

Guidelines on Verification of Measles Elimination and Rubella/Congenital Rubella Syndrome Control in the WHO South-East Asia Region

July 2016

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Printed in India

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Abbreviations

cMYP	comprehensive multiyear plan
CRI	congenital rubella infection
CRS	congenital rubella syndrome
DHS	Demographic and Health Survey
EPI	Expanded Programme on Immunization
ITAG	(SEAR) Immunization Technical Advisory Group
IVD	Immunization and Vaccine Development
JRF	joint reporting form
MCV1	first dose of measles-containing vaccine
MCV2	second dose of measles-containing vaccine
MoH	Ministry of Health
MR	measles-rubella/measles and rubella
MRCV	measles-rubella-containing vaccine
NIP	National Immunization Programme
NVC	National Verification Committee
RCA	rapid coverage assessment
RC	Regional Committee
RCV	rubella-containing vaccine
RVC	Regional Verification Commission

SEAR	South-East Asia Region
SIAs	supplementary immunization activities
TOR	terms of reference
VPD	vaccine preventable diseases
UNICEF	United Nations Children’s Fund
WHO	World Health Organization

Executive summary

The Sixty-sixth session of the Regional Committee of the World Health Organization's (WHO) South-East Asia (SEA) Region in 2013 adopted the goal of measles elimination and rubella/congenital rubella syndrome (CRS) control by 2020 following rigorous prior consultations. Efforts around the Region have reduced regional measles incidence to 16 per million population in 2015 compared with 70 per million in 2000. Three countries – Bhutan, the Democratic People's Republic of Korea and Maldives – may be near elimination with no reported established endemic measles virus transmission lasting more than 12 months. Establishing verification criteria, lines of evidence and processes will acknowledge countries that eliminate measles and rubella and will provide guidance for those that have not yet achieved elimination.

These guidelines are dynamic and periodically updated. They provide definitions of measles elimination and rubella, and CRS control and related core concepts. Core principles for verification of elimination include the independence of the verification process led by the Regional Verification Commission (RVC) and National Verification Committee (NVC) at regional and national levels, respectively. The RVC will also have the discretion to apply alternative/additional evidence for elimination in place of recommended evidence for countries unable to provide adequate data.

Three criteria and five lines of evidence that form the basis of verification are presented. The three criteria comprise: 1) documentation of the interruption of endemic measles, or rubella, virus transmission for a period of at least 36 months from the last-known endemic case; 2) the presence of a high-quality surveillance system that is sensitive and specific enough to detect imported and import-related cases; and 3) genotyping and molecular evidence that supports the interruption of endemic transmission.

The five lines of evidence include: 1) epidemiologic characteristics of measles and rubella over time; 2) genotyping and molecular evidence of sustained interruption of endemic virus transmission; 3) epidemiological surveillance and laboratory performance quality; 4) high population immunity; and 5) sustainability of measles

elimination in the context of national immunization programme sustainability. Specific indicators are suggested for each line of evidence.

Once the RVC is satisfied that these criteria are met – and unlike poliomyelitis-free certification – it will verify that the country has achieved elimination of measles and control of rubella/CRS. It can also eventually verify elimination status in the entire Region once all countries have met the criteria.

The structure and membership of the RVC and the NVC are described, as well as standard mechanisms for verification through a description of their functions and terms of reference. These include normative, verification and advisory functions and for the chair, leadership and management functions. An advocacy function is also included in their terms of reference. The NVC will coordinate the submission of annual reports to the RVC so that the RVC can monitor progress towards measles elimination and rubella/CRS control, and verify its achievement.

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 and response plans for potential outbreaks.

Definitions¹

- (1) *Measles, or rubella, eradication*: worldwide interruption of measles, or rubella, virus 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 or country) for ≥ 12 months in the presence of a well-performing surveillance system. However, verification of measles elimination takes place after 36 months of interrupted endemic measles virus transmission.
- (3) *Rubella and CRS elimination*: the absence of endemic rubella virus transmission in a defined geographical area (e.g. region or country) for > 12 months and the absence of CRS cases associated with endemic transmission in the presence of a well-performing surveillance system. However, verification takes place after 36 months of interrupted endemic virus transmission.
- (4) *Rubella and CRS control*:² a 95% reduction of rubella and CRS as compared with the 2008 baseline nationally and for the Region.
- (5) *Endemic measles, or rubella, virus transmission*: the existence of continuous transmission of indigenous or imported measles virus, or rubella virus, that persists for ≥ 12 months in any defined geographical area.
- (6) *Re-establishment of endemic transmission*: occurs when epidemiological and laboratory evidence indicates the presence of a chain of

1 World Health Organization. Framework for verifying elimination of measles and rubella. *Weekly Epidemiological Records* 2013; 88: 89–100.

2 WHO Regional Office for South-East Asia. Strategic Plan for Measles Elimination and Rubella and Congenital Rubella Syndrome Control in the South-East Asia Region 2014–2020. New Delhi: WHO SEAR. 2014.

transmission of a virus strain³ that continues uninterrupted for ≥ 12 months in a defined geographical area where measles or rubella had previously been eliminated.

- (7) *Measles outbreak in countries with an elimination goal*: a single laboratory-confirmed case of measles.
- (8) *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.
- (9) *Laboratory-confirmed measles, or rubella, case*: a suspected case of measles or rubella that has been confirmed by a proficient laboratory.⁴
- (10) *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 between 7 and 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.
- (11) *Clinically compatible measles case*: a case with fever and maculopapular (non-vesicular) rash and at least 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.
- (12) *Clinically compatible rubella case*: 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.
- (13) *Suspected case of congenital rubella syndrome (CRS)*:⁵ an infant less than one year of age in whom a health worker suspects CRS. A health

3 For measles, a virus strain comprises viruses with N gene (450) sequences that are at least 99.7% identical (1 nt change).

4 Manual for the laboratory diagnosis of measles and rubella virus infection, 2nd ed. Geneva, World Health Organization, 2007 (WHO/IVB/07.01). (Also available at http://whqlibdoc.who.int/hq/2007/WHO_IVB_07.01_eng.pdf).

5 World Health Organization. WHO-recommended standards for surveillance of selected vaccine-preventable diseases. Geneva: WHO 2003 (WHO/V&B/03/01).

worker should suspect CRS when an infant aged 0–11 months shows signs of heart disease and/or suspicion of hearing impairment and/or one or more of the following eye signs: white pupil (cataract), large eyeball (congenital glaucoma) or pigmentary retinopathy. A health worker should also suspect CRS when an infant's mother has a history of suspected or confirmed rubella during pregnancy, even when the infant shows no signs of CRS.

- (14) *Clinically compatible CRS case*: A case with presence of ≥ 2 clinical features from group A or ≥ 1 feature from group A and ≥ 1 feature from group B:
- Group (A): cataract(s), congenital glaucoma, congenital heart disease, hearing impairment, pigmentary retinopathy
 - Group (B): purpura, splenomegaly, microcephaly, mental retardation, meningoencephalitis, radiolucent bone disease, jaundice with onset within 24 hours after birth
- (15) *Laboratory-confirmed CRS case*: a suspected infant of CRS who meets the laboratory criteria for CRS case confirmation.
- (16) *Congenital rubella infection (CRI)*: an infant who does not have clinical signs of CRS but has a positive rubella specific IgM test, which is classified as having CRI.
- (17) *Non-measles, non-rubella discarded case*: a suspected case that has been investigated and discarded as a non-measles and non-rubella case using (a) laboratory testing in a proficient laboratory⁶, or (b) epidemiological linkage to a laboratory-confirmed outbreak of another communicable disease that is neither measles nor rubella.
- (18) *Measles vaccine-associated illness*: a suspected case that meets all five of the following criteria: (i) the patient had a rash illness, with or without fever, but did not have cough or other respiratory symptoms related to the rash; (ii) the rash began 7–14 days after vaccination with a measles-containing vaccine; (iii) the blood specimen, which was positive for measles IgM, was collected 8–56 days after vaccination;

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.

(iv) thorough field investigation did not identify any secondary cases; and (v) field and laboratory investigations failed to identify other causes.

Or, in a suspected case where virology is performed, the genotyping result indicating vaccine strain would also confirm vaccine-associated measles.

- (19) *Endemic measles, or rubella, case*: a laboratory or epidemiologically linked confirmed case of measles or rubella resulting from endemic transmission of measles, or rubella, virus.
- (20) *Imported measles, or rubella, case*: a case exposed to measles, or rubella, outside the Region or country during the 7–21 days (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 Region or country for only a part of the 7–21 day interval [or 12–23 days for rubella] prior to rash onset, additional evidence including a thorough investigation of contacts of the case is needed to exclude a local source of infection.)
- (21) *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: 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.)
- (22) *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 after a thorough investigation.

Overview of measles and rubella in the WHO South-East Asia Region

1.1 Introduction

Globally, 79% reduction in measles mortality has been reported, from an estimated 546 800 in 2000 to 114 900 in 2014. We are still 16% short of the 2015 target of 95% mortality reduction. Currently 119 (61%) countries have reported MCV1 coverage of equal to or more than 90%. On a positive note, MCV2 coverage has seen a rapid rise, and in 2015, it was 61%. A dramatic decline is evident in measles cases as MCV1 and MCV2 coverage increases. However, since 2009, cases have decreased minimally, and MCV1 coverage has stagnated globally between 84% and 85%.

With respect to regional elimination goals, four regions had targets to achieve measles elimination and two regions had targets for rubella elimination by 2015. Four out of six regions have a Regional Verification Commission for Measles and Rubella Elimination/Control, including the AMR, EUR, WPR and now SEAR. National Verification Committees have been established and are functional in 126 out of 194 Member States. None of the African countries has a National Verification Committee. Currently 81 of 194 Member States (43 in AMR, 32 in EUR, 6 in WPR) of WHO have been verified free of endemic measles.

Worldwide incidence of rubella has been reported to decline from 350/million in 2000 to million 3.3 in 2015. Currently, global RCV coverage is estimated to be 46% and all countries in the Region of the Americas have been verified as rubella-free.

In 2015, only 232 cases of CRS have been reported globally, while it is estimated that there are over 10 000 cases in India alone. Although there is a lack of CRS surveillance in many countries, it is estimated that the majority of the CRS burden is in sub-Saharan Africa and Asia.

A Global Framework for verifying elimination of measles and rubella has been available since 2013; however, it does not address definitions or surveillance indicators for rubella and CRS control, which has been incorporated in the SEAR framework. Regions have developed similar, but not identical framework including processes, criteria, and indicators for measles and rubella elimination.

1.2 WHO South-East Asia Regional Strategy for Measles Elimination and Rubella CRS Control 2014–2020

In September 2013, the WHO Regional Committee for South-East Asia adopted the goal of measles elimination and rubella/congenital rubella syndrome (CRS) control in the SEA Region by 2020 (Resolution SEA/RC66/R5).

The Strategic Plan for Measles Elimination and Rubella/CRS Control in the South-East Asia Region 2014–2020 provided a framework for Member States towards achieving the measles elimination and rubella/CRS control goal by 2020. The recommended strategies include (1) achieve and maintain at least 95% population immunity with two doses against measles and rubella within each district of each country in the Region through routine and/or supplementary immunization; (2) develop and sustain a sensitive and timely integrated measles and rubella case-based surveillance system and CRS surveillance in each country in the Region that fulfils recommended surveillance performance indicators; (3) develop and maintain an accredited measles and rubella laboratory network that supports every country or area in the Region; and (4) strengthen support and linkages to achieve the above three strategic objectives.

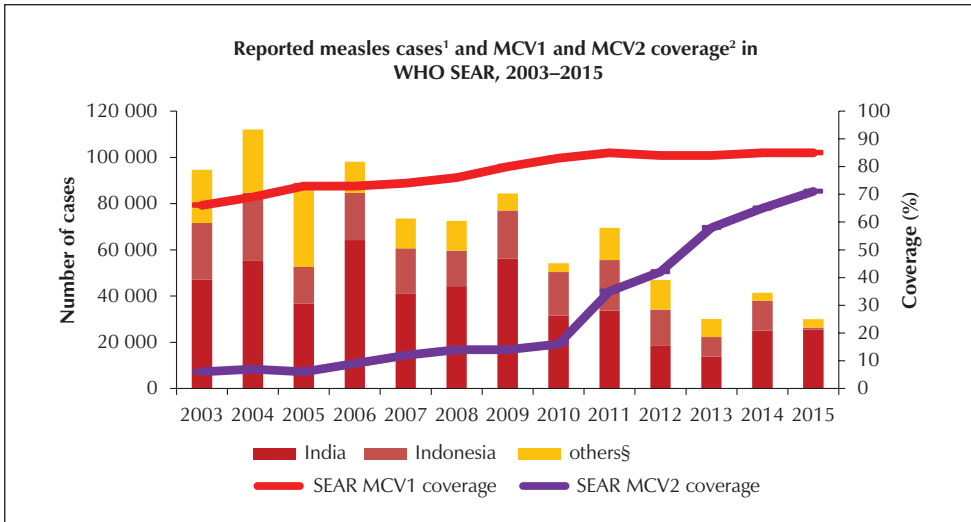
The strategic plan for measles elimination and rubella and congenital rubella syndrome control in the South-East Asia Region, from 2014 to 2020, fulfils the Regional Committee (RC) request to the Regional Director “to mobilize financial resources and build on the existing partnership in support of measles elimination and rubella/CRS control” (Resolution SEA/RC66/R5). The dramatic improvements in immunization coverage, case-based measles and rubella surveillance, and regional measles and rubella laboratory network over the past decade have prepared the Region to move forward towards the declared goal of measles elimination and rubella/CRS control by 2020.

Numerous strategies in line with existing global guidelines are suggested to achieve these four objectives. Guiding principles of country ownership; strengthening routine immunization and health systems; equity and critical linkages with other health sectors, line ministries and civil society are emphasized as being the largest contributors of measles elimination and rubella/CRS control activities to child health and for achieving the fourth Millennium Development Goal (MDG) 4.

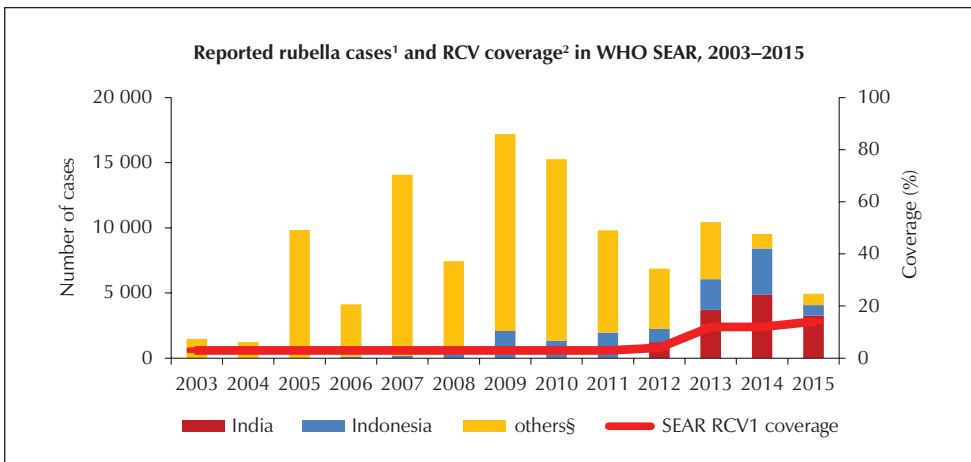
Total costs to achieve regional measles elimination and rubella/CRS control are estimated to be US\$ 803.1 million, of which US\$ 572.8 million (71%) is for supplementary immunization activities (SIAs); US\$ 199.5 million (25%) is for measles-rubella (MR) surveillance, including laboratory support; and US\$ 26.0 million (3%) is for outbreak response immunization. Costs for the other budget components are estimated to be US\$ 4.8 million (1%). These estimates do not include direct support to strengthen routine immunization services.

1.3 Progress towards measles elimination and rubella control in the SEA Region

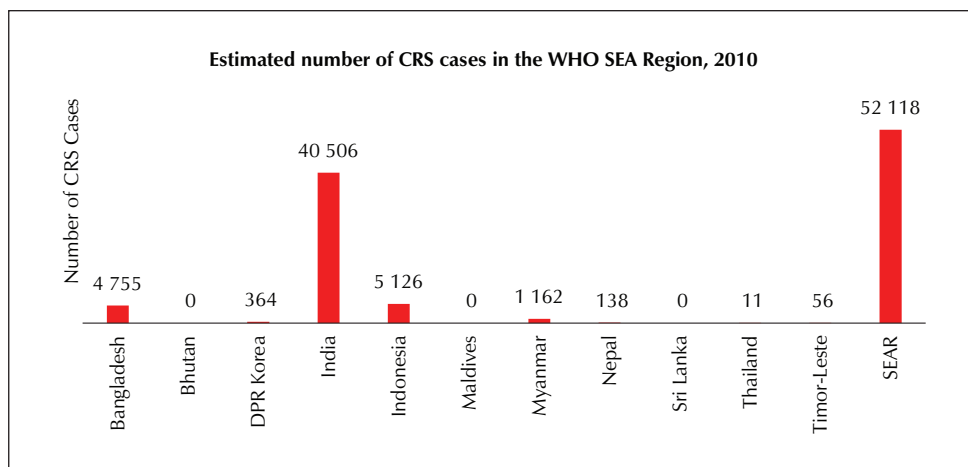
The WHO South-East Asia Region has made significant progress towards measles elimination since 2000. The number of measles cases as reported to WHO has decreased by 72% from 106 419 to 29 932 during 2000–2015. As of 2015, India contributes most to the burden of measles and rubella in the Region. In India, the number of reported cases of measles decreased by 54% from the reported 51 780 in 2001 to 23 728 in 2015. The number of rubella cases reported was 15 275 in 2010 and 4945 in 2015. Most cases reported in 2015 were from India (3252) and Indonesia (826). The incidence rate of CRS in the SEA Region is estimated to a mean of 136 per 100 000 live births since 1996 with a total annual number of CRS cases of 46 621 (95% CI 1016–168 910).



1. WHO vaccine-preventable diseases: monitoring system 2016
2. WHO and UNICEF estimates of national immunization coverage, July 2016 revision



1. WHO vaccine-preventable diseases: monitoring system 2016
2. WHO and UNICEF estimates of national immunization coverage, July 2016 revision



Estimated coverage with MCV1 increased from 56% in 2000 to 84% in 2015 (WUENIC 2015 revision). In 2015, five countries reported MCV1 coverage $\geq 95\%$, four had coverage $\geq 80\%$ and two had coverage $< 80\%$. All countries offer a second dose of MCV (MCV2) through routine immunization. However, 5.5 million children were still missed with MCV1 vaccination in the entire WHO South-East Asia Region.

As of July 2016, all countries except Thailand have conducted wide age-range measles SIAs targeting measles-susceptible populations; Bangladesh, Bhutan, Maldives, Nepal, Sri Lanka and Timor-Leste conducted campaigns with a combination measles and rubella vaccine. Similarly, India and Indonesia have planned a wide age-range campaign with a combination of measles and rubella vaccines in 2017–2018. Eight countries offer rubella vaccine through their national routine immunization in combination with measles and/or mumps vaccine. In 2015, with all the routine and supplementary immunization with the measles-containing vaccine, an estimated 640 000 deaths were averted due to measles vaccination alone in this Region.

Currently, all countries conduct case-based surveillance for measles and rubella among health facilities and outbreaks investigation. While the magnitude of the burden of rubella/CRS is not fully known, measles surveillance has “unmasked” a substantial burden in the Region. As per case-based data, the discarded measles and rubella rate was 0.58 per 100 000 population in 2015 (target $\geq 2/100\ 000$), with two countries exceeding the target (Maldives and Sri Lanka). Serologic specimens were collected from 37% of suspected cases, with nine out of 11 countries achieving a specimen collection rate of $\geq 80\%$.

CRS surveillance is routinely conducted in five countries in the Region – Bangladesh, Indonesia, Maldives, Nepal and Sri Lanka. In 2014, Nepal planned to establish CRS surveillance in five sentinel sites, while Indonesia conducted pilot CRS surveillance and had plans to expand their CRS surveillance by the end of 2016. In addition, special studies have been conducted in other countries. During 2000–2002, Myanmar conducted active surveillance that documented the presence of CRS during an inter-epidemic period. In India, a review of all studies related to CRS was published in 2012. In Maldives, a retrospective review of CRS was conducted in 2003. India, Myanmar and Timor-Leste are in the process of establishing CRS surveillance and are expected to do so by the end of 2016.

As of 2015, the SEAR Measles and Rubella Laboratory Network has been expanded to a total of 39 laboratories. The network comprises one regional reference laboratory (RRL) in Thailand, two national reference laboratories (2NRL) in India, at least one national laboratory (NL) in each Member State (8NL) except India (11NL) and Indonesia (4NL), and 13 subnational laboratories (SNL) in Thailand. Moreover, Indonesia, Myanmar and Nepal have planned to increase more laboratories to support national case-based surveillance. Among these 39 laboratories, 36 are accredited by WHO and three laboratories are pending accreditation.

In 2015, a total of 26 411 serologic specimens were tested in a measles-rubella laboratory network of SEAR. Of them, 64% specimen results were provided to the national programme within four days of the sample being received at laboratory.

Given a target discarded measles rate of 2 per 100 000 population, the laboratory network will need to evaluate at least 37 500 specimens per year in the absence of measles and rubella virus transmission. The network is capable of handling this quantity of specimens and more.

Core principles for verification of measles elimination and control of rubella and CRS

The framework for verification of measles elimination and rubella control is a dynamic document and will be regularly updated to meet the newer needs and adopt the newer technologies and evidences as they are available.

- 2.1 Attainment of measles elimination and control of rubella/CRS should be verified independently for individual countries and eventually for the Region following standard procedures and criteria.
- 2.2 The RVC will determine whether individual countries and the Region as a whole have eliminated endemic measles virus transmission and controlled rubella and CRS.
- 2.3 NVCs will be established to collect relevant evidence of national elimination of measles and control of rubella/CRS and submit corresponding documentation to the RVC annually to report progress towards or achievement of measles elimination and control of rubella and CRS. National secretariats may be formed to assist NVCs in collecting data and preparing documentation.
- 2.4 For large countries, such as India and Indonesia, RVCs may review data from the second level administrative unit towards progress in achieving measles elimination and rubella/CRS control, applying the same general criteria and processes as applied for the country. However, verification will be done for the country as a whole.
- 2.5 Verification of national and regional elimination will require the absence of endemic measles or rubella cases for at least 36 months. This is to ensure that re-established endemic transmission has not occurred.

- 2.6 Verification of rubella and CRS control will require demonstration of a 95% reduction in rubella and CRS cases from the estimation done in 2008.
- 2.7 The elimination of measles and control of rubella may occur at different times, which is likely. As such, the two events will be verified separately and with different time frames.
- 2.8 Documentation will address three major criteria, supported by indicators, within five components.
- 2.9 For countries with large population and geographical area, “interruption of endemic transmission” may not easily be achieved. Criteria, such as gradual decrease of epidemic peak, gradual increase of epidemic intervals, loss of seasonality, continuous reduction of measles in the vaccination target age group, etc. will be used to verify the progress of measles elimination and rubella/CRS control.
- 2.10 The RVC may apply complimentary or “additional” or alternative evidence as it deems appropriate to make a final determination of verification. Countries without a system to collect data related to one or more lines of evidence or indicators may still be verified as having eliminated measles and/or eliminated or controlled rubella as long as the RVC is satisfied that available evidence is sufficient to justify verification.
- 2,11 The verification process may involve field assessments by RVC or NVC members if additional information or validation of documentation is required.
- 2.12 The verification process may require to form subcommittees to review specific areas as deemed necessary by the Chair.

Standard verification criteria, lines of evidence and indicators

Verification of elimination will address three criteria. This section describes the criteria, components and component indicators.

Verification criteria for elimination

- (1) Documentation of the interruption of endemic measles, or rubella, virus transmission for a period of at least 36 months from the last-known endemic case;
- (2) The presence of a high-quality surveillance system that is sensitive and specific enough to detect imported and import-related cases; and
- (3) Genotyping and molecular evidence that supports the interruption of endemic transmission.

Lines of evidence and indicators for verification

3.1 A detailed description of the epidemiology of measles and rubella since the introduction of measles and rubella vaccine in the national immunization programme

The country should be able to describe the number of cases/incidence and epidemiology of measles and rubella within its borders over time, leading to a logical outcome of absence of endemic measles or rubella virus transmission. Ideally, the time period would begin 5 to 7 years prior to the year of measles and rubella vaccine introduction and conclude the year in which verification of elimination or control is being considered. The last five years should be particularly highlighted.

Case classification and incidence

In describing incidence of measles and rubella, it is necessary to classify confirmed cases by source of infection and by method of confirmation. Source of infection may be endemic, imported, import-related, or unknown. Method of confirmation may be by laboratory, epidemiologic linkage, or clinical criteria (Table 1). Definitions of these terms were listed at the beginning of the *Guidelines*.

Every confirmed or clinically compatible case of measles or rubella may be represented in one of the cells in Table 1. When measles and rubella 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. 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.

Table 1: Source and method of measles and rubella case confirmation

Source of infection ↓	Method confirmed →	Confirmed		Clinically compatible
		Laboratory	Epidemiological linkage	
Endemic		A	B	I
Unknown		C	D	J
Imported		E	F	K
Import-related		G	H	L

Indicator: Proportion of confirmed cases of known source of infection that are imported or import-related (Target: $\geq 80\%$).

This indicator is calculated as (total number of cases imported and import-related)/total confirmed cases, or $(E+F+G+H)/(A+B+C+D+E+F+G+H)$. Clinically compatible cases are excluded from the analysis, as it is unlikely that they are true measles or rubella cases in near-elimination settings.

Epidemiological characteristics

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

Epidemic curves of confirmed cases (regardless of source) are a simple way to show the evolution of measles/rubella incidence. Epidemic curve features consistent with progress leading to elimination normally include increasing intervals between clusters/outbreaks, decreasing number of cases in clusters/outbreaks, decreasing duration of clusters/outbreaks, increases in 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 geographic spread of measles virus over consecutive time intervals can help confirm progress towards and eventual achievement of measles elimination.

Tables and bar charts indicating age distribution and vaccination status of cases over time may also suggest progress towards elimination. As countries and areas near elimination, an increasing percentage of cases are 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.

Evidence: Wide range and multiple years of epidemiological analysis in support of achievement of elimination of endemic measles or elimination/control of rubella virus.

3.2 Genotyping and molecular evidence that measles and rubella virus transmission was interrupted (for elimination)

Genotype and molecular characteristics also are important to verify the absence of endemic measles or rubella virus transmission. Current and recently circulating measles genotypes appear to be primarily B3, D4, D8 and H1 in the Region. B3 genotype has been seen in the Region since 2012 and H1 since 2015.

Endemic rubella genotypes include 1E and 2B. However, 1E has not been reported since 2013.

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. The absence of previously endemic strains for ≥ 12 months with or without sporadic imported strains is consistent with elimination.

Evidence: Wide range and multiple years of virologic data with emphasis on the most recent 5 years in support of achievement of measles or rubella elimination.

3.3 Epidemiological surveillance and laboratory performance quality

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 laboratory must be fully accredited to ensure high-quality work. The credibility of elimination of measles and control of rubella/CRS depends on epidemiological and laboratory surveillance quality.

Standard indicators of surveillance performance and laboratory accreditation criteria have been described.^{1,5}

Indicators and suggested targets for high quality of epidemiological surveillance of measles and rubella

- Timeliness of reporting
 - Proportion of surveillance units reporting measles and rubella data to the national level and on time (target: $\geq 80\%$);
- Reporting rates of discarded non-measles and non-rubella cases as a proxy to sensitivity of surveillance
 - Reporting rate of non-measles non-rubella cases at national level (target: ≥ 2 per 100 000 population);
- Representativeness of reporting
 - Proportion of second administrative level units reporting at least two non-measles, non-rubella cases per 100 000 population (target: $\geq 80\%$ of second-level administrative units);

- Adequacy of investigation
 - Proportion of suspected cases with adequate investigation⁷ initiated within 48 hours of notification (target: $\geq 80\%$ of suspected cases);
- Laboratory confirmation
 - Proportion of suspected cases with adequate specimen collection⁸ for detecting acute measles and rubella infection collected and tested in a proficient laboratory (target: $\geq 80\%$ of suspected cases, excluding epidemiologically linked cases);
- Timeliness of specimen transport
 - Proportion of specimens received at the laboratory within 5 days of collection (target: $\geq 80\%$);
- Timeliness of laboratory reporting
 - Proportion of serology results reported by the laboratory within 4 days of specimen receipt (target: $\geq 80\%$);
 - Proportion of virology results reported by the laboratory within 2 months of specimen receipt (target: $\geq 80\%$);
- Viral detection
 - Proportion of laboratory-confirmed chains of transmission (defined as one or more confirmed measles cases) with specimens adequate for detecting measles virus collected and tested in an accredited laboratory (target: $\geq 80\%$).

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.

Indicators and suggested targets for epidemiological surveillance quality for CRS⁹

- Reporting rate
 - Annual rate of suspected CRS cases at the national level (target: ≥ 1 per 10 000 live births);
- Adequate investigation
 - Proportion of suspected CRS cases with the following data points completed: name and/or identifier, place of residence, sex, date of birth, date of reporting, date of investigation, date of specimen collection, history of rash illness of mother, travel history of mother, vaccination history of mother, age of mother, clinical examinations for hearing impairment, cataract, and congenital cardiac/heart defects and clinical outcome of the CRS case (alive or dead); (target: $\geq 80\%$ of suspected cases);
- Laboratory confirmation
 - Proportion of suspected cases with adequate blood specimen tested for laboratory confirmation (detection of IgM antibody, or virus) in an accredited laboratory (target: $\geq 80\%$ of suspected cases);
- Viral detection
 - Proportion of confirmed cases with adequate specimen tested for virus detection and genotyping (target: $\geq 80\%$ of confirmed cases); and
- Monitoring of viral excretion
 - Proportion of confirmed cases with at least two negative tests for virus detection/isolation after three months of age, with at least a one-month interval between tests (target: $\geq 80\%$ of confirmed cases);
- Timeliness of detection
 - Proportion of confirmed CRS cases detected within three months of birth;

⁹ Currently used by the Pan American Health Organization (PAHO); under review by Strategic Advisory Group of Experts (SAGE) on Immunization.

- Timeliness of specimen transport
 - Proportion of specimens (serologic or virologic) received at the laboratory within five days of collection;
- Timeliness of reporting laboratory result
 - Proportion of serologic results reported by the laboratory within four days of receiving the specimen.

Alternative evidence

- For countries without systems in place to collect the data required to calculate the indicators above, additional evidence may be submitted to demonstrate measles and rubella or CRS surveillance sensitivity and quality.
- For countries where a substantial number of measles and rubella or CRS cases are present in the private sector, additional evidence should be submitted to demonstrate that cases identified by the private sector are captured by national surveillance systems.
- Measles-rubella case-based surveillance is the gold standard for measles-rubella surveillance. To cross-check that system, the NVC should identify all other surveillance systems (i.e., EWAR, IDSR, others) that also report rash-fever cases.

Other indicators and suggested targets for laboratory performance

- Proportion of measles and rubella network laboratories that are WHO-accredited¹⁰ for serologic and, if relevant, for virologic testing (target: 100% of laboratories);
- Proportion of laboratories (government and private) that conduct measles, rubella and congenital rubella syndrome diagnostic testing that have adequate quality assurance mechanisms in place (target: 100% of laboratories); and
- Proportion of virus detection and genotyping results that are completed within two months of receipt of specimen (target: ≥80% of specimens received).

¹⁰ WHO measles laboratory accreditation criteria include (1) annual proficiency test results ≥90%; (2) at least 90% concordance of NML with RRL confirmatory testing; and (3) passing onsite inspection.

3.4 High population immunity

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

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

Several methods may be used to assess population immunity:

- 3.4.1 **Vaccination coverage estimates:** includes annual administrative reports of routine vaccination coverage with first and second dose measles- and rubella-containing vaccine (MRCV1 and MRCV2) 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 that sometimes differ from reported coverage. The reports should be available at least to the third administrative level. The advantage of this method is that it provides granularity to overall population immunity reports and can reveal large pockets of susceptible population groups. Limitations include uncertain denominators and inaccurate numerators. The measles strategic planning tool may be useful for estimating population immunity by year of birth. Having evaluated coverage at both national and subnational levels are preferred as administrative data are not free of data-quality issues.
- 3.4.2 **Surveys:** includes population-based surveys of routine and SIA coverage, demographic and health surveys (DHS) and multiple indicator cluster surveys (MICS). Limitations of population-based surveys may include lack of representativeness of all geographical areas (e.g. districts) and strata of society, as well as an inability to identify potentially large pockets of susceptible individuals. Data from rapid coverage assessments

(RCAs) usually conducted following mass vaccination campaigns may be an additional source of information to assess local level coverage, although should not be interpreted as coverage since RCAs do not use representative sampling methods.

- 3.4.3 **Sero-epidemiological surveys:** appropriately designed and implemented sero-epidemiological surveys can provide detailed information about the serological immunity by birth cohort, but suffer from the same potential limitations as coverage surveys and also potential limitations of sensitivity, specificity and predictive value of some laboratory tests for measles-specific immunoglobulin G (IgG) as correlates of immunity.
- 3.4.4 **Surveillance-dependent data and models:** an indicator of high levels of population immunity that relies on measles surveillance is the distribution of outbreak size: at least 80% of measles chains of transmission have <10 cases. Additional data such as distribution of outbreak duration, number of generations of transmission, proportion of imported and import-related cases and sero-epidemiological survey data may feed into models that determine effective reproduction numbers (R).^{11,12}
- 3.4.5 Indicators of population immunity:
- Administrative reports of MRCV1 coverage, national and by district (target: $\geq 95\%$ nationally and in every district);
 - Administrative reports of MRCV2 coverage, national and by district (target: $\geq 95\%$ nationally and in every district);
 - Administrative reports of SIA coverage, national and by district (target: $\geq 95\%$ nationally and in every district).

The RVC will prioritize to consider evaluated coverage when applicable. These include coverage from well-designed coverage evaluation surveys, or WHO UNICEF joint estimates done from national and subnational levels.

11 De Serres G, Gay NJ, Farrington CP. Epidemiology of transmissible diseases after elimination. *Am J Epidemiol* 2000; 151:1039–48.

12 Gay NJ, Hesketh LM, Morgan-Capner P, Miller E. Interpretation of serological surveillance data for measles using mathematical models: implications for vaccine strategy. *Epidemiol Infect* 1995; 113:139–156.

3.4.6 Additional evidence:

- Descriptions of intensified efforts made to identify and reach high-risk populations (migrants, remote, poor, ethnic minorities, etc.) through routine and supplementary immunization.

As elimination of rubella and CRS can be achieved with 85%–90% coverage with rubella-containing vaccine, the population immunity standards for verification of rubella elimination or control would not need to be as strict.

NVCs and the RVC should be judicious when interpreting immunity data. Countries may interrupt measles or rubella virus transmission without achieving very high levels of population immunity in every birth cohort, such as in adults among whom the force of infection may not be as high as in children and adolescents. 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 and therefore outbreak risks. Furthermore, it is important that all evidence supporting levels of population immunity be provided because each of the above methods has limitations. Such evidence should consider SIAs and changes in immunization schedules during specific years. Special additional analysis may also be done for vulnerable population groups that potentially have less access to vaccination services, e.g. migrants, urban or rural poor, people in remote areas.

3.5 Sustainability of measles elimination (and the national immunization programme)

Verification of measles elimination should include an assessment of whether elimination can be sustained, including whether resources will be available for outbreak response immunization and/or follow-up mass campaigns, where appropriate. The assessment should highlight strengths and weaknesses of the national immunization programme for maintaining high routine and/or supplementary immunization coverage against measles and rubella, and high-quality surveillance; and encourage the preparation of budgeted preparedness plans for needed responses to potential outbreaks resulting from measles virus importations.

This last verification component is indicative of impact that measles and rubella elimination activities have in strengthening routine immunization and surveillance systems, and in ensuring equity in immunization service delivery. Sustainability

assessments may be incorporated into larger programme reviews and feasibility assessments of new immunization-related initiatives, and should be further translated into national action plans outlining activities to overcome the identified programmatic gaps that can be used to strengthen health systems overall.

Lines of evidence

- Documented evidence of plans and financing for achieving and sustaining measles elimination and rubella/CRS control, including routine immunization, SIAs and/or outbreak response activities, and epidemiological and laboratory-based surveillance. Such evidence may be reflected in comprehensive multiyear plans, annual workplans and others.
- Documented evidence of monitoring and reviewing progress of the above plans.
- Evidence of immunization system security as indicated by:
 - secured funding for vaccine procurement (e.g. a line item in the national budget for vaccine procurement and programme implementation);
 - evidence of vaccine demand forecasting and vaccine stock management; and
 - standard operating procedures at each level of the programme (e.g. a checklist for conducting an immunization session).
- Written programmatic risk assessments that incorporate at a minimum population immunity, surveillance and ethno-demographic data at subnational levels.
- Budgeted importation and outbreak preparedness and response plans.
- Documented evidence on the capacity for epidemiological investigations and analysis of outbreaks at the subnational level.
- Documented evidence of capacity for outbreak preparedness and rapid outbreak response, at national and subnational levels. For example, does the country have an Emergency Operations Centre? or, are the rapid response Teams available at national and subnational levels?

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

3.6 Summary

The five lines of evidence, explained above, allow for a comprehensive evidence-based assessment of past programme performance and future capacity to sustain elimination. The indicators and individual lines of evidence should not be considered alone but should instead be evaluated together to establish the case for elimination of measles and control of rubella/CRS.

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 whether or not elimination has been achieved and maintained.

Once the RVC is satisfied that these criteria are met, and unlike poliomyelitis-free certification, it will verify that the country has eliminated measles and rubella/CRS. It can also eventually verify elimination status in the entire Region once all countries have met the criteria.

Structure of verification bodies

4.1 Regional Verification Commission and National Verification Committee structure

The RVC and the NVC will work together to verify measles elimination and rubella control or elimination in each country (Figure 2). The RVC will be the only body authorized to verify elimination or control in countries and areas. For the Region as a whole, for any technical and administrative issues, if required, this will be referred to relevant regional and global technical bodies.

The NVC will determine when countries 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 and/or rubella control or elimination. The national verification committee can be either a stand-alone entity or a part of the National Certification Committee for Polio Eradication depending on the availability of experts required within the country.

4.2 RVC 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 national immunization programmes or epidemiological and laboratory-based VPD surveillance. Members should be senior subject-matter experts with different areas of expertise, such as epidemiology, paediatrics, public health practice, virology and molecular biology.

RVC members (Chair, vice-Chair and rapporteur) are appointed by and report to the Regional Director of the WHO South-East Asia Region and remain independent of the SEAR Immunization Technical Advisory Group (ITAG), although they may

share information and reports with the ITAG. RVC members will serve terms of three years, with the possibility of renewal. To avoid any potential or perceived conflicts of interest, each RVC member will complete and sign a declaration of interest form prior to each RVC. The Regional Director may decide to discontinue a member's term for potential conflicts of interest or breach of confidentiality should the need arise following a review.

NVC members will be appointed by their respective ministries of health and report to the RVC through its Chairperson. The NVC should be independent of the National Committee on Immunization Practices or equivalent of a national technical advisory group on immunization. A minimum of five members should be represented on the NVC and should ideally represent different areas of expertise including epidemiology, clinical practice, public health practice, virology and molecular biology. NVC members should also provide a written declaration of interests to prevent potential conflicts of interest.

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 national immunization programmes (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 may arise.

Meetings of the RVC and the NVC are usually held annually and ad hoc as required. Support for the meetings will be provided by the Secretariat.

A proposed terms of reference (TOR) for the RVC is attached as Annex 1.

4.3 Secretariat support to RVC and NVCs

The Immunization and Vaccine Development (IVD) Unit in the WHO South-East Asia Regional Office will serve as the Secretariat for the RVC. At the national level, the NVC will have its own Secretariat, usually the NIP. In the countries with WHO country offices, WHO staff may provide technical and operational support to both the Secretariats and NVC. Countries without WHO country offices are welcome to consult with the IVD Unit in the WHO South-East Asia Regional Office for assistance when necessary.

Mechanism of verification

The authority to verify measles elimination and control or elimination of rubella will be vested solely in the RVC, which will assess progress towards, achievement and maintenance of measles elimination and rubella control or elimination in Member States annually or more often as appropriate, leading ultimately to regional verification of measles elimination. The NVC will similarly assess measles elimination status within its borders, determine when a country is ready for verification, and assist their ministries of health in preparing the necessary evidentiary documentation for submission to the RVC. The RVC will guide NVCs, and NVCs will guide NIPs and VPD surveillance units with respect to requirements to verify measles elimination.

In this respect, the RVC and NVCs will serve as de facto advisory bodies on the 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 South-East Asia Region Immunization Technical Advisory Group (ITAG).

The ITAG should be consulted in the event of discrepant technical opinions by the RVC. The RVC should be consulted in the event of discrepant technical opinions by any NVC. In addition to their normative, verification and advisory functions, the RVC and NVCs may also serve an advocacy role to promote measles and rubella/CRS elimination activities.

5.1 RVC functions

Normative function

- To review and establish criteria and procedures, including a plan of action, for monitoring progress and verifying the achievement of measles elimination and rubella/CRS control nationally and for the Region.

Verification function

- To verify achievement and maintaining of measles elimination and rubella/CRS control for individual countries and the Region;
- to monitor progress towards measles elimination and rubella/CRS control; and
- to execute post-verification role in individual countries and the Region, which as such needs to sustain the achievement and prevent re-establishment of endemic measles or rubella virus transmission by continuing the same strategies recommended for eliminating measles.

Advisory function

- To advise NVCs on verification criteria, requirements and procedures, including guidance on (i) reviewing data needed for verification, and (ii) proper documentation;
- to review the annual reports submitted by national verification committees and provide feedback; and
- to conduct field visits when needed to monitor progress, verify evidence and provide guidance to NVCs and government.

Leadership and management function of SEA-RVC Chair

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

Advocacy function

- SEA-RVC members may help raise awareness of and commitment to measles elimination and rubella /CRS control, targeting high-ranking health officials, health professionals, partners and political leaders through multiple channels such as national health conferences, professional societies, scientific seminars, media and personal contacts.

Accountability

- NVCs and RVCs will jointly, by virtue of the nature of their work, ensure that they hold respective counterparts accountable for the verification process and for the quality and authenticity of data and report presented to RVCs.

5.2 NVC terms of reference

- to advise the ministry of health (MoH), the NIP and the VPD surveillance units on requirements for verification;
- to compile and review information to monitor progress towards measles elimination and rubella/CRS control and assess if the country can verify elimination in accordance with established criteria and recommended lines of evidence;
- to conduct field visits when needed to monitor progress, assess data quality and validate analyses and assessments;
- to supervise and guide development of the annual progress report and verification documentation at the country level, and if necessary, propose additional analyses or feasible alternatives if standard verification data are insufficient or inconsistent;
- to review and validate the verification report, providing conclusions and recommendations before submitting the report to the RVC; and
- to provide programmatic guidance consistent with verification criteria and lines of evidence.

Management function of NVC Chair

- to define internal procedures and responsibilities of committee members in accordance with guidelines provided by the RVC;
- to prepare an NVC plan of action including activities, timeline, expected outcomes, and human and financial resource requirements in collaboration with the NIP and MoH, and to present the plan to the RVC for approval;
- to preside over NVC meetings to be held at least once a year;
- to represent the NVC and attend RVC or other regional meetings when required.

5.3 Advocacy function for both RVC and NVC

RVC and NVC members may help raise awareness of and commitment to measles and rubella elimination or control, targeting high-ranking health officials, health professionals, partners and political leaders through multiple channels such as national health conferences, professional societies, scientific seminars, media and personal contacts.

5.4 Mechanism of review of country annual progress report

The annual progress report will be shared by the country by the end of March of the next year. This report will be reviewed independently by at least two members of SEA-RVC and provide feedback in the subsequent SEA-RVC meeting, and the meeting will derive conclusions based on review of the report.

Countries whose fiscal cycle does not match with the review period will be provided annualized data for up to December of the fiscal year; and any future updates can be made in agreement with the Chair of the RVC and the Secretariat.

The SEA-RVC members may direct any queries to the NVCs during the review through the Secretariat.

At times the SEA-RVC may form special subcommittees deemed necessary by the chair from among the members along with an external consultant to review specific aspects of reports and to examine specific issues raised in the SEA-RVC meeting by members.

The RVC members may look for “alternate” and/or “additional” evidences for various lines of evidences as deemed necessary, which include but not limited to:

- field visits,
- policy environment,
- regional publication and reports, etc.

To standardize the review process, a checklist will be developed by the Secretariat in consultation with the chair and shared with SEA-RVC members. The checklist will be based on the annual reporting template and will be the basic minimum variable to be reviewed by the RVC member.

Documentation of verification

To document progress towards achieving and sustaining measles and rubella elimination, every country's NVC 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, and provide additional evidence when required.

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 control of rubella/CRS. The first progress reports are expected to be submitted during the last quarter of 2016. Subsequent progress reports will be updates to the first reports on the progress towards achievement of or maintenance of elimination of measles and control of rubella/CRS. During annual meetings, the RVC will review all reports and provide feedback and recommendations to governments through the NVCs.

The annual progress report should include the following components:

- (1) background information (essential for the first report and included in subsequent reports only if there are relevant changes);
- (2) detailed description of the epidemiology of measles, rubella and CRS since the introduction (if feasible 5–7 years prior to vaccine introduction) of the measles and rubella vaccines in the national immunization programme;
- (3) quality of epidemiological and laboratory surveillance systems for measles and rubella, including the status of standard surveillance performance indicators;
- (4) 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;

- (5) sustainability of the national immunization programme including resources for mass campaigns, where appropriate, in order to sustain measles and rubella elimination;
- (6) genotyping evidence that supports measles and rubella virus transmission is interrupted; and
- (7) NVC plan including activities, timeline and expected outcomes, and validation, comments, conclusions and recommendations provided by NVC.

A draft template of a country annual report is attached herewith as Annex 2.

Post-verification needs

After achievement and verification of measles elimination and rubella/CRS control, countries will need to sustain the achievement and prevent re-establishment of endemic measles virus transmission or occurrence of rubella outbreaks by continuing the same strategies recommended to eliminate measles and control rubella/CRS:

- (1) high population immunity against measles and rubella through supplementary and/or routine immunization;
- (2) high-quality epidemiological and virological surveillance;
- (3) access to a WHO-accredited laboratory for case confirmation and virological identification.

In addition, countries should have budgeted preparedness and response 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 reports and field visits when necessary, and provide feedback and recommendations to governments through NVCs.

Post verification, annual risk assessments should be conducted by governments with NVC assistance, and annual progress reports should continue to be submitted to the RVC.

8

Description of key indicators

Indicator	Description
<p>Disease incidence</p> <p>(i) Annual incidence of confirmed measles cases</p> <p>(ii) Annual incidence of confirmed rubella cases.</p>	<p>The numerator is the confirmed number of measles or rubella cases for the year, and the denominator is the population in which the cases occurred multiplied by 1 million. When the numerator is zero, the target incidence would be zero.</p>
<p>Indicators for high quality of epidemiologic surveillance of measles and rubella</p>	
<p>Proportion of surveillance units reporting measles and rubella data to the national level and on time (target: $\geq 80\%$)</p>	<p>The numerator is the number of surveillance units reporting on time, and the denominator is the total number of surveillance units in the country multiplied by 100 <i>[remember that each reporting unit will report 52 times a year]</i>.</p>
<p>Reporting rate of non-measles non-rubella cases at the national level (target: ≥ 2 per 100 000 population)</p>	<p>The numerator is the number of discarded non-measles non-rubella cases, and the denominator is the total population of the country multiplied by 100 000.</p>
<p>Proportion of second administrative level units reporting at least two non-measles non-rubella case per 100 000 (target: $\geq 80\%$ of second-level administrative units)</p>	<p>The numerator is the number of subnational units reporting at least two discarded non-measles non-rubella cases per 100 000, and the denominator is the total number of subnational units multiplied by 100.</p> <p>Note: If the administrative unit has a population $< 100\ 000$, the rate should be calculated by combining data over more than 1 year for a given administrative unit to achieve $\geq 100\ 000$ person-years of observation.</p>
<p>Proportion of suspected cases with adequate investigation**** (target: $\geq 80\%$ of suspected cases)</p>	<p>The numerator is the number of suspected cases of measles or rubella for which an adequate**** investigation was initiated within 48 hours of notification, and the denominator is the total number of suspected measles and rubella cases, multiplied by 100.</p>

Indicator	Description
Proportion of suspected cases with adequate specimen collection ^{††††} (target: $\geq 80\%$ of suspected cases, excluding epidemiologically linked cases)	The numerator is the number of suspected cases from whom adequate specimens ^{††††} for detecting measles or rubella were collected and tested, and the denominator is the total number of suspected measles or rubella cases multiplied by 100 [epidemiologically linked cases should be removed from the denominator].
Proportion of specimens received at the laboratory within 5 days of collection (target: $\geq 80\%$)	The numerator is the total number of specimens received in the laboratory within five days of collection, and the denominator is the total number of specimens received by the laboratory multiplied by 100.
Proportion of laboratory-confirmed chains of transmission (defined as two or more confirmed measles cases) with specimens adequate for detecting measles virus collected and tested in an accredited laboratory (target: $\geq 80\%$).	The numerator is the number of chains of transmission for which adequate samples have been submitted for viral detection, and the denominator is the number of chains of transmission identified. Note: Where possible, samples should be collected from at least 5–10 cases early in a chain of transmission and every 2–3 months thereafter if transmission continues. For virus isolation, adequate throat or urine samples are those collected within 5 days after rash onset. For virus detection using molecular techniques, adequate throat samples are those collected up to 14 days after onset of rash, and adequate oral fluid samples are those collected up to 21 days after onset of rash.
Indicators and suggested targets for epidemiological surveillance quality for congenital rubella syndrome (CRS)	
Reporting rate of suspected CRS cases at the national level (target: ≥ 1 per 10 000 live births)	The numerator is the number of suspected CRS cases for the year, and the denominator is the live birth cohort of the population in which the cases occurred multiplied by 10 000. When numerator is zero, the target incidence would be zero.
Proportion of suspected CRS cases with adequate investigation (target: $\geq 80\%$ of suspected cases)	The numerator is the number of suspected CRS cases for which an adequate investigation was initiated after three months of age of the child and the denominator is the total number of suspected CRS cases, multiplied by 100. Adequate investigation defined as the collection of the following data points: name and/or identifier; place of residence; sex; date of birth; date of reporting; date of investigation; date of specimen collection; history of rash illness of mother; travel history of mother; vaccination history of mother; age of mother; clinical examinations for hearing impairment, cataract, and congenital cardiac/heart defects and clinical outcome of the CRS case (alive or dead).

Indicator	Description
Proportion of suspected cases with adequate specimen collection (target: $\geq 80\%$ of suspected cases)	The numerator is the number of suspected cases from whom adequate specimens ^{††††} for detecting CRS (IgM/IgG) were collected and tested, and the denominator is the total number of suspected CRS cases multiplied by 100 [epidemiologically linked cases].
Proportion of confirmed cases with adequate specimen analysed for virus detection (target: $\geq 80\%$ of confirmed cases)	The numerator is the number of lab-confirmed CRS cases for the year for whom adequate specimen was analysed for viral detection, and the denominator is the total number of laboratory-confirmed CRS cases, multiplied by 100.
Proportion of lab-confirmed cases with at least two negative tests for virus detection after 3 months of age, with at least a 1-month interval between tests (target: $\geq 80\%$ of confirmed cases)	The numerator is the number of lab-confirmed CRS cases with at least two negative tests for virus detection after three months of age, with at least a one-month interval between tests for the year, and the denominator is the total number of lab-confirmed CRS cases, multiplied by 100.
Proportion of confirmed CRS cases detected within 3 months of birth.	The numerator is the number of confirmed CRS cases (clinical compatible and laboratory confirmed) detected within three months of birth, and the denominator is the total number of lab-confirmed CRS cases, multiplied by 100.
Indicators and suggested targets for laboratory performance	
Proportion of measles and rubella network laboratories that are WHO-accredited ^{§§§§} for serologic and, if relevant, for virologic testing (target: 100% of laboratories)	The numerator is the total number that is WHO-accredited for virologic and serologic testing and the denominator is the total number of laboratories (private and public) testing for MR in the geographic region.
Completeness and timeliness of monthly reporting (including zero reporting) to the WHO Regional Office for specimens received for serologic and virologic testing (target: $\geq 80\%$ of specimens received in the laboratory)	

Indicator	Description
Proportion of specimens with serologic results reported by the laboratory within four days of receiving the specimen (target: $\geq 80\%$ of specimens received)	The numerator is the total number of specimens for which laboratory results were available within four days of receiving the specimen and the denominator is the total number of specimen received for testing multiplied by 100, in the given year.
Proportion of laboratories (government and private) that conduct measles and rubella diagnostic testing that have adequate quality assurance mechanisms in place (target: 100% of laboratories)	The numerator is the total number of laboratories (government and private) that conduct measles diagnostic testing that have adequate quality assurance mechanisms in place and the denominator is the total number laboratories (government and private) that conduct measles diagnostic testing multiplied by 100, in the given year.
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)	The numerator is the total number of virus detection and genotyping results (where appropriate) that are completed within two months of receipt of specimen and the denominator is the total number of specimen received for testing multiplied by 100, in the given year.

**** 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.

†††† Adequate specimens for serology are those collected within 28 days after rash onset that consist of ≥ 0.5 ml serum or ≥ 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 one minute along the gum until the device is thoroughly wet; epidemiologically linked cases should be excluded from the denominator.

‡‡‡‡ Adequate specimens for serology are those collected within 12 months of age of the child that consist of ≥ 0.5 ml serum

§§§§ 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 onsite inspection.

Annex 1

Terms of reference

Regional Verification Commission for Measles Elimination and Rubella/CRS Control (SEA-RVC)

Background

In September 2013, after an extensive review of the progress made and the biological, programmatic, and financial feasibility of measles and rubella elimination, the Sixty-sixth session of the Regional Committee for South-East Asia Region, adopted the goal of measles elimination and rubella/CRS control in the South-East Asia Region by 2020 (SEA/RC66/R5). As a result of this resolution, all six WHO regions now have a measles elimination goal. The Strategic Plan for Measles Elimination and Rubella/CRS Control in the South-East Asia Region for 2014–2020 developed to provide a framework for the Member States towards achieving the measles elimination and rubella/CRS control goal by 2020 also envisions the formation of a regional commission to monitor progress towards and verify elimination of measles and rubella. The European Region, the Region of Americas and Western Pacific Region already have such regional commissions that have been instrumental in monitoring the progress made in measles elimination in those regions. These commissions till date have already verified 22 (41%) countries in Europe, 34 (97%) countries in the Americas and six (22%) countries in the Western Pacific.

The Sixth South-East Asia Regional Immunization Technical Advisory Group (SEAR-ITAG) meeting in June 2015 considering the progress made in measles elimination and rubella/CRS control in the Region recommended that by the end of 2015 a Regional Verification Commission for measles elimination and rubella/CRS control (SEA-RVC) be established.

Principles and processes of SEA-RVC

- (1) Function as an independent commission.
- (2) Involve two levels of external and independent expert bodies involved in verification process – regional and national.
- (3) Verify individually for countries and eventually for the Region.
- (4) Apply standard procedures and criteria.
- (5) For larger countries verify by second level administrative unit when appropriate.
- (6) Seize the opportunity to document the impact the initiative has on strengthening the health system and health equity.

Principles of functioning of SEA-RVC

- (1) *Normative function*
To review and establish criteria and procedures, including a plan of action, for monitoring progress and verifying the achievement of measles elimination and rubella/CRS control nationally and for the Region.
- (2) *Verification function*
To verify achievement and maintaining of measles elimination and rubella/CRS control for individual countries and the Region.
To monitor progress towards measles elimination and rubella/CRS control.
Post-verification role in individual countries and the Region as such needs to sustain the achievement and prevent re-establishment of endemic measles or rubella virus transmission by continuing the same strategies recommended for eliminating measles.
- (3) *Advisory function*
To advise national verification committees (NVCs) on verification criteria, requirements and procedures, including guidance on
 - (a) Reviewing data needed for verification, and

(b) Proper documentation.

- To review the annual reports submitted by national verification committees and provide feedback.
- To conduct field visits when needed to monitor progress, verify evidence, and provide guidance to NVCs and governments.

(4) *Leadership and management functions of SEA-RVC Chair*

To prepare a plan of action and preside over meetings to be held at least once a year.

To define internal operating procedures and responsibilities of RVC members.

To supervise the documentation and verification process.

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

(5) *Advocacy function*

SEA-RVC members may help raise awareness of and commitment to measles elimination and rubella/CRS control, targeting high-ranking health officials, health professionals, partners and political leaders through multiple channels such as national health conferences, professional societies, scientific seminars, media and personal contacts.

(6) *Accountability*

NVCs and RVCs will jointly, by virtue of the nature of their work, ensure that they hold respective counterparts accountable for the verification process and for the quality and authenticity of data and report presented to RVCs.

Terms of reference of RVC

- (1) Serves in an honorary capacity and verifies the status of measles elimination and rubella/CRS control in countries and the Region as a whole.
- (2) Establish criteria and procedures required for the verification for the Region.

- (3) Provide guidance to national verification committees (NVC) and conduct field visits when needed.
- (4) Review information provided by NVCs and provides recommendations when indicated.
- (5) Provide recommendation when standard verification data are not sufficient or consistent.
- (6) Advocate for measles elimination and rubella/CRS control at the country and regional level.
- (7) Meet at least once every year.
- (8) Advise respective NVC {to be conveyed to respective MOH, national immunization programme (NIP) and vaccine preventable disease (VPD) surveillance units} on the requirements for verification of measles elimination.
- (9) Assess and verify, on request of NVCs, if the country is ready for verification.

Membership – general principle

Members will serve as temporary advisors to the Regional Director and will be

- (1) honorary;
- (2) independent – NOT directly involved in the management and operations of national immunization programmes, and measles laboratory in Member States but have an opportunity to monitor and provide recommendations when appropriate;
- (3) expert – epidemiology, paediatrics, public health practice, virology, molecular biology;
- (4) committed – committed to carry out responsibilities independently with the highest professional standards; and
- (5) profess no conflict of interest.

The proposed members of SEA-RVC

The SEA-RVC will comprise 12 regular members. A Chair will be nominated from among the members at the first meeting.

The duration of membership will be three years with the possibility of extension at the discretion of the Regional Director. The composition of the regular members will be as follows:

- (1) Member, International Expert Epidemiologist (2)
- (2) Member, International Expert, Public Health (3)
- (3) Member, International, Expert Virologist (2)
- (4) Member, International Expert, Clinical Medicine/Paediatrician (2)
- (5) Member, International Expert, Epidemiologist/Social Scientist (1)
- (6) Member, Representative SEA–RCCPE (1)
- (7) Member, Representative RVC WPR (1).

Chairs of the National Verification Committee for Measles Elimination and Rubella/CRS Control or equivalent of such committees from Member States will be invited to attend the meetings as observers/invitees as and when decided by the chair as appropriate.

Termination of membership

- (1) automatically at the end of the tenure unless renewed by the Regional Director,
- (2) when the member voluntarily resigns,
- (3) membership can be terminated by the Regional Director:
 - (a) when a member is identified to be physically and mentally not able to perform as per the TOR;
 - (b) when a documented conflict of interest is demonstrated;
 - (c) if under a legal trial or accused of serious offence; and
 - (d) other unforeseen conditions, at the discretion of the Regional Director.

Secretariat support

IVD-WHO-SEARO will serve as the Secretariat for the Commission.

Annex 2

Template for annual progress report by countries

Annual Country Report on Progress towards Measles Elimination and Rubella/CRS Control

Year

Country name

Submitted by:
Chair, National Verification Committee

Signature
Name
Date

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Executive summary

Key definitions

1. Measles elimination
2. Rubella and CRS control
3. Measles outbreak
4. Suspected case of measles or rubella
5. Laboratory-confirmed measles, rubella and CRS case
6. Epidemiologically linked confirmed measles, or rubella, case
7. Clinically compatible measles case
8. Clinically compatible rubella case
9. Suspected case of congenital rubella syndrome (CRS)
10. Clinically compatible CRS case
11. Laboratory-confirmed CRS, case (by age group)
12. Congenital rubella infection (CRI)
13. Non-measles, non-rubella discarded case

Section 1: The National Verification Committee (NVC)

1.1 National Verification Committee

Name of the committee:

Date of formation:

Date of first meeting:

Is it a standalone committee or has other verification/certification function also?
Please elaborate:

1.2 Members of the National Verification Committee

	Name	NVC Status	Position	Organization	Contact details (email, tel.)	Signature
1		<i>Chairperson</i>				
2		<i>Member</i>				
3		<i>Member</i>				
4		<i>Member</i>				
5		<i>Member</i>				
6		<i>Member</i>				
7		<i>Member</i>				

1.3 Secretariat support to NVC:

1.4 General information on the activities of the National Verification Committee in year of reporting

Below, please provide a brief summary of the NVC activities in the year under review and current year to-date, including key issues addressed from the meetings and list any concerns that have arisen, including concerns from the NVC about the national programme, challenges in organizing and/or holding regular NVC meetings.

	Date	Activity	Highlights and challenges
1			
2			
3			

1.5 NVC plan including activities, timeline and expected outcomes for next year

Section 2: Country demography

2.1 Map of the country down to second administrative unit

2.2 Description of the primary health-care structure of the country

2.3 Population demography

Total population

Under-1 population

Under-5 population

Under-15 population

Married women in reproductive age group

Identified hard-to-reach/migratory/at-risk population

Under-1 mortality (geographical variations, if any)

Under-5 mortality (geographical variations, if any)

Section 3: History of measles elimination, rubella control in the country

1. Vaccine introduction

Date of introduction of measles and rubella vaccination in national immunization programme

MCV-1	MCV-2	RCV-1	RCV-2

2. Schedule of MCV and RCV

Mention current schedule and history of change in schedule with years

3. Laboratory supported surveillance activities

- a) Year – case-based surveillance started:
 - a. Measles
 - b. Rubella
- b) Year when mandatory reporting started:
 - a. Measles
 - b. Rubella
- c) Year laboratory was first accredited by WHO:
 - a.

d) Number of accredited measles rubella laboratories

Name of laboratory	Head of laboratory	Date of last accreditation

e) Year when CRS surveillance started:

f) Type of CRS surveillance:

g) Baseline CRS cases in 2010:

Section 4: Measles elimination and rubella control activities for the country

- (1) Goal:
- (2) National Strategic Plan for Measles Elimination and Rubella Control (period covered, single or as part of cMYP/National Health Plan, etc.):
- (3) Recent activities to interrupt measles and rubella virus transmission:
- (4) Update on strategies and procedures towards elimination:

Please indicate in the table below any programmatic changes related to measles, rubella and CRS in your country in the year of reporting.

Area of work	
Strategies (changes or new strategies)	
Routine immunization schedule	
Surveillance and reporting	
Other	

Section 5: Epidemiology of measles and rubella

1. Incidence and genotype

(Starting five years prior to introduction of respective vaccine till the date of reporting)

Measles											
# Confirmed cases											
Incidence											
Genotypes											
Confirmed outbreaks											

Rubella											
# Confirmed cases											
Incidence											
Genotypes											
Confirmed outbreaks											

CRS											
# Confirmed cases											

2. Epidemic curve for cases of measles and rubella 2010–2015

(at least for the last 3-5 years, by month)

3. Spot map of measles and rubella cases

(for the last 3 years)

4. Number of suspected cases investigated for measles and rubella in YYYY

(in the year of reporting)

Initial diagnosis of suspected case	Total suspected cases	Classified as measles*	Classified as rubella*	Clinically measles or rubella compatible	Discarded (non-measles, non-rubella)
Measles					
Rubella					
Total					

* To include laboratory-confirmed and epidemiologically linked, regardless of origin.

5. Number of measles, rubella and CRS cases, classification by origin of infection

(for the year of reporting)

Measles	Laboratory-confirmed	Epidemiologically linked	Total	Clinically compatible
Imported				
Import-related				
Endemic				
Unknown				
Total (excluding imported cases)				

Rubella	Laboratory-confirmed	Epidemiologically linked	Total	Clinically compatible
Imported				
Import-related				
Endemic				
Unknown				
Total (excluding imported)				
CRS	Laboratory-confirmed		Clinically compatible	Total
Imported				
Import-related				
Endemic				
Unknown				
Total (excluding imported cases)				

Clinically Measles-compatible cases:

Please provide description of how these cases were evaluated and outcome of evaluation.

Clinically Rubella compatible cases:

Please provide description of how these cases were evaluated and outcome of evaluation.

6. Age and vaccination status

(of laboratory-confirmed and epidemiologically linked cases of measles and rubella, excluding imported cases for the year of reporting).

Measles	<1 year	1–4 years	5–9 years	10–14 years	15–19 years	20–29 years	30+	Unknown	Total
0 doses									
1 dose									
2 or more doses									
Unknown									
Total									

Rubella	<1 year	1–4 years	5–9 years	10–14 years	15–19 years	20–29 years	30+	Unknown	Total
0 doses									
1 dose									
2 or more doses									
Unknown									
Total									

7. Measles and rubella cases at subnational level

Please complete the following tables for each territory at first subnational administrative level for the year in review:

Number of all measles cases (classified as laboratory-confirmed or epidemiologically linked), regardless of origin:

Administrative territory	Population size	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total

Number of all rubella cases (classified as laboratory-confirmed or epidemiologically linked), regardless of origin:

Administrative territory	Population size	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total

8. Outbreaks

(Include all suspected measles rubella outbreak that happened in the year of reporting)

Please note that each outbreak or chain of transmission should report only one genotype. If more than one genotype is reported for an outbreak, this refers to more than one chain of transmission and should be described as a separate outbreak in the table. Please include an additional descriptive paragraph for each outbreak – including the setting, the identified immunity gap(s) and measures taken to eliminate this gap in similar populations to prevent future outbreaks. If maps of cases or epidemic curves are available, please include. Any other epidemiological presentation or analysis that will help illuminate the measles virus transmission is welcomed.

Measles:

Outbreak ID	Name of the affected first admin. level (sub-national)	Date of onset of the first case	Date of onset of the last case or "ongoing"	Total number of cases in 2015	Genotype, variant lineage (named strain)	MeaNS sample ID	Virus/first case by origin (imported/not imported)	

Rubella:

Outbreak ID	Name of the affected first admin. level (sub-national)	Date of onset of the first case	Date of onset of the last case or "ongoing"	Total number of cases in 2014	Genotype	RubenNS sample ID	Virus/first case by origin (Imported/not imported)	

(Please attach the report from each outbreak)

Section 6: Genotyping and molecular epidemiology

For the genotyping and molecular evidence that supports interruption of measles and rubella virus transmission outcomes, 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. (refer to Section 5 for this information)
- Other information, such as genotyping of cases by date of onset and phylogenetic trees should be included, when available (for at least the last 1–3 years).

If case is part of an outbreak, it should be reported in section on *Outbreaks*. Please **ONLY** include cases here that are not part of an outbreak

Case ID	First admin. Level (sub-national)	Date of onset of rash	MeaNS or RubeNS ID	Genotype and variant lineage	Origin, if known (imported or not imported)	Tested in WHO accredited lab (Yes/no)

Section 7: Measles, rubella and CRS surveillance performance indicators

Please provide results for surveillance performance indicators as rate or percentage for the last five years including the year of reporting.

Please calculate as described in Verification Guidelines document.

(a) Standard indicators

Measles/rubella		Target						
Epi	Proportion of surveillance units reporting measles and rubella data to the national level and on time	≥80%						
	Reporting rate of non-measles non-rubella cases at national level	≥2/ 100 000						
	Proportion of second administrative level units reporting at least two non-measles non-rubella case per 100 000 population	≥80%						
	Proportion of suspected cases with adequate investigation initiated within 48 hours of notification	≥80%						
	proportion of suspected cases with adequate specimen collection for detecting acute measles and rubella infection collected and tested in a proficient laboratory	≥80%						
Lab	Proportion of specimens received at the laboratory within 5 days of collection	≥80%						
	Proportion of laboratory-confirmed chains of transmission (defined as one or more confirmed measles cases) with specimens adequate for detecting measles virus collected and tested in an accredited laboratory	≥80%						

Measles/rubella	Target						
Proportion of measles and rubella network laboratories that are WHO-accredited for serologic and, if relevant, for virologic testing	100%						
Proportion of laboratories in the country (government and private) that conduct measles diagnostic testing that have adequate quality assurance mechanisms in place	100%						
Proportion of serology results reported by the laboratory within 4 days of specimen receipt	≥80%						
Proportion of virus detection and genotyping results (where appropriate) that are completed within 2 months of receipt of specimen	≥80%						

CRS	Target						
Annual rate of suspected CRS cases at the national level	≥1 per 10 000 live births						
Proportion of suspected CRS cases with the key data points completed	≥80%						
Proportion of suspected cases with adequate blood specimen tested for laboratory confirmation (IgM/IgG, PCR) in an accredited laboratory	≥80%						
Proportion of confirmed cases with adequate specimen tested for virus detection	≥80%						

Epi

Lab

CRS	Target						
Proportion of confirmed cases with at least two negative tests for virus detection/isolation after 3 months of age, with at least a 1-month interval between tests	≥80%						
Proportion of confirmed CRS cases detected within 3 months of birth	≥80%						
Proportion of specimens (serologic or virologic) received at the laboratory within 5 days of collection	≥80%						
Proportion of serologic results reported by the laboratory within 4 days of receiving the specimen	≥80%						

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.

Measles-rubella case-based surveillance is the gold standard for measles-rubella surveillance. To cross-check that system, the NVC should identify all other surveillance systems (i.e., EWAR, IDSR, others) that also report rash-fever cases.

To allow the RVC better interpretation of 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 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.

If alternative indicators or methods were used to evaluate surveillance performance, please describe below:

Measles

Rubella

(b) Laboratory testing and molecular epidemiology of measles and rubella viruses

Please fill in the table below. Include testing performed in WHO accredited or proficient laboratory for the year of reporting.

Test	Number of cases tested	Positive	Negative	Pending-inconclusive
Measles IgM				
Measles RT-PCR				
Measles virus isolation				
Measles genotyping available				
Rubella IgM				
Rubella RT-PCR				
Rubella virus isolation				
Rubella genotyping available				

Section 8: Population immunity against measles and rubella

(a) Routine immunization coverage

(From the year of vaccine introduction or at least for the last 20 years)

MRCV1											
MRCV2											
Survey											
Others											
% districts w/>95% coverage of MRCV1											
% districts w/>95% coverage of MRCV2											

Qualitative assessment of RI coverage and any DQA or efforts to ensure data quality in the last 2–3 years?

(b) Immunity profile by birth cohort

(Immunity profile for the year in report using the MSP tool)

(c) Additional evidence on immunity profile

Are additional data available for determining immunization coverage or population immunity in the year of review? (e.g. results from rapid coverage monitoring, coverage surveys or seroprevalence studies, when applicable) should be included in the report. For published studies or final written reports, references may be appended to this report.

	Serological (S) or coverage (C) studies/surveys	Targeted territory or subpopulation	Results
1			
2			
3			

(d) Low-coverage area

Administrative areas with measles or rubella-containing vaccine coverage less than 90% in the year of reporting

Please list all administrative territories at the first subnational administrative level where the coverage (as described under 3.4) with first and/or second doses was less than 90%. Please include data from smaller administrative territories (e.g. districts), if available:

	Second administrative level (districts) with coverage less than 90%	Population size	Coverage first dose (%)	Coverage second dose (%)
1.				
2.				
3.				

(e) High-risk population groups

Please describe any changes in regards to status or movements of high-risk population groups during the reporting year, if applicable.

(f) Actions taken to improve the level of immunization coverage in selected territories and/or in high-risk subpopulations in the year under review:

(g) Supplemental immunization activities (SIA)

Were supplementary immunization activities with measles/rubella-containing vaccine conducted in the year under review (please check the appropriate box)?

- Yes No

If supplementary immunization activities were done, please summarize results in the table below and complete the SIA Technical Report form for the most recent SIA if not yet done.

Please fill the SIA information since 1995

SIA conducted as national or subnational	Vaccine (M, MR, MMR)	Dates (start – end)	Age (range) of target group	Target population size	Coverage achieved (%)	% subnational units w/<95% coverage

(h) Qualitative assessment of most recent SIA

According to administrative coverage and monitoring results (if done), provide qualitative assessment of SIA that was conducted. Indicate whether there were any geographic clusters and/or high-risk groups where coverage was less than 90%.

(i) Subnational risk assessment for measles and rubella transmission

(Use the tool to identify number of very high-risk, high-risk, medium-risk and low-risk districts in the country)

Section 9: Sustainability of national immunization programme

NVC to comment on the following key areas related to programme sustainability.

- Documented evidence of plans and financing for achieving and sustaining measles elimination, including routine immunization, SIAs and/or outbreak response activities, and epidemiologic and laboratory-based surveillance, while fostering cooperation with other relevant sectors such as the community, health professionals and the media. Such evidence may be reflected in comprehensive multiyear plans, annual work plans and others.
- Subnational strategic plan for measles and rubella elimination (countries with large population, e.g. >50 million).
- Documented evidence of monitoring and reviewing progress of the above plans.
- Evidence of immunization system security as indicated by:
 - secured funding for vaccine procurement (e.g. a line item in the national budget for vaccine procurement and programme implementation);
 - evidence of vaccine demand forecasting and vaccine stock management;
 - standard operating procedures at each level of the programme (e.g. a checklist for conducting an immunization session);
 - Total current and future measles budget, percentage committed by government and donors, shortfall; and
 - Zero stock-outs of MCV and RCV at peripheral level.
- Written programmatic risk assessments at subnational levels.
- Budgeted importation and outbreak preparedness and response plans.
- Documented evidence of subnational capacity to conduct epidemiological investigation for measles cases/outbreak.

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

Section 10: Validation, comments, conclusions and recommendations provided by NVC, including key challenges faced