreak size as an indicator when population immunity is high: at least 80% of measles chains of transmission have fewer than 10 cases. Additional data, such as distribution of outbreak duration, number of generations of transmission, proportion of imported and import-related cases, as well as seroepidemiological survey data may feed into models that determine effective reproduction numbers (R).

Experience with several Western Pacific Region countries, including the Philippines and Viet Nam, suggest that very high levels of protection may not be required among all adults to interrupt measles virus transmission if high coverage exists among children and adolescents, as young and school-age children appear to be a critical link in sustaining chains of measles virus transmission. Nevertheless, an accurate description of vaccine and natural immunity by individual birth cohort, beginning the year when measles vaccine was first introduced into the country, is useful to assess potential immunity gaps. Such a description should consider SIAs and changes in immunization schedule in specific years. Special additional analysis may also be undertaken for vulnerable population groups who potentially have less access to vaccination services, e.g. migrants, the urban or rural poor, and people in remote areas.

3.4.1 Indicators of population immunity:

(1) Administrative reports of MCV1 coverage, national and by district (target: \( \geq 95\% \) nationally and in every district);

(2) Administrative reports of MCV2 coverage, national and by district (target: \( \geq 95\% \) nationally and in every district);

(3) Administrative reports of SIA coverage, national and by district (target: \( \geq 95\% \) nationally and in every district);

(4) Additional evidence:

(a) Coverage and/or seroepidemiological survey data (e.g., DHS, MICS, WHO 30 cluster surveys, etc.);
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(b) Descriptions of intensified efforts made to identify and reach high-risk populations (migrants, remote, poor, ethnic minorities, etc.) through routine and supplementary immunization.

3.4.2 Indicators

(1) Evidence of plans and financing for routine immunization and achieving and sustaining measles elimination, including SIAs, surveillance and laboratory services, while fostering cooperation with other relevant sectors;

(2) Documented evidence of the monitoring and review progress for the above-mentioned plans;

(3) Documented programmatic risk assessment;

(4) Budgeted importation and outbreak preparedness and response plans in place.

3.5 Sustainability of measles elimination in the context of national immunization programme sustainability

Verification of measles elimination should include an assessment of whether elimination can be sustained. The assessment aims to: (1) highlight strengths and weaknesses of national immunization programmes that are linked to maintaining high routine and/or supplementary immunization coverage and high-quality surveillance; and (2) encourage the preparation of costed preparedness plans for needed responses to potential outbreaks resulting from measles virus importations.

Sources of information for national immunization programme (NIP) sustainability include JRF reports, comprehensive Multi-Year Plans (c-MYPs) for immunization, national reviews of the Expanded Programme on Immunization and other sources.

This last verification component is indicative of measles elimination's role in strengthening routine immunization and surveillance systems and ensuring equity in immunization service delivery. Such sustainability assessments may be incorporated into larger programme reviews and feasibility assessments of new immunization-related initiatives, and can also be used to strengthen health systems overall.
4. Structure of verification bodies

4.1 RVC and NVC structure

The Regional Verification Commission (RVC) and National Verification Committees (NVCs) will work together to verify measles elimination in each country and area, and for the Pacific island countries and areas as a group (see Figure 2). The RVC will be the only body authorized to verify measles elimination in countries and areas, and for the Region as a whole. NVCs will determine when countries and areas are ready for verification, submit the necessary documentation to the RVC for its consideration, and coordinate the collection of relevant data that demonstrate measles elimination.

4.2 RVC and NVC membership and appointment

RVC and NVC members should be independent and objective, and therefore they should not be involved directly in the management and operations of their respective NIPs or in epidemiological and laboratory-based vaccine-preventable disease (VPD) surveillance. Members should be senior subject-matter experts with different areas of expertise, such as epidemiology, paediatrics, public health practice, virology or molecular biology.

RVC members and officers (chairperson, vice-chairperson, rapporteur) are appointed by and report to the WHO Regional Director for the Western Pacific and remain independent of the Western Pacific Region’s Technical Advisory Group (TAG) on Immunization and Vaccine-Preventable Diseases, although they may share information and reports with the TAG. RVC members will serve terms of two years, with the possibility of renewal. To avoid any potential or perceived conflicts of interest, each RVC member will complete and sign a declaration of interests form prior to each RVC meeting.
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NVC members will be appointed by their respective Ministers of Health and report to the RVC. There should be a minimum of five members on the NVC and, as with the RVC, these should ideally represent different areas of expertise, including epidemiology, paediatrics, public health practice, virology or molecular biology. NVC members should also provide periodic written declarations of interests to prevent potential conflicts of interest.

As the 21 Pacific island countries and areas are to be considered as one epidemiological block for the purpose of verification of measles elimination, a subregional verification committee (SRVC) will be formed in the same manner as for certification of polio-free status. SRVC members will be appointed by the WHO Regional Director for the Western Pacific and will serve in a similar way as an NVC for the Pacific with the same terms of reference (see 5.1 below).

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

4.3 Secretariat support to RVC and NVCs

The WHO Regional Office of the Western Pacific will serve as the secretariat for the RVC. NVCs may establish their own secretariats, such as the NIP and Vaccine-Preventable Disease surveillance units, to provide necessary evidence of measles elimination. In countries with WHO country offices, WHO staff may provide technical and operational support to both the secretariats and NVCs. Countries and areas without WHO country offices are welcome to consult with the WHO Regional Office for the Western Pacific for assistance when necessary.

5. Verification mechanism

Authority to verify measles elimination will be vested solely in the RVC, which will assess progress towards, achievement of and maintenance of measles elimination in countries and areas of the Region annually, leading ultimately to the regional verification of measles elimination. The NVC will similarly assess measles elimination status within its borders, determine when the country or area is ready for verification, and assist the Ministry of Health to prepare the necessary evidentiary documentation for submission to the RVC. The RVC will guide NVCs, and NVCs will guide NIPs and VPD surveillance units regarding requirements for verification of measles elimination. In this
respect, the RVC and NVCs will serve as de facto advisory bodies on fulfilment of verification criteria and the components of verification. Insofar as the indicators within the components are directly related to WHO-recommended measles elimination strategies, the RVC and NVCs also will serve as de facto national advisory bodies for measles elimination. Guidance provided by RVC and NVC members should be consistent with recommendations from the Western Pacific Region TAG. The TAG should be consulted in the event of discrepant technical opinions among the RVC members. The RVC should be consulted in the event of discrepant technical opinions among the members of any NVC. In addition to their normative, verification and advisory functions, RVCs and NVCs may also serve an advocacy role to promote measles elimination activities.

5.1 **RVC functions and terms of reference**

5.1.1 **Normative function**

(1) To review and establish criteria and procedures for documenting and verifying the achievement of measles elimination nationally and for the Region.

5.1.2 **Advisory and verification functions — national**

(1) To advise NVCs on verification criteria, requirements and procedures, including guidance on: (i) collecting and analysing data needed for verification, and (ii) proper documentation;

(2) To review and analyse the annual reports submitted by NVCs;

(3) To conduct field visits, when needed, to monitor progress and verify evidence;

(4) To monitor progress and determine national verification status and recommend pathways of verification for delayed or provisionally approved countries and areas;

(5) To monitor progress towards accelerated rubella control and Congenital Rubella Syndrome (CRS) prevention and, if established as a national or regional goal, rubella elimination.

5.1.3 **Verification functions — regional**

(1) To verify achievement of measles elimination for the Region;

(2) To monitor progress towards accelerated rubella control and CRS prevention and, if established as a national or regional goal, rubella elimination.
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In addition, the RVC Chairperson will serve a leadership and management function.

5.1.4 Management functions of the RVC Chairperson

(1) To preside over RVC meetings, to be held at least once a year;

(2) To define internal operating procedures and RVC member responsibilities;

(3) To supervise the documentation and verification process;

(4) To prepare and submit annual meeting/verification reports to the WHO Regional Director, who will then share the information with Member States through appropriate channels.

5.2 NVC functions and terms of reference

5.2.1 Advisory and assessment functions

(1) To advise the Ministry of Health, the NIP and the VPD surveillance units on requirements for verification of measles elimination;

(2) To compile and analyse information from the Ministry of Health to monitor progress towards measles elimination and assess if the country or area can verify elimination of endemic measles virus in accordance with established criteria and components;

(3) To conduct field visits, when needed, to monitor progress, assess data quality and validate analyses and assessments;

(4) To provide guidance and propose feasible alternatives if standard verification data are insufficient or inconsistent;

(5) To supervise and guide the annual verification documentation process at the country level, propose feasible alternatives if standard verification data are insufficient and endorse the government's annual verification report before submission to the RVC;

(6) To monitor progress towards accelerated rubella control and CRS prevention and, if established as a national or regional goal, rubella elimination;

(7) To provide programmatic guidance consistent with verification criteria and components.

As with the RVC Chairperson, the NVC Chairperson will serve a leadership and management function.
5.2.2 Management functions of the NVC Chairperson

(1) To define the internal procedures and responsibilities of committee members in accordance with guidelines provided by the RVC;

(2) To prepare an NVC plan of action, including activities, a timeline, expected outcomes, and human and financial resource requirements, in collaboration with the NIP and the Ministry of Health, and to present the plan of action to the RVC for approval;

(3) To preside over NVC meetings, to be held at least twice per year;

(4) To attend RVC or other regional meetings when required.

5.3 Advocacy function for both RVC and NVCs

To raise awareness of and commitment to measles elimination, targeting high ranking health officials, health professionals, partners and political leaders through multiple channels, such as national health conferences, scientific seminars, the media and personal contacts.

6. Post-verification needs

After verification of measles elimination, countries and areas will need to sustain measles elimination and prevent re-establishment of endemic measles virus transmission by continuing the same strategies recommended to eliminate the disease: (1) high population immunity against measles through supplementary and/or routine immunization; (2) high-quality epidemiological and virological surveillance; and (3) access to a WHO-accredited laboratory. Moreover, countries and areas should have budgeted preparedness plans in place in the event of import-related measles outbreaks. Annual assessments should be conducted by governments with NVC assistance, and annual reports submitted to the RVC. The RVC, in turn, will review annual country and area reports, conduct field visits when necessary, and provide feedback and recommendations to governments through NVCs.
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Summary of criteria, components and indicators for verification of measles elimination

Criteria:

1. No endemic measles virus infection for three years nationally and for the Region, in the presence of high-quality surveillance;

2. Genotype analysis indicates an absence of endemic measles virus.

Components:

1. Measles incidence and epidemiological and virological characteristics (absence of endemic virus).
   
   1.1. Proportion of confirmed and clinically compatible cases of known source of infection (target: ≥ 80%);

   1.2. Wide range and multiple years of epidemiological and virological analysis in support of achievement of elimination of endemic measles virus.

2. Epidemiological surveillance and laboratory performance

   2.1. Epidemiological surveillance performance:

   (1) Percentage of suspected cases with adequate investigation (target: ≥ 80% of suspected cases);

   (2) Percentage of suspected cases with adequate specimen collection (target: ≥ 80% of suspected cases, excluding epidemiologically linked cases);

   (3) Discarded measles rate at the national level (target: ≥ 2 per 100 000 population);

   (4) Discarded measles rate at the subnational level (target: ≥ 2 per 100 000 population in ≥ 80% of second-level administrative units);

   (5) Specimens for genotypic analysis are available from cases associated with outbreaks (or chains of transmission) (target: ≥ 80% of outbreaks or chains of transmission);

   (6) Additional evidence:

   • For countries without systems in place to collect the data required to calculate the four indicators above, additional evidence may be submitted to demonstrate the sensitivity and quality of measles surveillance;

   • For countries where substantial numbers of measles cases present to the private sector, additional evidence should be submitted to demonstrate that
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cases identified by the private sector are captured by national surveillance systems.

2.2. Laboratory performance

(1) Measles network laboratories are WHO-accredited for serological and, if relevant, for virological work (target: 100% of laboratories);

(2) The proportion of laboratories (government and private) that conduct measles diagnostic testing that have adequate quality-assurance mechanisms in place (target: 100% of laboratories);

(3) The proportion of virus detection and genotyping results (where appropriate) that are completed within two months of receipt of specimen (target: ≥ 80% of specimens received);

(4) Complementary evidence: completeness and timeliness of monthly reporting (including zero reporting) to the WHO Regional Office for specimens received for serological and virological testing (target: ≥ 80% of specimens received in the laboratory).

3. Population immunity

3.1. Administrative reports of MCV1 coverage, national and by district (target: ≥ 95% nationally and in every district);

3.2. Administrative reports of MCV2 coverage, national and by district (target: ≥ 95% nationally and in every district);

3.3. Administrative reports of SIA coverage, national and by district (target: ≥ 95% nationally and in every district);

3.4. Additional evidence:

(1) Coverage and/or seroepidemiological survey data (e.g., Demographic and Health Survey (DHS), Multiple Indicator Cluster Surveys (MICS), WHO 30 cluster surveys);

(2) Descriptions of intensified efforts made to identify and reach high-risk populations (migrants, remote, poor, ethnic minorities, etc.) through routine and supplementary immunization.
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4. Sustainability of measles elimination in the context of a sustainable NIP

4.1. Evidence of plans and financing for routine immunization and for achieving and sustaining measles elimination, including SIAs, surveillance and laboratory services, while fostering cooperation with other relevant sectors;

4.2. Documented evidence of monitoring and reviewing progress against the above-mentioned plans;

4.3. Documented programmatic risk assessment;

4.4. Budgeted importation and outbreak preparedness and response plans in place.