

Guide to the  
**documentation  
and verification of  
measles and rubella  
elimination**  
in the WHO  
Eastern Mediterranean Region



**World Health  
Organization**

REGIONAL OFFICE FOR THE **Eastern Mediterranean**



Guide to the documentation and  
verification of measles and rubella  
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# Abbreviations

<b>CRS</b>	Congenital rubella syndrome
<b>EPI</b>	Expanded Programme on Immunization
<b>GAVI</b>	GAVI, the Vaccine Alliance
<b>Ig</b>	Immunoglobulin (IgG, IgM)
<b>MCV</b>	Measles-containing vaccine (MCV1 = dose 1)
<b>MRCV</b>	Measles- and rubella-containing vaccine
<b>NIP</b>	National Immunization Programme
<b>NITAG</b>	National Immunization Technical Advisory Group
<b>NVC</b>	National Verification Committee
<b>RCV</b>	Rubella-containing vaccine (RCV1 = dose 1)
<b>RTAG</b>	Regional Technical Advisory Group on Immunization
<b>RVC</b>	Regional Verification Commission
<b>SIA</b>	Supplemental immunization activity

# Definitions<sup>1</sup>

Phrase	Definition
<b>Measles or rubella eradication</b>	Worldwide interruption of measles, or rubella, virus transmission in the presence of a surveillance system that has been verified to be performing well.
<b>Measles elimination</b>	The absence of endemic measles transmission in a defined geographical area (e.g. region or country) for $\geq 12$ months in the presence of a well performing surveillance system. Note: Verification of measles elimination takes place after 36 months of interrupted endemic measles virus transmission.
<b>Rubella elimination</b>	The absence of endemic rubella virus transmission in a defined geographical area (e.g. region or country) for $>12$ months and the absence of congenital rubella syndrome (CRS) cases associated with endemic transmission in the presence of a well-performing surveillance system. Note: There may be a lag (up to 9 months) in occurrence of CRS cases after interruption of rubella virus transmission has occurred. Evidence of the absence of rubella transmission from CRS cases is needed because CRS cases excrete rubella virus for up to 12 months after birth. Note: Verification of rubella elimination takes place after 36 months of interrupted rubella virus transmission.
<b>Endemic measles or rubella virus transmission</b>	The existence of continuous transmission of indigenous or imported measles virus or rubella virus that persists for $\geq 12$ months in any defined geographical area.
<b>Endemic measles or rubella case</b>	Laboratory or epidemiologically-linked confirmed cases of measles, or rubella, resulting from endemic transmission of measles, or rubella, virus.
<b>Re-establishment of endemic transmission of measles or rubella</b>	Occurs when epidemiological and laboratory evidence indicates the presence of a chain of transmission of a measles, or rubella, virus strain that continues uninterrupted for $\geq 12$ months in a defined geographical area (country or region) where measles or rubella had been previously eliminated. Note: a measles or rubella virus strain is determined by sequencing the WHO standard 450nt region of the N gene for measles and the 739nt of the E1 gene for rubella.
<b>Measles, or rubella, outbreak in an elimination setting</b>	A single laboratory-confirmed case.
<b>Suspected case of measles or rubella</b>	A patient in whom a health-care worker suspects measles or rubella infection or a patient with fever and maculopapular (non-vesicular) rash.

<sup>1</sup> Excerpted and adapted from Table 1 in World Health Organization, "Framework for verifying elimination of measles and rubella", Weekly Epidemiological Record 2013; 88:91–93 (<https://www.who.int/wer/2013/wer8809.pdf?ua=>, accessed 6 December 2018).



<p><b>Laboratory-confirmed measles case, or rubella case</b></p>	<p>A suspected case of measles or rubella that has been confirmed by a proficient laboratory.  Note: A proficient laboratory is one that is WHO accredited and/or has an established quality assurance programme with oversight by a WHO accredited laboratory.</p>
<p><b>Epidemiologically linked confirmed measles case</b></p>	<p>A suspected case of measles that has not been confirmed by a laboratory but that was geographically and temporally related with dates of rash onset occurring between 7 and 23 days apart, to a laboratory-confirmed case or, in the event of a chain of transmission, to another epidemiologically confirmed measles case.</p>
<p><b>Epidemiologically linked confirmed rubella case</b></p>	<p>A suspected case of rubella that has not been confirmed by a laboratory but that was geographically and temporally related with dates of rash onset, occurring between 12 and 23 days apart, to a laboratory-confirmed case or, in the event of a chain of transmission, to another epidemiologically confirmed rubella case.</p>
<p><b>Clinically compatible measles case</b></p>	<p>A case with fever and maculopapular (non-vesicular) rash and one of cough, coryza, or conjunctivitis but 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.  (Note: Clinically compatible cases are the result of inadequate case investigation. They indicate weakness in the surveillance system. A high-quality surveillance system will rarely have cases classified as clinically compatible.)</p>
<p><b>Clinically compatible rubella case</b></p>	<p>A case with maculopapular (non-vesicular) rash and fever (if measured) and one of arthritis/arthralgia or lymphadenopathy but 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.</p>
<p><b>Non-measles non-rubella discarded case</b></p>	<p>A suspected case that has been investigated and classified as a non-measles and non-rubella discarded case using (a) laboratory testing in a proficient laboratory or (b) epidemiological linkage to a laboratory-confirmed case or outbreak of another communicable disease that is neither measles nor rubella.</p>
<p><b>Measles vaccine-associated illness</b></p>	<p>A suspected case that meets all 5 of the following criteria: (1) the patient had a rash illness, with or without fever, but did not have cough or other respiratory symptoms related to the rash; (2) the rash began 7–14 days after vaccination with a measles-containing vaccine; (3) the blood specimen, which was positive for measles IgM, was collected 8–56 days after vaccination; (4) thorough field investigation did not identify any secondary cases; and (5) field and laboratory investigations failed to identify other causes. Alternatively, a suspected case from whom virus was isolated and found on genotyping to be a vaccine strain (Genotype A).</p>

<p><b>Imported measles case</b></p>	<p>A case exposed to measles outside the region or country during the 7–23 days 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 7–23-day interval prior to rash onset, additional evidence, including a thorough investigation of contacts of the case, is needed to exclude a local source of infection.</p>
<p><b>Imported rubella case</b></p>	<p>A case exposed to rubella outside the region or country during the 12–23 days 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 12–23-day interval prior to rash onset, additional evidence including a thorough investigation of contacts of the case, is needed to exclude a local source of infection.</p>
<p><b>Importation-related measles or rubella case</b></p>	<p>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 or rubella cases related to importation persists for <math>\geq 12</math> months, cases are no longer considered to be import-related, they are endemic.</p>
<p><b>Unknown source measles or rubella case</b></p>	<p>A confirmed case for which an epidemiologic or virological link to importation or to endemic transmission cannot be established after a thorough investigation.</p>
<p><b>Suspected CRS case</b></p>	<p>Any infant less than 1 year of age in whom a health worker suspects CRS, usually in an infant 0–11 months old who presents with heart disease and/or suspicion of hearing impairment and/or one or more of the following eye signs (cataracts, congenital glaucoma, pigmentary retinopathy) or if infant's mother has history of suspected or confirmed rubella during pregnancy, even when the infant shows no signs of CRS.</p>
<p><b>Laboratory-confirmed CRS case</b></p>	<p>A suspected case with at least one condition from group A (cataracts, congenital glaucoma, congenital heart disease, hearing impairment, pigmentary retinopathy) and meets the laboratory criteria for CRS laboratory confirmation.</p>
<p><b>Clinically confirmed CRS case</b></p>	<p>A case in which no adequate clinical specimen was taken but in whom a health worker detects at least two of the complications listed in group A (cataracts, congenital glaucoma, congenital heart disease, hearing impairment, pigmentary retinopathy) or one in group A and one in group B (purpura, splenomegaly, microcephaly, developmental delay, meningoencephalitis, radiolucent bone disease, jaundice that begins within 24 hours after birth).</p>

# Executive summary

In 1997, the Eastern Mediterranean Region established a measles elimination goal, to be achieved by 2010. Remarkable progress towards interrupting measles virus transmission was made: from 1998 to 2010, the number of reported measles cases decreased by 89%, from 89 478 cases to 10 072. However, due to the multiple challenges faced by several countries since 2011, progress has slowed: the number of reported cases almost tripled during the period 2010 to 2019, from 10 072 to 33 943 cases. Of the cases reported in 2019, 90% are from two countries, Somalia (70%) and Pakistan (20%). While the Eastern Mediterranean Region has not yet established a regional goal for rubella/congenital rubella syndrome (CRS) elimination, 13 countries have set national goals related to rubella and/or CRS control/elimination (see Annex 1 for an overview of measles and rubella elimination in the Region).

As several countries move towards interruption of measles and rubella virus transmission, the Region has established a Regional Verification Commission (RVC) for verification of elimination of measles and rubella in order to verify the achievements of countries, and provide guidance to countries to help achieve elimination. Measles or rubella elimination is defined as absence of endemic measles or rubella virus transmission in a defined geographical area (a country or a region) for >12 months in the presence of a well performing surveillance system.

For both measles and rubella, verification of elimination takes place after 36 months of interrupted virus transmission. Transmission is re-established when a chain of transmission of a measles or rubella virus strain continues uninterrupted for  $\geq 12$  months in a defined geographical area where measles or rubella had been previously eliminated.

Verification of measles and/or rubella elimination in the Region will require each country to establish a National Verification Committee (NVC) to work with the ministry of health to document the progress made in achieving elimination. Global guidelines have established two criteria and five lines of evidence to be the basis of verification of elimination.

The two criteria are based upon the global framework for elimination:

1. Epidemiological and laboratory-supported documentation of the interruption of endemic measles and rubella virus transmission for a period of at least 36 months from the last known endemic case; and
2. The presence of a high-quality surveillance system (as per surveillance system performance indicators) that is sensitive and specific enough to, in a timely manner, detect, notify, and investigate suspected cases and outbreaks, correctly classify cases by source (that is, import/import-related) as well as confirmed or discarded, and undertake rapid public health action to prevent further virus transmission. (See Annex 2.) The five lines of evidence are:
  1. a detailed description of the epidemiology of measles and rubella since the introduction of measles and rubella vaccine in the national immunization programme;
  2. molecular epidemiology evidence that supports interruption of measles and rubella virus;
  3. quality of epidemiological and laboratory surveillance systems for measles and rubella transmission;

4. population immunity presented as a birth cohort analysis with the addition of evidence related to any marginalized and migrant groups; and
5. sustainability of the national immunization programme including the resources for mass campaigns, where appropriate, in order to sustain elimination.

This document outlines how the RVC and the NVC will work together to document elimination in countries of the Region. The RVC is responsible for verification of countries that have documented elimination of measles and/or rubella based upon the five lines of evidence. NVCs will ensure the development of annual progress reports, providing the documented evidence of the progress towards elimination in the country, and will submit the progress report to the RVC. This document outlines how this process will occur, including the terms of reference of the RVC and NVCs, as well as guidance for the general structure of NVC reports, based upon the global guidance for measles and rubella elimination verification.

# Purpose of document

The purpose of this document is to describe the steps to document and verify elimination of measles and rubella in countries of the World Health Organization's Eastern Mediterranean Region. It aims to provide the Regional Verification Commission (RVC), National Verification Committees (NVC), health authorities, Expanded Programme on Immunization (EPI) managers, medical officers, and other public health professionals involved in measles and rubella/CRS elimination with guidance on how to document measles and rubella elimination in the Region. It standardizes and establishes the basic concepts, essential criteria, appropriate lines of evidence, and necessary data analysis.



# Chapter 1

## Core principles for verification of measles and rubella elimination

The achievement of measles and rubella elimination should be verified for individual countries and areas and eventually for the Region as a whole, following a standardized process. The definitions, basic principles and process of verification followed in this document are based on WHO recommended surveillance standards.

### 1.1 Core principles

1. Elimination of measles and/or rubella virus transmission occurs when endemic measles and/or rubella transmission has not been detected in a defined geographical area (for example, region or country) for  $\geq 12$  months in the presence of a high-quality performing surveillance system.
2. Verification of elimination at the regional and national level occurs when there is interruption of transmission of measles and/or rubella virus for at least 3 years (36 months) in the presence of high-quality surveillance. This is to ensure that the achievement is sustainable and endemic transmission has not occurred.
3. Attainment of measles and rubella elimination should be verified independently for individual countries and eventually for the Region following standard procedures and criteria.
4. Documentation of progress towards elimination is done based on two criteria along with five lines of evidence using a standardized documentation format to facilitate collection, analysis and interpretation of data.
5. The Regional Verification Commission (RVC) will support the National Verification Committee (NVC) for measles and rubella elimination to document elimination in countries of the Region.
6. The RVC and each NVC will be comprised of leading public health experts to oversee the formal verification process at the national and regional levels.
7. The NVCs are responsible for reviewing, analysing and validating the national data, and endorsing and submitting the necessary documentation to the RVC on an annual basis to report progress towards the achievement and maintenance of measles and rubella elimination.
8. The RVC will verify progress towards measles and rubella elimination and determine whether individual countries have eliminated endemic measles and, where appropriate, rubella/CRS. Regional verification of measles or rubella elimination occurs after measles and/or rubella elimination is verified in all countries in the Region.
9. The RVC may require alternative or complementary evidence, as it deems appropriate, to verify measles and rubella elimination. Countries unable to provide data satisfying one or more standard indicators may still be verified as having eliminated measles and/or rubella as long as the RVC is satisfied that there is sufficient evidence to justify verification.
10. Due to the strict requirement for professional independence and to avoid personal conflicts of interest, members of these committees must meet certain criteria as described in the terms of reference and sign declaration of interest prior to attending any meeting.

11. Countries with large populations or geographic areas should report evidence at the subnational level to demonstrate elimination.
12. As countries move closer toward elimination, they must develop plans and strategies to maintain elimination. Maintenance of elimination will require vaccination activities that maintain high levels of population immunity and epidemiological and laboratory surveillance capacities to detect cases and to implement timely and effective response measures to minimize outbreak size and to prevent the re-establishment of endemic virus circulation.



## Chapter 2

# Verification structure and verification process

## 2.1 Verification structure

### 2.1.1 Regional Verification Commission for Measles and Rubella Elimination: standard operating procedures

#### Mission

The Regional Verification Commission for Measles and Rubella Elimination (RVC) is the body authorized to verify measles and rubella elimination in each country, as well as in the Eastern Mediterranean Region as a whole. The RVC will develop and monitor the verification process for the Region.

#### Structure and membership

1. The RVC will be an external and independent entity. Members will not be involved in managerial or operational issues of the immunization programme, measles/rubella surveillance or measles/rubella laboratory activities, nor will they have a direct responsibility in achievement of the goal at regional or national level.
2. The RVC will be composed of an interdisciplinary team composed of 8–10 members. Members should include key technical expertise, covering: Expanded Programme on Immunization (EPI) experts, epidemiologists, virologists, immunologists, clinicians/paediatricians, infectious disease specialists and public health physicians.
3. Participation of members from other regional verification commission(s) will be welcome.
4. Members of the RVC will be appointed by the WHO Regional Director for the Eastern Mediterranean. Members will be selected on the basis of their experience, qualifications and ability to contribute to the accomplishment of the RVC's terms of reference.
5. The chairperson of the RVC will be appointed by the Regional Director from among the members of the RVC.
6. A vice-chairperson should be selected from the RVC to act when the appointed chairperson is not available.
7. Members of RVC will work on a voluntary basis and will not be financially compensated for serving on the RVC. Travel-related expenses will be compensated as per WHO rules.
8. The duration of membership of RVC members will be a 3-year renewable term.
9. Termination of membership will occur if a member fails to attend two consecutive scheduled meetings, without acceptable justification, and/or a member fails to accomplish the assigned tasks related to the RVC terms of reference for two consecutive times without justification acceptable to the RVC.

#### Terms of reference

1. Define the criteria, parameters, and process for documenting and verifying the achievement of measles and/or rubella elimination for Member States and the Region as a whole.

2. Advise the national verification committees (NVCs) on the process for obtaining, analysing and presenting the data required to verify the interruption of endemic measles and/or rubella virus transmission.
3. Participate in field visits for national programmatic reviews (including EPI and surveillance reviews) in the Region.
4. Evaluate the documentation submitted by the NVCs to verify elimination for each country and at the regional level, and monitor progress towards that goal.
5. Classify each country, based on the reports submitted by the NVCs and using the two criteria and five lines of evidence, according to the categories: eliminated and verified; interrupted transmission but not verified; re-established transmission after verification; or endemic.
6. Declare verification of elimination at the national and regional levels.
7. Make recommendations to the NVC to improve the documentation of elimination in the reports submitted to the RVC.
8. Submit reports and raise technical and strategic concerns on measles and/or rubella elimination to the WHO Regional Director for the Eastern Mediterranean.
9. Share its reports and coordinate technical and policy issues with the Regional Technical Advisory Group (RTAG).
10. Prepare and submit the final annual reports for the Eastern Mediterranean Region to the global verification commission, should it be established.
11. Advocate for measles and rubella elimination in different fora and at different levels.

### **Operating procedures of the RVC**

1. Frequency of RVC meetings: The RVC will meet at least once per year. The chairperson of the RVC might call for additional meetings, face to face or virtually, where necessary.
2. Planning of the RVC meetings: Meeting dates should be decided upon and communicated to Commission members long in advance.
3. Venues of the meetings: The meetings are preferably to be conducted in different countries in order to use the opportunity for advocacy and raising visibility of the elimination goal.
4. Review process: Each country's report will be reviewed by one or more RVC members. The reviewer(s) will lead the discussion of the submission during the RVC meeting. The distribution of the countries among the RVC members will be determined in consultation with the secretariat.
5. Documentation:
  - a. The RVC member(s) assigned to a specific country should prepare a feedback report, using the standard template, to be discussed during the RVC meeting.
  - b. The RVC should issue a meeting report, with the support of a professional rapporteur, at the end of each meeting which highlights its specific recommendations with clear time frames for execution.
  - c. The secretariat should develop a sharepoint, accessible to all RVC members, to be used as a forum for discussion and sharing information and documents.

## **Responsibility of the RVC chair, in collaboration with the RVC members**

1. Set an annual timeline for RVC activities, including the dates NVC reports are due to the secretariat, RVC meeting dates, and the dates feedback is due to countries.
2. Define RVC members' responsibilities in reviewing the country reports.
3. Set the agenda for the RVC meetings in collaboration with the secretariat.
4. Preside over RVC meetings.
5. Submit annual meeting reports to the Regional Director (to share with Member States through appropriate channels).

## **Secretariat support and its role**

The Vaccine Preventable Diseases and Immunization (VPI) unit in the Department of Communicable Diseases Prevention and Control, Regional Office for the Eastern Mediterranean, will serve as the secretariat of the RVC. The role of the secretariat will be to:

1. Develop guidelines and formats for reporting to the RVC by the NVC.
2. Support the establishment of NVCs and identify suitable NVC members for countries with limited capacity to establish the committee.
3. Identify the funds required for the meetings and activities of the RVC.
4. Organize RVC meetings.
5. Coordinate country visits when requested by the RVC.
6. Communicate decisions of the RVC to the NVC and brief and update NVCs on related activities.
7. Share the RVC report with the Member States, as well as other advisory bodies, including the RTAG.

## **2.1.2 National Verification Committees for Measles and Rubella Elimination: standard operating procedures**

### **Mission**

The National Verification Committees for Measles and Rubella Elimination (NVCs) will develop and monitor the verification process in their respective countries. The NVCs will be responsible for establishing, reviewing and monitoring verification activities at the country level, following standardized operational procedures, and for preparing and submitting national reports to the RVC.

### **Structure and membership**

1. The NVC should consist of 6–8 members according to needs.
2. Members should be independent of the measles/rubella elimination programme. Members should not be involved in managerial or operational issues of the immunization programme, measles/rubella surveillance or measles/rubella laboratory activities, nor should they have a direct responsibility in achievement of the goal at national level.
3. Members should include key technical experts, such as EPI experts, virologists,

immunologists, public health experts, infectious disease specialists who are experts in measles, epidemiologists, and clinicians/paediatricians.

4. When human resources are scarce, the National Certification Committee for polio eradication might serve as the national measles elimination verification committee after modifying composition of the members as necessary.
5. The chairperson and members are to be notified by the minister of health.

### **Terms of reference**

1. Advise the ministry of health and the National Immunization Programme (NIP), including the national surveillance and laboratory teams, on the requirements for the verification of elimination of measles/rubella in the country.
2. Prepare the plan of action for the documentation and verification of measles, rubella and CRS elimination in the country, defining responsibilities, products, resources, and a timeline of activities, in collaboration with the NIP and with technical cooperation from the WHO Regional Office for the Eastern Mediterranean Secretariat and the RVC.
3. Analyse and verify information required to document measles/rubella elimination in accordance with the criteria and procedures established by the RVC.
4. Participate in programme reviews and field visits to verify progress in measles/rubella elimination.
5. Raise technical and strategic concerns on measles/rubella elimination to the EPI programme and National Immunization Technical Advisory Group (NITAG).
6. Participate in the work sessions and visits of the RVC to the country at the different stages of the documentation and verification process, as necessary.
7. Prepare an initial national report and subsequent annual update reports, providing conclusions and recommendations, share them with the national authorities, and submit them to the RVC. Annual updates should continue to be submitted until elimination in the Region as a whole has been verified.
8. Coordinate response to RVC comments.
9. Advocate for strengthening measles and rubella elimination programmes by promoting the verification process, encouraging the country to implement appropriate strategies, and monitoring progress towards elimination goals.

### **Operating procedures of the NVC**

1. Frequency of NVC meetings: The NVC will meet at least once per year. The chairperson of the NVC might call for additional meetings where necessary.
2. Planning of the NVC meetings: meeting dates should be decided upon and communicated to the committee members long in advance.
3. Documentation:
  - a. The NVC should issue meeting report at the end of each meeting which highlights its specific recommendations with clear time frames for execution.

- b. Secretariat of the NVC to develop a SharePoint, accessible to all NVC members, to be used as a forum for discussion and sharing information and documents.

### **Role of the NVC chairperson**

1. Define internal procedures and responsibilities of committee members in accordance with the RVC guidelines.
2. Prepare an annual NVC plan, including activities, timeline, expected outcomes and human and financial resource requirements in collaboration with the NIP and other related departments within the ministry of health.
3. Ensure preparation of reports for submission to the RVC.
4. Preside over NVC meetings.
5. Represent NVC by attending RVC or other regional meetings, if requested by the RVC.

### **Secretariat support and its role**

1. The NIP within the ministry of health will serve as the secretariat.
2. Collect, collate and analyse the data and provide the information necessary for the NVC to develop the report to be submitted to the RVC.
3. Mobilize resources for the NVC to carry out its activities including required logistics.
4. Coordinate support from key partners, e.g. WHO, the United Nations Children's Fund (UNICEF) as necessary for the functioning of the NVC.

## **2.2 Verification process**

Documentation for verification of measles and rubella elimination aims to provide convincing and well-structured evidence to demonstrate that a country has met the verification criteria for measles and rubella elimination and the country is able to sustain its achievements.

Countries must provide evidence that they have interrupted endemic measles and rubella virus transmission for a period of at least 36 months in the presence of a high-quality surveillance system (as indicated by the surveillance system performance indicators).

Each NVC, working with the NIP, will compile a comprehensive report organized according to the five lines of evidence to document progress towards elimination. The report is to be finalized by the NVC and then submitted to the RVC. The RVC will discuss the NVC reports and will classify/verify countries. The RVC will also provide recommendations to the NVCs.

All countries of the Region, including the less performing countries, should establish a national verification committee and submit reports to the RVC in order to gain experience and build country and NVC capacity to document elimination. Once an NVC submits an initial report, in subsequent years it should submit annual progress reports that update the initial report, amend any previous information, and provide new data that document the progress towards elimination. A sample format and template for the cover letters to be attached to the report are in Annexes 3 and 4, respectively.

Once a country or area has been verified as having achieved elimination for measles or rubella, a

shorter post-verification annual progress report should be submitted to the RVC for the disease or diseases verified as eliminated. The shorter post-verification progress report is meant to ease the burden of reporting of NVCs and allow the RVC to more efficiently monitor maintenance of elimination status in countries in the Region. If transmission of measles or rubella becomes re-established, a complete pre-verification detailed report, and not the shortened post-verification report, must be submitted for that disease.

The country initial and annual progress report to the RVC should include the following components, to demonstrate the progress towards elimination based upon the five lines of evidence (see template, Annex 6):

1. the NVC's history, membership, past and planned activities, as well as responses to the previous year's RVC comments;
2. country background information, programme history and measles/rubella elimination activities,
3. a detailed description of the epidemiology of measles, rubella and CRS since the introduction of the measles and rubella vaccines in the NIP;
4. the quality of epidemiological and laboratory surveillance systems for measles and rubella, including the standard surveillance performance indicators;
5. molecular epidemiology evidence supporting that measles and rubella virus transmission is interrupted;
6. population immunity presented as a birth cohort analysis at the subnational level (second or third administrative level in small countries and third or fourth administrative level in large countries) at which the data are available, including vaccination coverage, and evidence related to any underserved or marginalized groups;
7. the sustainability of the NIP, including the resources for implementation of programme strategies, in order to close known programme gaps and sustain measles and rubella elimination; and
8. the NVC's validation, comments, conclusions and recommendations.
9. The RVC will review the country's report and provide country-specific feedback and recommendations to be shared with the governments through the NVCs.

### **2.2.1 RVC classification outcomes**

Based on the country's initial or annual progress report, the RVC, using the two criteria and five lines of evidence, will classify countries into one of the following four categories:

1. verified: no endemic transmission for >36 months in the presence of a high-quality surveillance system;
2. eliminated/interrupted but not verified: absence of endemic transmission for  $\geq 12$  but <36 months in the presence of a high-quality surveillance system;
3. re-established endemic transmission post-verification: ongoing chains of transmission for  $\geq 12$  months following previous verification of elimination; or
4. endemic: the existence of continuous transmission of measles and/or rubella virus that persists for  $\geq 12$  months in any defined geographical area, with no previous verification of elimination.

The RVC can only classify countries based on received reports. In the absence of a country report, a country will be classified as endemic regardless of its control status.

## Chapter 3

# Standard verification criteria and lines of evidence

This section describes the verification criteria, lines of evidence and relevant indicators under each line of evidence, based on the global framework for elimination of measles and rubella.

### 3.1 Verification criteria

Based on the global standards, two essential criteria are required for verifying the progress, achievement and maintenance of measles and rubella elimination. Each one of the criteria cannot stand alone but should be evaluated and interrelated to support the argument for elimination:

1. epidemiologic and laboratory-supported documentation of the interruption of endemic measles and rubella virus transmission for a period of at least 36 months from the last known endemic case;
2. the presence of a high-quality surveillance system (as per surveillance system performance indicators) that is sensitive and specific enough to, in a timely manner, detect, notify, and investigate suspected cases and outbreaks; correctly classify cases by source (for example, import/import-related) as well as confirmed or discarded; and undertake rapid public health action to prevent further virus transmission. (See Annex 2.)

### 3.2 Lines of evidence for documentation and verification of elimination

The five lines of evidence, and details for each, follow:

1. detailed description of the epidemiology of measles, rubella and CRS since the introduction of measles and rubella vaccines in the NIP;
2. molecular epidemiology evidence that supports measles and rubella virus transmission is interrupted;
3. the quality of epidemiological and laboratory surveillance systems for measles, rubella and CRS;
4. population immunity presented as a birth cohort analysis, with the addition of evidence related to any underserved and marginalized groups; and
5. the sustainability of national immunization programmes, including the resources for mass campaigns, where appropriate, in order to sustain measles and rubella elimination.

#### 3.2.1 Epidemiology of measles and rubella since the introduction of measles and rubella vaccine in the NIP

The implementation of elimination strategies in countries will lead to a change in the epidemiology, with a decrease in measles and/or rubella and CRS cases and outbreak patterns. Thorough epidemiological analysis should be undertaken by each country in order to document these changes, and determine if measles and/or rubella endemic virus circulation has been interrupted and, if not interrupted, why transmission is still occurring.

When a country is approaching elimination, thorough epidemiological analyses should include the pre-interruption and post-interruption periods. A detailed description of the epidemiology of measles and rubella provides critical information on whether and when endemic virus transmission has been interrupted. Descriptive epidemiologic characteristics of measles and rubella cases corresponding to time, place and person are important indicators of achieving elimination.

The country should describe the incidence<sup>2</sup> (cases per million population) and epidemiology of total and endemic measles, rubella and CRS cases over the time period prior to measles and rubella vaccine introduction until the year in which verification of elimination is being considered. The standard case definitions provided at the beginning of this document, the algorithm for case classification (Fig. 1) and the table of case classification (Table 1) should be used.

Each country should provide a detailed epidemiological description of measles and rubella cases by classification of cases according to the method of confirmation and source of infection (Table 1) for the current year of the report, and for previous years using the following standard:

- Classification according to method of confirmation: cases are classified as laboratory-confirmed, epidemiologically linked or clinically compatible, using the standard algorithm for case classification (Fig. 1) and the standard definitions provided in the beginning of this document.
- Classification based on source of infection: cases are classified to endemic, imported, import-related, or unknown source.

All countries are expected to provide data from the second administrative level; however, when available, data from the third administrative level should be included. For countries with large populations, there may be a need for an analysis that groups provinces based on their similarities (e.g. geographic, demographic, epidemiological, or immunization programme performance).

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<sup>2</sup> Incidence of total measles or rubella cases = the sum of the total measles or rubella cases (laboratory-confirmed cases + measles or rubella epidemiologically linked cases + measles or rubella clinically compatible cases) from all sources (endemic, imported, import related, unknown source) per million population. Incidence of endemic measles or rubella cases = same as above calculated for endemic cases only.



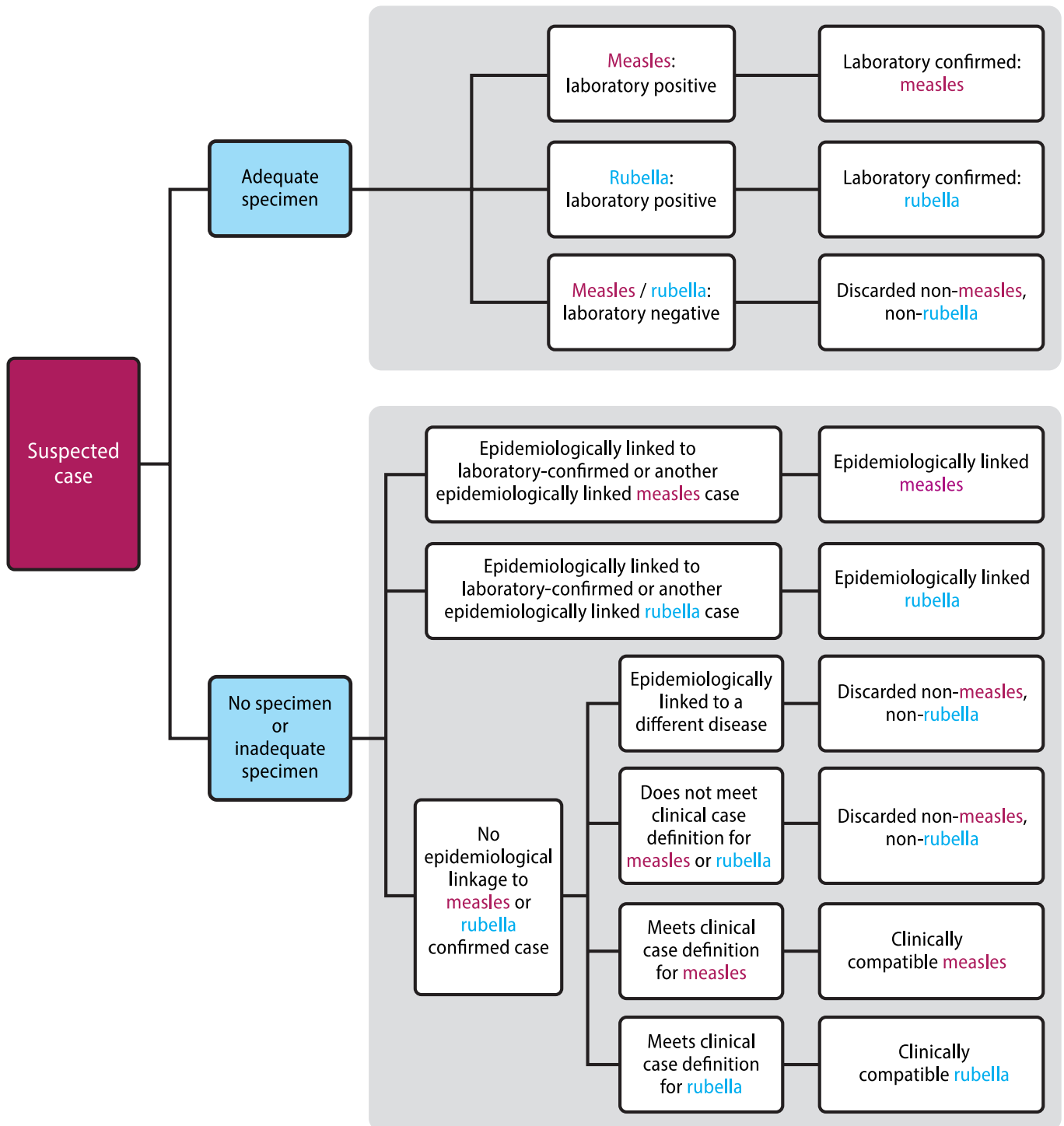


Fig. 1: Classification of suspected measles and rubella cases<sup>3</sup>

<sup>3</sup> Surveillance standards for vaccine-preventable diseases, second edition. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO.

**Table 1. Source and method of measles and rubella case confirmation**

Confirmation Source of infection	Confirmed		Clinically compatible	Total
	Laboratory	Epidemiologic linkage		
Endemic				
Unknown				
Import-related				
Total				

Every confirmed or clinically compatible case of measles or rubella may be represented in one of the cells in Table 1. In the presence of a high-quality surveillance system, the numbers of clinically compatible cases should be small. Measles elimination status will be determined by the absence of endemic cases. However, as cases of unknown source may also result from endemic transmission, these cases may be considered as possibly endemic. If many confirmed cases of unknown origin are reported, this will raise concerns about the quality of surveillance and the ability of a country to confidently determine the absence of endemic measles virus transmission.

Imported and import-related cases are likely to continue to appear to varying degrees after endemic measles virus has been eliminated, depending on migration/movement patterns into and out of the country.

Cases of the same genetic sequence information with a gap of two or three incubation periods cannot be considered separate chains of transmission without a documented epidemiologic history of two separate importations. In such a situation, additional field investigation and case finding is required to determine whether additional cases were overlooked or misclassified. Further investigation of known and newly identified suspected cases with clinically compatible disease should attempt to be linked with known cases. A second specimen sample should be collected and tested if the first specimen was negative and collected within the first 4 days of rash onset, as IgM tests can be negative during this time.

Data may be presented using graphs, maps and/or tables, for example:

- Epidemic curves analysing the source of infection and method of confirmation of measles, rubella and CRS cases can be colour-coded based on cases that are: endemic, unknown, imported and import-related; by genotype name strain or sequence variant; or by cluster (Fig. 2).
- Epidemic curves of confirmed cases, regardless of source, can show the progress of measles/rubella incidence; 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; immunization interventions undertaken at specific years; routine immunization coverage; catch-up or follow-up supplemental immunization activities (SIAs) (Fig. 3).

- Spot maps can show 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.

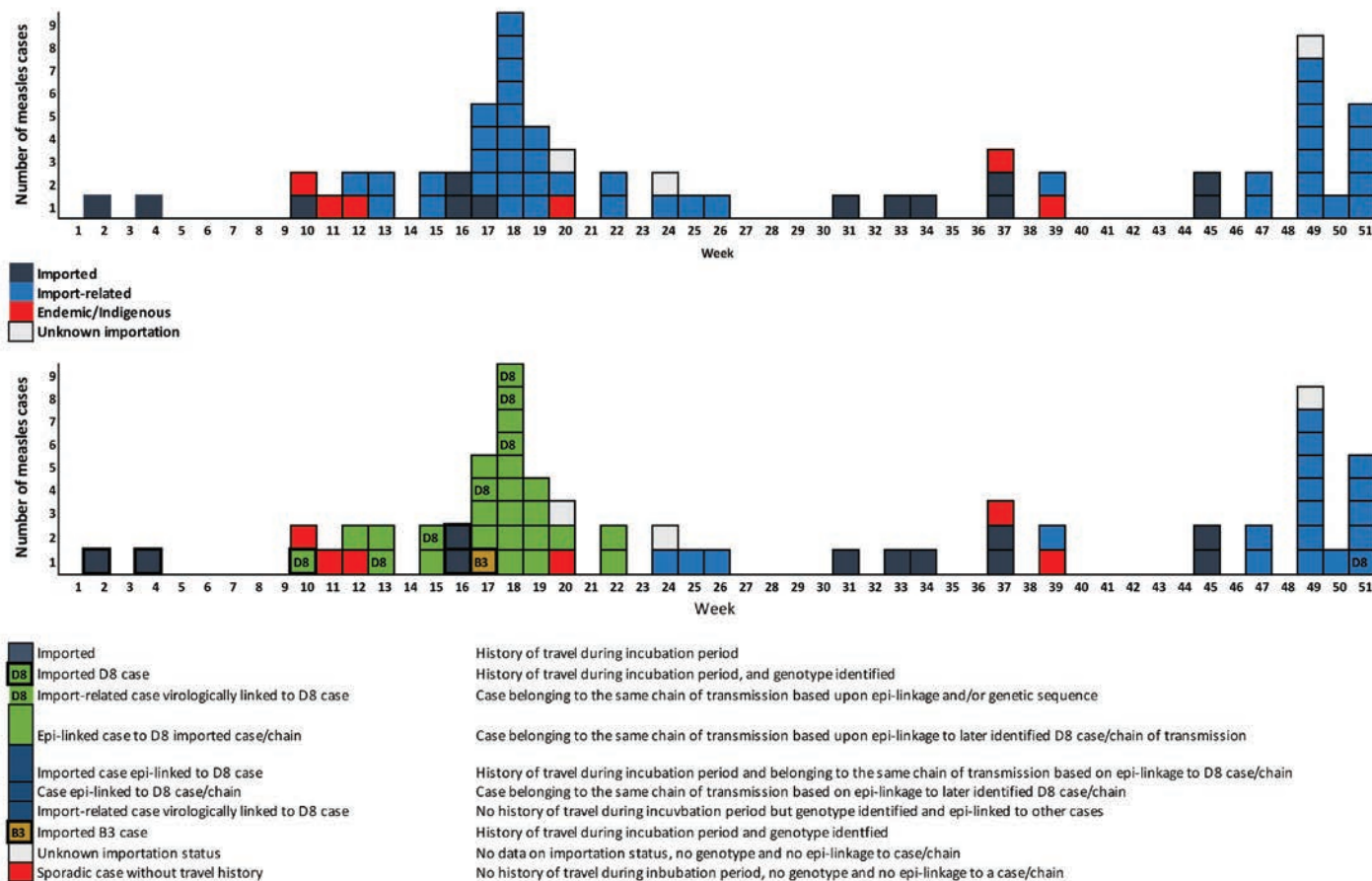
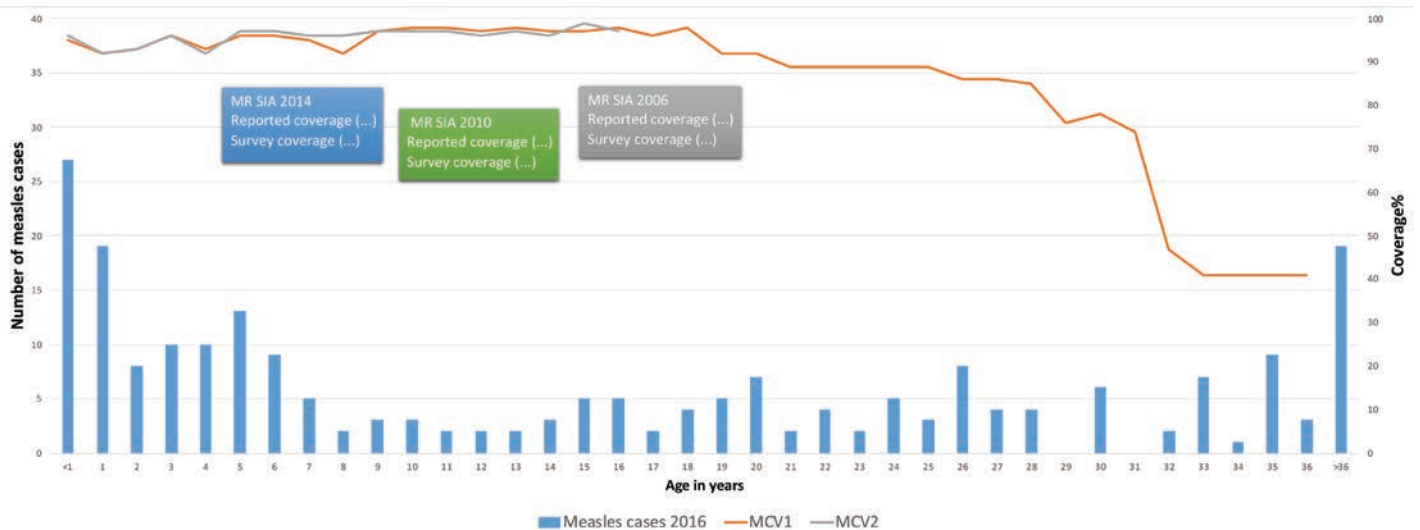


Fig. 2. Example of epidemic curve with confirmation, source of infection and genotype indicated



**Fig. 3. Example of analysis/charts/studies describing the epidemiology of measles**

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

A map may be used to show facilities or events determined to be related to measles and rubella virus transmission, such as hospitals or clinics where nosocomial transmission was identified, or schools where outbreaks occurred. For hard-to-reach populations, the description should include steps taken to reach the populations. Findings from any vaccine efficacy studies should also be included, if available.

For rubella outbreaks, it should be described if follow-up of the infants born to pregnant women exposed to rubella during the outbreak was performed, and if there was surveillance for CRS cases for at least nine months following the rash onset of the last rubella case.<sup>4</sup>

<sup>4</sup> Additional tips on interpreting measles epidemiology as elimination is approached or achieved are available in Durrheim DN, Crowcroft NS, Strebel PM. Measles – the epidemiology of elimination, *Vaccine* 2013; 32, 51: 6880–6883, open access version (<http://www.sciencedirect.com/science/article/pii/S0264410X14014510>, accessed 8 December 2018).

### 3.2.2 Molecular epidemiology evidence that measles and/or rubella virus transmission is interrupted

The availability of consistent data on circulating genotypes and sequence variants before and after the implementation of measles and rubella elimination strategies provides baseline evidence for determining the interruption and/or absence of endemic measles and rubella virus transmission in the Eastern Mediterranean Region.

Molecular epidemiology, that is, genetic sequencing, is used to determine viral transmission patterns and the duration of circulation of specific viral lineages. Molecular epidemiology and traditional epidemiological data are complementary for determining endemicity. Distinct viral sequences are proof that cases are not linked. Identical viral sequences are normally considered to belong to the same chain of transmission, but may also belong to a different chain of transmission depending on the epidemiological settings.

Prior to elimination, genetic characterization is used to identify endemic lineages, track importation, and distinguish multiple importations from a single chain of transmission. After elimination has been achieved, the molecular epidemiological information from the new cases should be compared with the pre-elimination endemic viral lineages/strains. The absence of endemic strains for >12 months with or without sporadic imported strains is consistent with elimination.

Countries should make every effort to obtain viral genetic information to provide a baseline of the circulating measles and rubella strains, including endemic strains and some imported strains. If data are not available, an explanation should be provided why data are unavailable. Laboratory, NIP and surveillance should work together to ensure proper and timely collection of needed virological specimens (see Annex 2), and ensure testing of viral specimens in an accredited WHO proficient laboratory and/or a laboratory that has an established quality assurance (QA) programme with oversight by a WHO accredited laboratory.

Countries should ensure the presence of the following genetic information to provide evidence of interruption of endemic transmission, outbreak and sporadic cases:

1. 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; and
2. Sequencing information of cases by date of onset, location, and importation history:
  - a. Provide description of the named strains/lineages in addition to genotype and include matches with named strain or identical sequence from the global databases MeaNS/ RubeNS;
  - b. For measles only, the detection of variant lineages within a genotype should be described if available, and the sequence differences presented as a phylogenetic tree or distance table. Sequence variants should be linked to closely related sequences in MeaNS.

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

- MeaNS: WHO Measles Nucleotide Surveillance online database (<http://www.who-measles.org>)
- RubeNS: WHO Rubella Nucleotide Surveillance online database (<http://www.who-rubella.org>)
- An epi-curve including genetic sequence data (can refer to the previous curve).

### 3.2.3 Quality of epidemiological and laboratory surveillance systems for measles, rubella and congenital rubella syndrome (CRS)

In the setting of measles and rubella elimination, surveillance for measles and rubella must be sufficiently sensitive to detect endemic measles and rubella cases and imported/import-related chains of transmission. Surveillance must also have adequate capacity for timely and proper case investigation and laboratory analysis. The credibility of elimination depends on the quality of the epidemiological and laboratory surveillance system and according to the standard performance indicators as described in Annex 2.

This line of evidence describes in detail the design and extent of case-based surveillance for measles and rubella, in terms of: case definition; specific population covered; representativeness; and sources of case reporting; analysis against the standard surveillance system performance indicators<sup>5</sup> conducted at the second administrative level (state/province/governorate) or third administrative level (district, locality or other) in big countries; description and results of active searches conducted in silent or high-risk areas; and documentation of special surveys, epidemiological and other research studies conducted.

Active case finding and retrospective case searches identify the strengths and weaknesses of the system and monitor the integrity of epidemiological reports. Active case searches are required, including case search during case investigation, and case search in high-risk areas. Active searches should be conducted in health centres or other appropriate medical facilities and in communities where suspected cases are reported to identify additional cases and unvaccinated contacts for vaccination. Active searches should also be carried out in silent areas, areas that do not adhere to reporting standards, areas of high population movement/migration, and areas with low vaccination coverage.

#### CRS surveillance

The goals of CRS surveillance are to supplement rubella surveillance in order to monitor progress towards the achievement and maintenance of rubella elimination, and to monitor the impact of immunization programme interventions such as the recent introduction of rubella-containing vaccine (RCV). A system that includes sentinel case-based CRS surveillance with laboratory confirmation is needed to document rubella elimination. The more functional CRS surveillance sites utilized will result in stronger evidence for rubella and CRS elimination. If there is no surveillance in place, countries should first establish CRS surveillance. The most common approach used is sentinel-site surveillance (sentinel sites are generally secondary- or tertiary-care facilities where CRS-affected infants are most likely to present). However, enhanced birth defect surveillance, cataract-only surveillance, or national passive surveillance (notification) are alternative approaches that may be more appropriate based on local context. CRS surveillance allows for detection of infants with clinically apparent manifestations and can be standardized for regional and global reporting and comparison. The CRS system must be evaluated (for example, using periodic retrospective medical record review for case finding) to document the elimination of CRS and to demonstrate that the surveillance system is well-functioning.

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<sup>5</sup> WHO, *Weekly Epidemiological Record*, 2013; 9: 88, 89–100, <http://www.who.int/wer/2013/wer8809.pdf?ua=>; and WHO, *Weekly Epidemiological Record*, 2017: 9/10: 97–105, <http://apps.who.int/iris/bitstream/handle/10665/254652/WER9209-10.pdf;jsessionid=EAD8BC95A3F502924D29D9B3A087779C?sequence=1> (accessed 6 December 2018).

Registries identifying pregnant women with confirmed or suspected rubella also complement CRS surveillance systems, but by themselves are insufficient for identifying the majority of CRS cases, as rubella generally causes a mild or asymptomatic clinical illness.

### **Laboratory surveillance**

High-quality case-based surveillance relies on laboratory confirmation to help document that measles and/or rubella has been eliminated. Each national reference laboratory in the Eastern Mediterranean Region should produce high-quality surveillance data, in accordance with WHO laboratory testing guidelines.<sup>6</sup> Laboratory support should demonstrate the following characteristics:

1. Samples tested in a fully accredited laboratory, according to the current WHO Global Measles Rubella Laboratory Network standards.
2. The algorithm for testing of laboratory specimens for example: countries may test sera for measles immunoglobulin M (IgM) first and if it is negative, they test for rubella IgM. However, other countries may do parallel testing for measles and rubella IgM.
3. Highly collaborative relationship between the laboratory, surveillance and the NIP.
4. Laboratory data to be linked to clinical and epidemiological data and used for measles and rubella case classification.
5. Genotype mapping of viruses found in each region or province in each country through the characterization of endemic cases or archival samples (e.g. serum, urine, nasopharyngeal swab and oral fluid).

Countries should identify and address any surveillance and laboratory gaps and take the necessary actions.

### **3.2.4 Population immunity against measles and/or rubella: analysis of measles and rubella vaccinated population cohorts**

To achieve and maintain measles and rubella elimination it is necessary to achieve a level of population immunity sufficient to interrupt endemic transmission and prevent sustained transmission if importation of cases occurs.

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. However, an accurate description of vaccine-induced and immunity-acquired from previous infection, by individual birth cohort beginning from the year when measles (or rubella) vaccine was first introduced into the country up to 40 years of age, is important to document how interruption of transmission was achieved and 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

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<sup>6</sup> Manual for the laboratory diagnosis of measles and rubella virus infection, 2nd ed. Geneva, World Health Organization, 2007 (WHO/IVB/07.01) ([http://whqlibdoc.who.int/hq/2007/WHO\\_IVB\\_07.01\\_eng.pdf](http://whqlibdoc.who.int/hq/2007/WHO_IVB_07.01_eng.pdf), accessed 7 December 2018).

vaccination services, including migrants, urban or rural poor, and people in remote areas. Cohorts with the year of birth prior to the year of measles vaccine introduction into the routine immunization programme can be assumed immune unless there are specific epidemiological data to suggest the contrary. For countries being verified for measles elimination despite presence of immunity gaps, the population immunity profile should be used to elaborate on the “risk of measles reintroduction”. Data demonstrating that high population immunity levels have been achieved will need to be provided by the third administrative level (district/locality) in each country.

### **Main sources of data for assessing population immunity**

1. Administrative coverage estimates: Annual administrative reports of routine vaccination coverage with measles-containing vaccine (MCV1 and MCV2) and SIA coverage as reported in the WHO/United Nations Children’s Fund (UNICEF) Joint Reporting Form (JRF) on Immunization, as well as annual WHO/UNICEF estimates of national coverage that sometimes differ from reported administrative coverage, as well as other estimates of coverage based on assumptions available at the country level. The analysis should be available to the third administrative level.
2. Population-based surveys: Population-based surveys of routine immunization and SIA coverage surveys are also useful and include WHO coverage evaluation surveys, demographic and health surveys (DHS), multiple indicator cluster surveys (MICs), PAP-Fam survey, PAP-Child survey or equivalent surveys.
3. Sero-surveys: Appropriately designed and implemented sero-epidemiological surveys can provide detailed information about the serological immunity by birth cohort. The scale and scope of the survey often depends on available resources (human and financial) to implement the survey, collect the data, test the specimens and analyse the data. Potential limitations include those related to the sensitivity, specificity and predictive value of the laboratory tests used to detect measles immunoglobulin G (IgG) when conducting the sero-survey as well as the precision of the age and gender-specific estimates and the representativeness of the survey if it is dependent on opportunistic laboratory specimens.

### **3.2.5 Sustainability of measles and/or rubella elimination**

In order to achieve and sustain measles and rubella elimination, the NIP is required to conduct an annual measles/rubella programme assessment at all levels, including the sustainability issues (management, health system reform, insecurity issues, and decentralization process that may influence the immunization programme) and accordingly develop an action plan to address all the identified gaps. A strong and sustainable NIP is essential for fulfilling this requirement.

Countries need to demonstrate political commitment and a legal basis for the sustainability of elimination, which should be reflected in financial support to fund vaccine procurement, epidemiological and laboratory surveillance components, and an adequately resourced outbreak preparedness and response plan.

Countries may consider implementing other strategies/national policies that will contribute to accelerating/sustaining measles elimination, for example, reducing nosocomial infection and transmission, advocacy and communication for raising public awareness, and a monitoring system for public acceptance of vaccines.



## Chapter 4 | Post-verification needs

After elimination has been achieved by a country, especially if elimination was for both measles and rubella, the country will need to sustain efforts and prevent re-establishment of endemic transmission. In addition to continuing the strategies used to achieve elimination, there are a number of other issues a country will need to consider, especially after verification.

- Maintain political will and commitment from national authorities, partners and stakeholders, to ensure that resources continue to be available to sustain elimination.
- Maintain a high-quality surveillance system as per the surveillance system performance indicators, including genetic sequencing of all chains of transmission and timely reporting of this data to global online databases. Genetic information provides an essential tool for documenting the transmission patterns.
- Ensure that outbreak investigation and emergency response capacity is sufficient to quickly detect, investigate, analyse, and respond to outbreaks of measles and rubella. This is especially important so that: import-related outbreaks can be quickly contained before broader spread can occur; outbreaks related to multiple importations can be convincingly characterized as distinct events rather than an extended period of continuous transmission; and circulating strains of measles and rubella can be identified.
- Provide evidence-based and user-friendly communication materials for health workers to ensure there is continued public interest in and demand for vaccination.

Countries, through the NVC, should continue to assess the country's elimination status after verification and submit annual progress reports to the RVC.



# **Annexes**

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# Annex 1

## Overview of measles and rubella elimination in the Eastern Mediterranean Region

### 1. Introduction

At its 44th session in 1997, the Regional Committee for the Eastern Mediterranean adopted a resolution for measles elimination in all Member States of the Region by 2010 (EM/RC44/R.6). In 2011, due to delay in achieving the measles elimination goal, the Regional Committee decided to revise the target year of measles elimination to 2017 (resolution EM/RC58/R.5). However, this goal was not achieved by the target date and the regional vaccine action plan 2018–2020, adopted by the Regional Committee in 2017, called for this goal to be achieved as soon as possible and for elimination to be verified in any country that achieved it without waiting for regional elimination. While the Eastern Mediterranean Region has not yet established a regional target for rubella/CRS elimination, 13 countries have set national rubella and/or CRS elimination targets.

### 2. Strategies

The strategy for measles elimination in the Eastern Mediterranean Region is based on four components:

1. Achieve and maintain high population immunity against measles (and rubella where applicable) by reaching at least 95% coverage of the population, at the lowest administrative level (district level or the equivalent), with two doses of measles-containing vaccine (MCV) through routine immunization and supplemental immunization activities (SIAs) where necessary.
2. Establish case-based surveillance supported by a proficient laboratory with investigation of all suspected cases of measles, rubella and CRS.
3. Develop and maintain outbreak preparedness, respond rapidly to outbreaks and manage cases.
4. Communicate and engage to build public confidence and demand for immunization.

### 3. Progress towards measles elimination and rubella control 1998–2019

#### 3.1 Measles

The Region witnessed significant progress towards the interruption of measles virus transmission during the period 1998–2010, and reported measles cases decreased by 89% from 89 478 cases in 1998 to 10 072 in 2010.<sup>7</sup> However, due to the geopolitical situation in several countries of the Eastern Mediterranean Region since 2011, and the significant decrease in donor funding of measles SIAs, regional progress slowed and the number of reported cases more than tripled from 10 072 to 33 943 between 2010 and December 2019.<sup>8</sup>

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<sup>7</sup> Countries reported data through WHO UNICEF Joint Reporting Form (JRF).

<sup>8</sup> Source for 2010: JRF; for 2017: monthly reported data to VPI, Eastern Mediterranean Region.

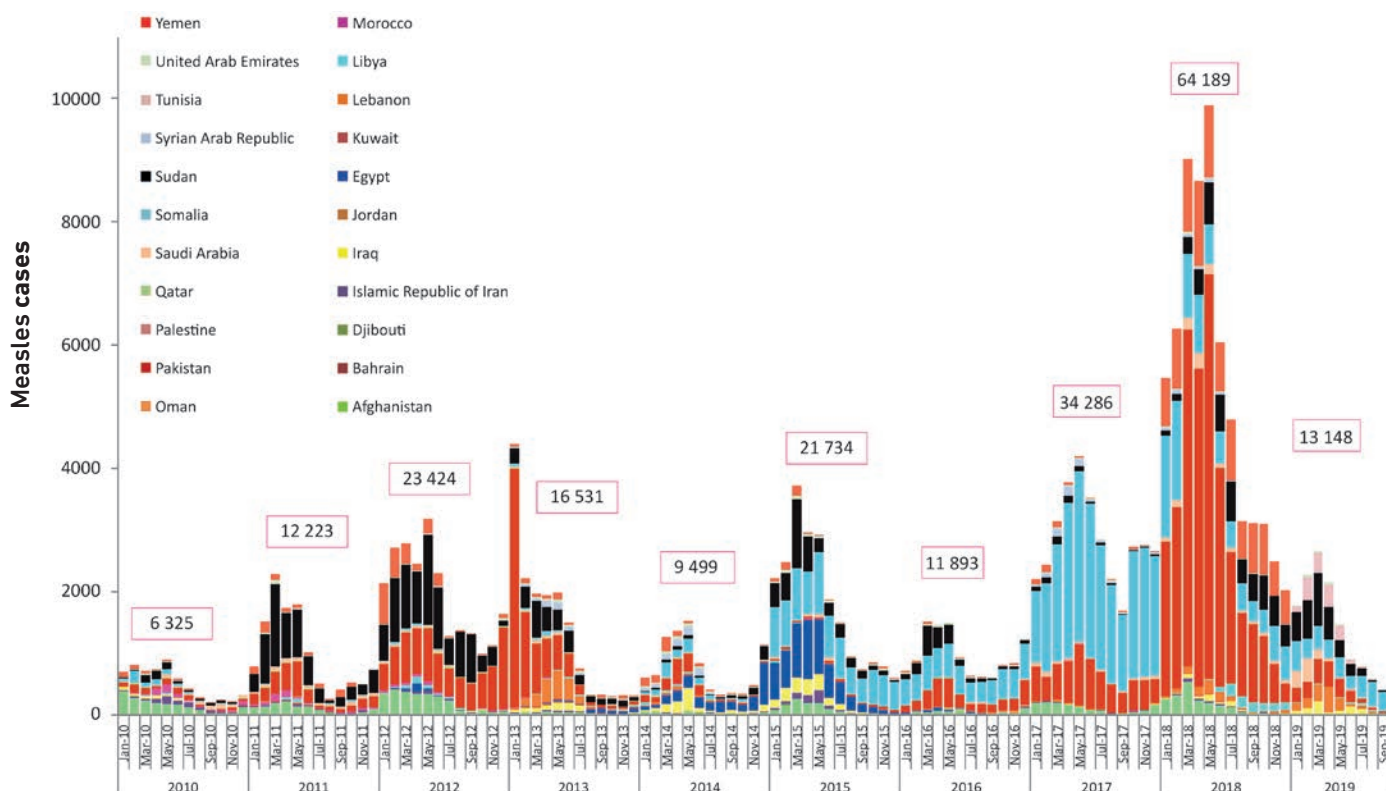


Fig. 4. Monthly distribution of measles cases by country in the Eastern Mediterranean Region 2010–2019

Member States of the Eastern Mediterranean Region have been implementing the regional strategy for measles elimination with varying levels of success. Based on WHO-UNICEF estimates of national immunization coverage (WUENIC) 2018, of the 22 countries in the Region, coverage for the first dose of MCV1 was:

- $\geq 95\%$  in 12 (54.5%) countries, (Bahrain, Egypt, the Islamic Republic of Iran, Jordan, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Tunisia and the United Arab Emirates). However, of these countries only 5 countries (23% of all countries) reported  $>95\%$  coverage in all districts.
- 90%–94% in 1 (4.5%) country (Kuwait).
- And  $<90\%$  (range 46%–86%) in 9 (40.9%) countries (Afghanistan, Djibouti, Iraq, Lebanon, Pakistan, Somalia, Sudan, the Syrian Arab Republic and Yemen).

In the same year (2018), among the 21 countries and areas (all except Somalia) that provide routine second dose of MCV2, coverage with MCV2 was  $\geq 95\%$  in 10 (48%), 90%–94% in 3 (14.3%), and  $<90\%$  (range 40–82%) in 8 (38%).

To bridge immunity gaps,  $>500$  million people were reached through catch up and follow up national or subnational measles (SIAs) during the period 2002–2018.

Measles case-based laboratory surveillance, supported by national proficient laboratories, has been implemented in 20 of the 22 Eastern Mediterranean Region countries (all countries except Djibouti and Somalia). Measles surveillance performance indicators showed that several countries met

surveillance standards despite the ongoing challenging situation. The measles/rubella laboratory network is composed of 21 national (all countries except Djibouti) and 2 regional reference laboratories (located in Oman and Tunis). The laboratory network has capacity to accommodate molecular diagnostic requirements for measles/rubella case-based surveillance and molecular diagnostic capacity. Eighteen of the 22 countries had well-established virus detection by RT-PCR or virus isolation. The efforts to improve vaccination coverage and strengthening surveillance to identify and respond to cases has significantly decreased measles morbidity and mortality. From 2000 to 2018, estimated measles mortality and morbidity decreased by 79%, from 55 300 to 11 400 cases.<sup>9</sup>

Experience from the Americas<sup>10</sup> shows that to sustain measles and rubella elimination over a long period of time, countries need to continue to fully apply the appropriate strategies of vaccination and integrate surveillance for measles and rubella. The measles outbreaks in Brazil and Venezuela have demonstrated the importance of continuation of the elimination strategies after elimination has been achieved.<sup>11</sup> In the Eastern Mediterranean Region, while implementation of the measles elimination strategy has varied in intensity by country because of managerial, financial, security and other constraints, all countries have exhibited strong commitment and determination to achieve measles elimination.

### 3.2 Rubella

Thirteen countries in the Region have developed national goals for rubella/CRS. Since 2011, the RTAG for Immunization has therefore recommended including the documentation of rubella elimination with the measles elimination verification guidelines and subsequent verification documentation. Since the vaccination and the surveillance platforms for measles and rubella are integrated, countries documenting progress towards measles elimination should also submit documentation of progress towards or achievement of rubella elimination.

Countries in the Region have been strongly encouraged to use measles elimination activities as an opportunity to control rubella and prevent CRS, as recommended by WHO.<sup>12</sup> By the end of 2019, 16 countries and one area were using RCV in their routine programme. Twenty out of the 22 countries and areas have integrated rubella surveillance with measles case-based laboratory surveillance and routinely report rubella surveillance data to the Regional Office for the Eastern Mediterranean Region through the monthly integrated measles/rubella reporting system. Thirteen countries reported having implemented CRS surveillance. The situation of confirmed rubella cases in the Region is reflected in Fig. 5. There continue to be seasonal trends of rubella disease, though primarily in countries that are yet to introduce RCV (Afghanistan, Djibouti, Pakistan, Somalia and Sudan).

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<sup>9</sup> World Health Organization, 2017; "Progress towards regional measles elimination – worldwide, 2000–2016". *Weekly Epidemiologic Reports* 92(43): 649-660.

<sup>10</sup> De Quadros C, Andrus J, Danovaro C, Castillo-Solorzano C. Feasibility of global measles eradication after interruption of transmission in the Americas. *Expert. Rev. Vaccines* 7, 3 (2008): 355-362.

<sup>11</sup> Leite RD, Barreto J, Monteiro D. Measles Reemergence in Ceará, Northeast Brazil, 15 Years after Elimination. *Emerging Infectious Diseases*. 2015; 21(9):1681-1683.

<sup>12</sup> World Health Organization, 2011; "Rubella Vaccine: WHO Position Paper". *Weekly Epidemiologic Reports* 86 (29): 301-316.

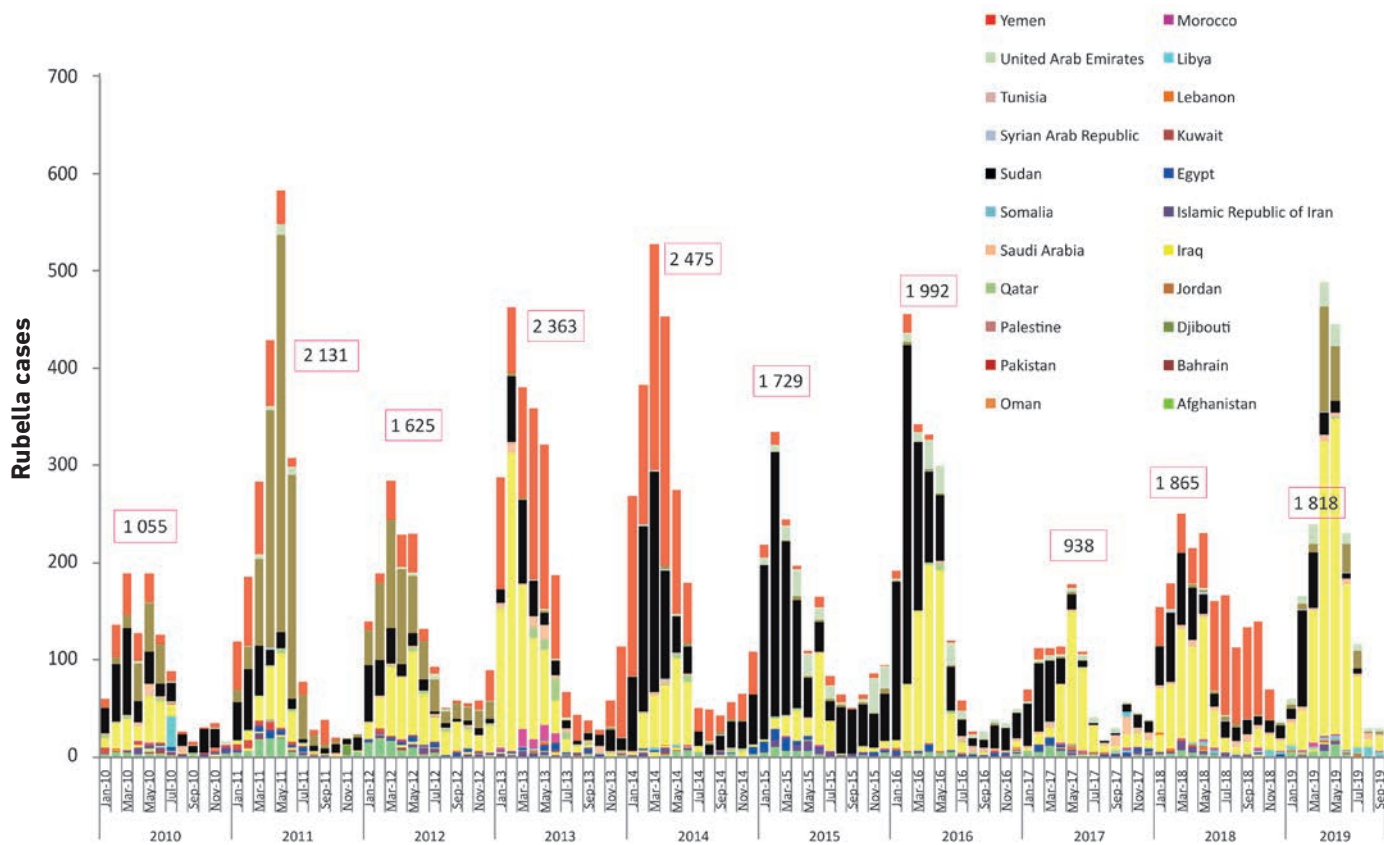


Fig. 5: Monthly distribution of confirmed rubella cases in the Eastern Mediterranean Region by month, 2010–2019

### Measles and rubella genotyping

Before 2011 the predominant genotype in the Region was D4 followed by B3, but since 2011 and 2012 circulation of measles virus B3 seems to be more pronounced in the Region. Almost all endemic virus lineages have disappeared from all countries and been displaced by genotype B3 followed by D8. The new B3 lineage replaced the previously endemic B3 viruses. This is an indication of the progress of measles elimination with endemicity being interrupted. Only limited sequence information is available for rubella genotype; information is available from some countries in the Region, genotypes 1E, 1G and 2B. After elimination has been achieved, the molecular epidemiological information from new cases should be compared with the pre-elimination endemic viral strains. The absence of endemic strains for > 12 months with or without sporadic imported strains is consistent with elimination.

## Annex 2

# Surveillance system performance indicators

Surveillance attribute	Indicators	Target	How to calculate (numerator/denominator)	Comments
<b>Completeness of reporting</b>	Proportion of surveillance units reporting measles and rubella data to the national level (completeness); large countries should report at the third administrative level as well	≥80%	Number of surveillance units in the country reporting/number of surveillance units in the country*100	
<b>Timeliness of reporting</b>	Proportion of surveillance units reporting measles and rubella surveillance data to the national level on time, even in the absence of cases (zero reporting)	≥80%	Number of surveillance units in the country reporting by the deadline/ number of surveillance units in the country*100	At each level reports should be received on or before the requested date.
<b>Sensitivity of the surveillance system</b>	Reporting rate of discarded non-measles non-rubella cases at the national level	≥2/100 000 population per 12 months	Number of suspect cases that have been investigated and discarded as a non-measles and non-rubella case through (a) testing in a proficient laboratory or (b) epidemiological linkage to a laboratory-confirmed case of another communicable disease that is neither measles nor rubella in a 12-month period /national population*100 000	
<b>Representativeness of reporting</b>	Proportion of second administrative units (for example, at the province level or its administrative equivalent) reporting at least 2 discarded non-measles non-rubella cases per 100 000 population per year	≥80%	Number of subnational units achieving ≥2/100 000 discard rate/# of subnational units*100	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 ≥100 000 person-years of observation, or neighbouring administrative units can be combined for the purpose of this calculation.  Administrative units should include all cases reported from their catchment area, including import and importation-related cases residing in neighbouring administrative units but reported in this one.



<b>Timeliness and completeness of investigation</b>	Proportion of suspected measles and rubella cases that have had an adequate investigation initiated within 48 hours of notification	≥80%	Number of suspected cases of measles or rubella for which an adequate investigation was initiated within 48 hours of notification/ number of suspected measles and rubella cases*100	<p>Note 1: An adequate investigation includes collection of all the following data elements from each suspected measles or rubella case: 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; measles-rubella vaccination status; date of all measles rubella or measles-mumps-rubella vaccination; date of notification; date of investigation and travel history.</p> <p>Note 2: Some variables may not be required for cases that are confirmed as measles by epidemiological linkage (for example, date of specimen collection).</p>
<b>Timeliness of specimen transport</b>	Proportion of specimens received at the laboratory within 5 days of collection	≥80%	Number of specimens received within 5 days of collection by laboratory/ number of specimens *100	Indicator only applies to public laboratories.
<b>Specimen collection and testing adequacy</b>	Proportion of suspected cases with adequate specimens collected for detecting acute measles or rubella infection collected and tested in a proficient laboratory	≥80%	Number of suspected cases with an adequate specimen tested in a proficient lab/number of suspected cases – suspected cases of measles or rubella that are not tested by a laboratory and are (a) confirmed as measles or rubella by epidemiological linkage or (b) discarded as non-measles and non-rubella by epidemiological linkage to another laboratory-confirmed communicable disease case*100	<p>Note 1: Adequate specimens are: a blood sample by venepuncture in a sterile tube with a volume of at least 1 ml for older children and adults and 0.5 ml for infants and younger children; a dried blood sample, at least 3 fully filled circles on a filter-paper collection device; an oral fluid sample using a sponge collection device that is rubbed along the gums for &gt;1 minute to ensure the device is thoroughly wet. Adequate samples for antibody detection are those collected within 28 days after onset of rash.</p> <p>Note 2: A proficient laboratory is one that is WHO accredited and/or has established a recognized quality assurance programme (for example, International Organization for Standards (ISO) or Clinical Laboratory Improvement Amendments (CLIA) certified).</p>

<b>Timeliness of reporting laboratory results</b>	Proportion of IgM results reported to national public health authorities by the laboratory within 4 days of specimen receipt	≥80%	Number of IgM test results reported within 4 days of specimen receipt/ number of specimens received by lab*100	Indicator only applies to public laboratories.
<b>Viral detection</b>	Proportion of laboratory-confirmed outbreaks with specimens adequate for detecting measles virus collected and tested in an accredited laboratory	≥80%	Number of outbreaks for which adequate samples have been submitted for viral detection/ number of outbreaks identified	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.
Source classification	Percentage of confirmed cases for which source of transmission is classified as endemic, import or importation-related	≥80%	Number of confirmed cases in which the source can be classified as endemic, import, or importation-related/total number of confirmed cases*100	Unknown source should be kept to a minimum but will continue to occur even with thorough field investigations. This target might not be achievable in large outbreaks

## Congenital rubella syndrome (CRS) surveillance performance indicators

Surveillance attribute	Indicators	Target	How to calculate (numerator/denominator)	Comments
<b>Timeliness of reporting</b>	Proportion of designated units reporting to the national level on time, even in the absence of cases	≥80%	Number of designated reporting units in the country reporting by the deadline / number of designated reporting units in the country*100	At each level reports should be received on or before the requested date
<b>Completeness of reporting</b>	Proportion of designated units submitting 12 monthly reports per year, even in the absence of cases	≥80%	Number of designated reporting units in the country submitting 12 reports in the last year/ number of designated reporting units in the country*100	
<b>Sensitivity</b>	Annual rate of suspected CRS cases at the national level	≥ 1 per10,000 live births	Number of suspected CRS cases/live birth cohort of the population*10 000.	
<b>Adequacy of investigation</b>	Proportion of all suspected CRS cases that have had an adequate investigation initiated within 48 hours of notification	≥80%	Number of suspected CRS cases for which an adequate investigation was initiated within 48 hours of notification / total number of suspected CRS cases*100.	Adequate CRS case investigation is defined as the collection of the following data points: name and/ or unique identifier; place of residence; sex; date of birth; date of notification; 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) at time of investigation
<b>Specimen collection and testing adequacy</b>	Proportion of suspected cases with adequate blood specimens for detecting rubella infection collected and tested in a proficient laboratory	≥80%	Number of suspected cases tested in a proficient laboratory/Total number of suspected CRS cases*100	An adequate specimen is a blood sample by venipuncture in a sterile tube with a volume of at least 0.5 ml.  A proficient laboratory is one that is WHO accredited or has established a recognized quality assurance programme such as International Organization for Standards (ISO) or Clinical Laboratory Improvement Amendments (CLIA) certification
<b>Adequacy of specimens for viral detection</b>	Proportion of confirmed cases with adequate specimen tested for virus detection/isolation	≥80%	Number of confirmed CRS cases with an adequate specimen for viral detection tested in a proficient laboratory/the total number of confirmed CRS cases*100.	An adequate specimen is a throat swab, NP swab or aspirate, nasal swab, serum, urine or clinical specimen based on symptoms (e.g. cataracts, cerebrospinal fluid specimen). Usual specimen is throat swab

<b>Timeliness of case detection</b>	Proportion of CRS cases detected within three months of birth	≥80%	Number of confirmed CRS detected within three months of birth/total number of confirmed CRS cases*100	This should include individuals found through active case search in both the numerator and denominator.
<b>Timeliness of specimen transport</b>	Proportion of specimens (serologic or virologic) received at the laboratory within 5 days of collection	≥80%	Number of specimens received at the laboratory within five days of collection / total number of specimens collected*100 (The denominator is multiplied by 100.)	Indicator only applies to public laboratory
<b>Timeliness of reporting laboratory results</b>	Proportion of serologic results reported by the laboratory within 4 days of specimen receipt	≥80%	Number of serologic results reported within four days of specimen receipt / number of specimens received by the laboratory*100	Indicator only applies to public laboratory

## Annex 3

# Cover letter for initial country report of the National Verification Committee

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Initial country report:

National Verification Committee for Measles, Rubella and CRS Elimination

Name of country: \_\_\_\_\_

Date submitted to WHO/EMR: \_\_\_\_\_

World Health Organization  
Regional Office for the Eastern Mediterranean  
Cairo, Egypt

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The initial national report of the NVC should include:

- The composition of the NVC (list and signatures on page 2).
- Executive summary describing the method of work, main findings, critical discussion points, comments on data or findings that did or did not convince the NVC of the national status of measles, rubella and/or CRS elimination, ongoing concerns, conclusions and recommendations.
- National documentation for verification in accordance with this guideline – this is the main content of the initial report by the NVC to the RVC.
- Action(s) taken and, where appropriate, attachment of additional sheets and appropriate maps and/or tables.
- Minutes of NVC meetings held before this initial report was prepared and submitted.

**SIGNATURES OF THE NATIONAL VERIFICATION COMMITTEE MEMBERS**

1. CHAIR Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

2. VICE-CHAIR Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

3. MEMBER Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

4. MEMBER Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

5. MEMBER Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

6. MEMBER Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

7. MEMBER Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

Place and date of completing report: \_\_\_\_\_

## Annex 4

# Cover letter for annual country update of the National Verification Committee

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Annual country update:

National Verification Committee for Measles, Rubella and CRS Elimination

Name of country: \_\_\_\_\_ Year covered: \_\_\_\_\_

Date submitted to WHO/EMR: \_\_\_\_\_

World Health Organization  
Regional Office for the Eastern Mediterranean  
Cairo, Egypt

Please note: This document is for submission of annual update reports by the National Verification Committees of countries which have submitted an initial national report that has been reviewed and accepted as adequate by the Regional Verification Commission.

Please note: For countries that have been verified by the Regional Verification Commission to have eliminated measles, rubella and/or CRS, their respective National Verification Committees are still required to continue to submit annual updates on measles, rubella and CRS, possibly in an abbreviated form, until Global Eradication has been officially announced by WHO headquarters.

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The annual update report of the NVC should include:

- The composition of the NVC (list and signatures on page 2), noting changes in membership since the last report, if applicable.
- An executive summary describing the method of work, main findings, critical discussion points, comments on data or findings that did or did not convince the NVC of the national status of measles, rubella and/or CRS elimination, ongoing concerns, conclusions and recommendations.
- An update on the national documentation for verification in accordance with this guideline, and any updates made by the RVC – this is the main content of the update report by the NVC to the RVC.
- Copy of the comments of the RVC on the initial national report or annual update, if applicable.
- Follow-up and response to specific comments and recommendations by the RVC on the previous report or update, if applicable.
- Action(s) taken and, where appropriate, attachment of additional sheets and appropriate maps and/or tables.
- Minutes of NVC meetings held since the last report was prepared and submitted.

**SIGNATURES OF THE NATIONAL VERIFICATION COMMITTEE MEMBERS**

1. CHAIR Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

2. VICE-CHAIR Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

3. MEMBER Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

4. MEMBER Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

5. MEMBER Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

6. MEMBER Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

7. MEMBER Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

8. MEMBER Name: \_\_\_\_\_

Professional position: \_\_\_\_\_

Signature:

Place and date of completing report: \_\_\_\_\_



## Annex 5

# Report of laboratory data for verification of elimination

Starting date: \_\_\_\_\_ Ending date: \_\_\_\_\_

	Number of cases				
	With specimens tested	Positive	Negative	Inconclusive	Pending
<b>Measles</b>					
IgM					
RT-PCR					
Virus isolation					
Genotyping					
<b>Rubella</b>					
IgM					
RT-PCR					
Virus isolation					
Genotyping					

Documentation of annual results of measles virus genotyping in detail. (This table may include outbreak and sporadic cases, or a separate table for outbreaks can be included that includes additional outbreak data, e.g. dates of index and last case, number of cases.)

Starting date: \_\_\_\_\_ Ending date: \_\_\_\_\_

Case ID	First admin. level (subnational)	Date of onset of rash	MeaNS or RubeNS ID	Genotype and named strain	Origin	Comments
<b>Measles</b>						
<b>Rubella</b>						

## **Annex 6**

# Template for initial country report on progress towards measles and rubella elimination

### **Initial country report on progress towards measles and rubella elimination**

[Name of the country]

**YEAR .....**

Submitted by:

Chair of National Verification Committee

Signature:

Name:

Date:

# Purpose of the report

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

The following template provides guidance to countries to provide verification documents to the RVC through the NVC. Countries are encouraged to analyse and present data in whatever format they feel is most appropriate to fully describe and communicate the status of measles and rubella elimination along the lines of evidence of measles/rubella elimination.

# Executive summary

**Conclusion of the National Verification Committee on measles and rubella elimination status in** (country name) in (year ....):

**Instructions:** Please provide your statement on the status of measles and rubella virus circulation in your country, based on the information provided by the national surveillance and immunization systems. Tick the boxes below as deemed appropriate and provide summary along the lines of evidence (main facts that led to the NVC's conclusion). If you have difficulties in selecting one of the three status definitions for measles and rubella elimination, please leave the boxes unchecked and explain in the text box. Please delete provided text and enter your text addressing mentioned areas in the below box.

## Measles:

Endemic

Interrupted endemic transmission for.....months

Re-established endemic transmission for.....months

The NVC conclusion is based on the following:

**Epidemiology of measles:** number and description of cases and outbreaks (person-time-place, seasonality, immunization status, known origin, adequate confirmation and discarding of cases).

**Molecular epidemiology of measles:** comprehensive analysis of epidemiological and laboratory data on detected genotypes/lineages of measles viruses, and extended to analysis of available data from previous and following year looking for/to exclude continuous circulation of >12 months.

**Measles surveillance quality:** systems quality and capacity to detect, report, investigate and confirm/discard suspected cases all over the country for the entire year; performance against surveillance indicators and other reliable indicators used in country to confirm adequate surveillance quality and performance; additional activities (active case finding, retrospective case/data analysis, addressing "silent" territories and populations); integration with laboratory segment of surveillance for confirming cases and genotypes/lineages (sporadic cases and outbreaks); and strengths and weaknesses of surveillance data quality.

**Activities to achieve and maintain high population immunity:** routine immunization programme coverage at national and subnational levels, and especially where suboptimal programme performance exists (for example, age cohorts, territories and/or specific population with known low coverage); supplemental immunization activities and coverage; additional studies and surveys about immunity to MR; and strengths and weaknesses of immunization data quality.

**Sustainability of and commitment to activities on MR elimination:** political commitment; decision-making structures and main players; involvement of partners; promotion of and advocacy for elimination; sustainability of immunization programme; political and technical regulation and guidelines developed or renewed; secure funds and vaccine supply; organized activities towards particular groups (for example, health care workers – to increase knowledge, population; to increase demand).

## Rubella and CRS:

Endemic

Interrupted endemic transmission for.....months

Re-established endemic transmission for.....months

The NVC conclusion is based on the following:

**Epidemiology of rubella and CRS:** number and description of cases and outbreaks (person-time-place, seasonality, immunization status, known origin, adequate confirmation and discarding of cases).

**Molecular epidemiology of rubella:** comprehensive analysis of epidemiological and laboratory data on detected genotypes/lineages of measles viruses, and extended to analysis of available data from previous and following year looking for/to exclude continuous circulation of >12 months.

**Rubella and CRS surveillance quality:** systems quality and capacity to detect, report, investigate and confirm/discard suspected cases all over the country for the entire year; performance against surveillance indicators, other reliable indicators used in country to confirm adequate surveillance quality and performance; additional activities (active case finding, retrospective case/data analysis, addressing "silent" territories and populations); integration with laboratory segment of surveillance for confirming cases and genotypes/lineages (sporadic cases and outbreaks); and strengths and weaknesses of surveillance data quality.

**Activities to achieve and maintain high population immunity:** routine immunization programme coverage at national and subnational levels, and especially where suboptimal programme performance exists (for example, age cohorts, territories and/or specific population with known low coverage); supplemental immunization activities and coverage; additional studies and surveys about immunity to MR; and strengths and weaknesses of immunization data quality.

**Sustainability of and commitment to activities on MR elimination:** political commitment, decision-making structures and main players, involvement of partners, promotion of and advocacy for elimination, sustainability of immunization programme, political and technical regulation and guidelines developed or renewed, secure funds and vaccine supply, organized activities towards particular groups (for example, health care workers – to increase knowledge, population; to increase demand).

## Section 1. The National Verification Committee (NVC)

**Instructions:** Please provide below the following information about the NVC:

- *History of establishment and meeting of the NVC.*
  - *List of members of the NVC.*
  - *Secretariat support to NVC: Please describe secretariat support, composition, functions, activities implemented, available resources, challenges and other support.*
  - *NVC activities in 2019: 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, and challenges in organizing and/or holding regular NVC meetings.*
  - *NVC workplan for the next year.*
  - *Other activities, as applicable, such as attendance of RVC meetings, feedback to NIP for action on RVC recommendations, or field visits when required, particularly for advocacy purposes. Please provide the NVC (and national technical counterparts') response to RVC's comments/ conclusion and recommendation, summarizing the conducted interventions and activities.*
- 

Date of establishment:

Date of reorganization:

Date of first meeting:

Is it a standalone committee or does it also have other verification/certification functions?

Yes  No

If the NVC has other verification/certification functions, please describe them:

## 1. Members of the National Verification Committee:

*(Please notify any changes.)*

	Name	NVC status (chair/member)	Area of expertise	Occupation/position/ affiliation	Contact details (email; tel.)	Signature
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

## 2. Secretariat support to NVC:

**3. General information on the activities of the NVC in 2019:**

*(Please insert extra rows as needed.)*

	Date	Activity	Highlights and challenges
1			
2			
3			

**4. NVC plan for the next year:**

*(Please insert extra rows as needed.)*

	Date	Activity	Highlights and challenges
1			
2			
3			

**5. NVC response to comments, conclusion and recommendations of RVC on the previous report:**



**6. Other activities of NVC as applicable:**

*(For example, activities such as attendance at RVC meetings, field visits.)*

## Section 2. Country background information and programme history

**Instructions:** Information on the country situation, including demography as well as programme history, will assist giving context to the data presented to the RVC for verification. This data will be generated for the initial country report, and will only be required to be updated annually for the annual progress report.

### 2.1 Country background

a. Geographic description:

b. Demography and population characteristics:

1. **Demography on the national level for the year of the report:**

*Population density:*

*Population size:*

*Population growth rate:*

*Under-1 population:*

*Under-5 population:*

*Under-15 population:*

*Women of reproductive age:*

*Infant mortality rate:*

*Under-5 mortality rate:*

*Urban population:*

*Rural population:*

*Migrant/expatriate population:*

2. **Demography on the subnational level for the year of the report:**

*Population density:*

*Population size:*

*Population growth rate:*

*Under-1 population:*

*Under-5 population:*

*Under-15 population:*

*Women of reproductive age:*

*Infant mortality rate:*

*Under-5 mortality rate:*

*Urban population:*

*Rural population:*

*Migrant/expatriate population:*

- c. Description of high-risk populations for measles/rubella infection and reasons for their high level of risk (e.g. migrant workers, populations living in insecure areas, generally underserved populations, individuals served by private providers, urban slums, mass gatherings, borders with endemic countries, etc.):

- d. Description of the health care delivery system and EPI service providers of the country:

## **2.2 Description of the NIP components**

- a. National targets and goals:

b. Structure of the immunization programme:

c. EPI supporting bodies (e.g. Interagency Coordinating Committee, NITAG, etc.):

d. The country's human resource capacities for MR surveillance and laboratory capacity:

e. The national MR plan of action:

## 2.3 History of the measles and rubella control/elimination programme in the country

a. Description of national elimination goals and targets<sup>13</sup>

b. Description of the history of the vaccination schedule for measles and rubella:  
*(Current and historic immunization schedule for MCV and RCV and number of doses (if any), including vaccination of adolescent and adult females, school entry and prenatal screening.)*

Year of introduction	Type of vaccine (M, MR, MMR, MMRV) and dos-es (MCV1, MCV2, RCV1, RCV2)	Schedule (age by month)	School entry requirements for measles (Yes, No)	Prenatal screening (Yes, No)

c. Description of evolution of strategies for controlling and eliminating measles and rubella:

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<sup>13</sup> If there is no rubella elimination target for the country, the NVC should focus on measles elimination activities only, although some general information about the situation of rubella from the existing data sources in the country should also be provided.

d. Description of relevant surveillance systems and establishment of case-based measles and rubella surveillance including standard case definitions:

e. Description of the structure and function of CRS surveillance in the country:

f. Information on any special studies (for example, identifying CRS cases through review of rubella in pregnancy registries or retrospective medical record searches for CRS cases):

g. Surveillance guidelines and other related documents may be attached, for example, as an annex:

## Section 3. Lines of evidence

### 3.1 First line of evidence: epidemiology of measles and rubella

*Description of the progress towards measles elimination in the country starting from the time of vaccine introduction should be provided. The narrative should correlate changes in incidence with immunization interventions undertaken at any specific year, for example, routine immunization coverage, catch-up or follow-up SIAs which can be illustrated by graphs, maps and/or tables.*

**Instructions:** Please provide the following information:

- *Number of cases, total incidence, incidence of indigenous cases of measles, rubella and CRS at the national and genotype of measles and rubella prior to measles and rubella vaccine introduction. If not available, provide data for the last the last 10 years.*
- *Number and incidence of confirmed cases at subnational level (province and district) illustrated in table, map showing incidence by district in the last 5 years.*
- *Final classification of cases according to confirmation (laboratory-confirmed, epidemiologically linked, clinically compatible, and discarded), source of infection status (imported, import-related, unknown source, endemic) and genotyping.*
- *Monthly epidemic curve of measles/rubella cases.*
- *Distribution of cases by age cohort, vaccination status.*
- *Cohort analysis showing the correlation between age of measles cases in 2019, the national coverage at the time they were expected to be vaccinated, the year of the SIA with SIA survey coverage and the routine immunization coverage for MCV1 and MCV2. (Please see verification guide Fig. 3.)*
- *Review of any special cases, for example, equivocal, indeterminate cases, vaccine-associated cases.*
- *Detailed description of the characteristics of clinically compatible cases, illustrated by map to show location and clustering, if present. Information on age and immunization status and clinical signs and symptoms consistent with measles (yes or no) and cases discarded by the Expert Review Committee.*
- *Measles and rubella outbreaks:*
  - *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 in each outbreak including the setting, the identified immunity gap and measures taken to eliminate this gap in similar populations to prevent future outbreaks. Maps of cases or epidemic curves maybe included. All outbreak investigation reports for last 5 years should be attached as an annex.*
  - *Temporal and spatial association: temporal patterns through incidence graphs demonstrate trends. Spatial patterns can indicate areas where measles interruption may have been achieved, as well as noting whether confirmed cases occur in isolation or in possible*

*transmission chains and identifying epidemiologically linked cases. Special attention should be given to unknown source cases, including if they fit a geospatial pattern that might suggest endemic transmission. Age distribution and vaccination status (by year of birth) should be presented in tables and bar charts to illustrate progress towards elimination.*

- CRS:

*Information on CRS cases and epidemiology should include the following:*

- number of CRS cases over the time period of evaluation
- annual incidence per 10 000 live births if available
- final classification and importation status of cases.

## 1. Measles:

- Measles cases, incidence and genotype at the national level since the introduction of the MCV: \*

Measles								
Total suspected cases								
Total confirmed cases								
Total discarded								
Pending classification								
Total deaths related to measles								
Total incidence of cases								
Incidence of indigenous cases								
Genotype(s)								

\*(Please add columns as needed.)



b. Measles cases and incidence at subnational level (province and districts as applicable):

2019

Province	District	Population size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Incidence rate

2018

Province	District	Population size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Incidence rate

2017

Province	District	Population size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Incidence rate

2016


Province	District	Population size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Incidence rate

2015

Province	District	Population size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Incidence rate

Spot maps to present geographical distribution of total measles cases by province/district for the last 5 years:

Colour code for spot map:


 **Green:** Sporadic "imported" cases (unrelated to any other case in the country)


 **Yellow:** Case is part of an outbreak (>1 case)

 **Red:** Sporadic "unknown" case (unrelated to any other case in the country)

Spot maps to present geographical distribution of discarded measles cases by province/district for the last five years:

Colour code for spot map:

 **Red:** >2/100000

 **Green:** <2/1000000

- c. Measles cases by final classification and source of infection at national level for the last five years:

### 2019

Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

### 2018

Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

### 2017

Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

2016

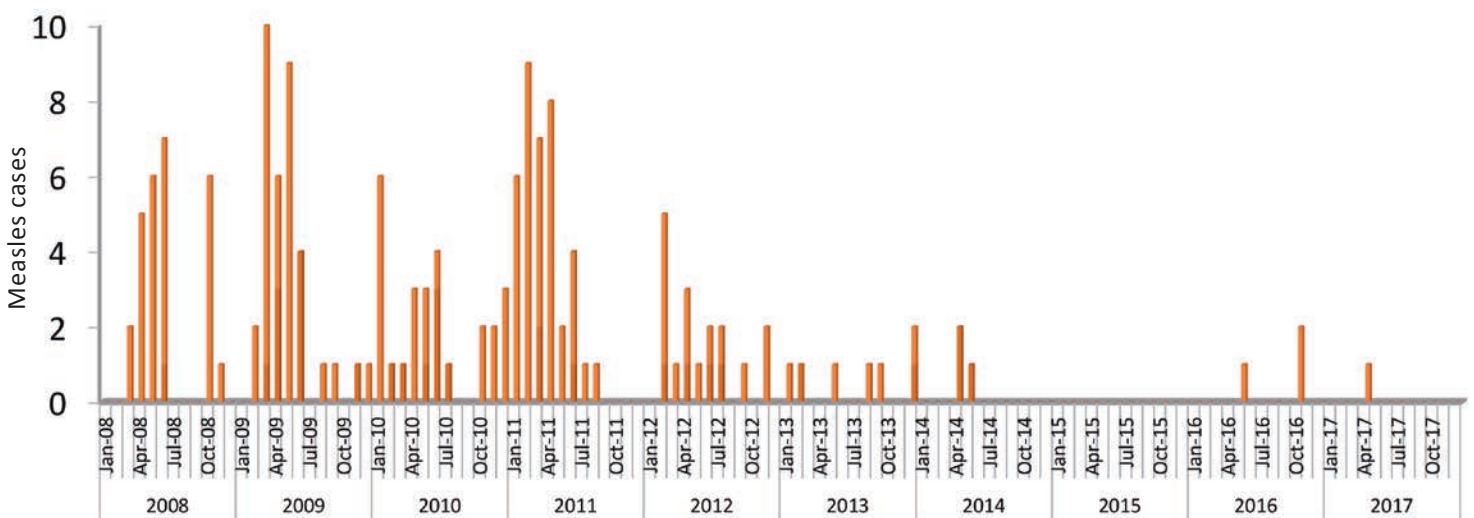
Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

2015

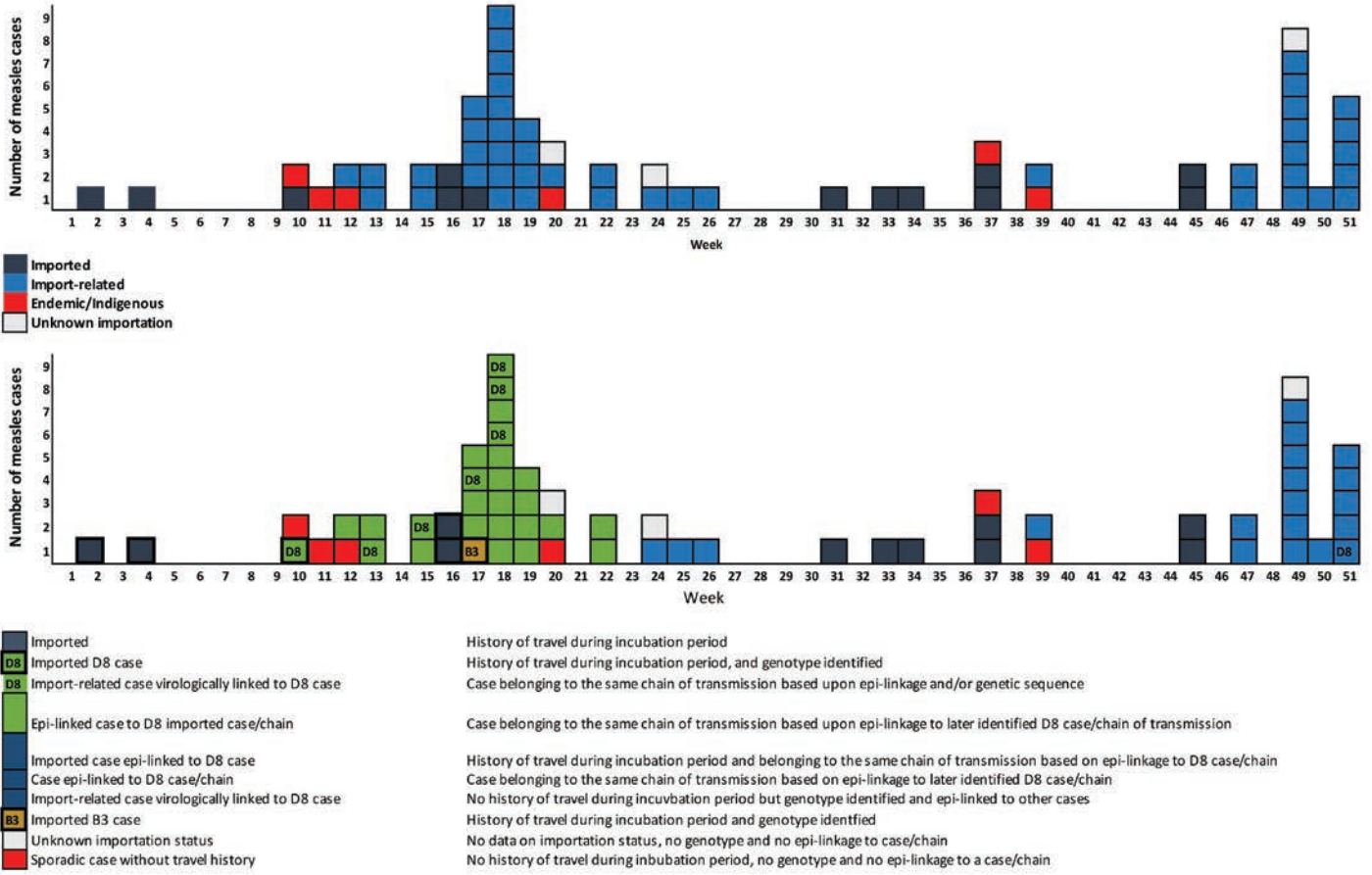
Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

d. Measles epidemic curve for the last 10 years:

- Measles monthly epidemic curve for the last 10 years



● Measles weekly epidemic curve by source of infection and genotype\*

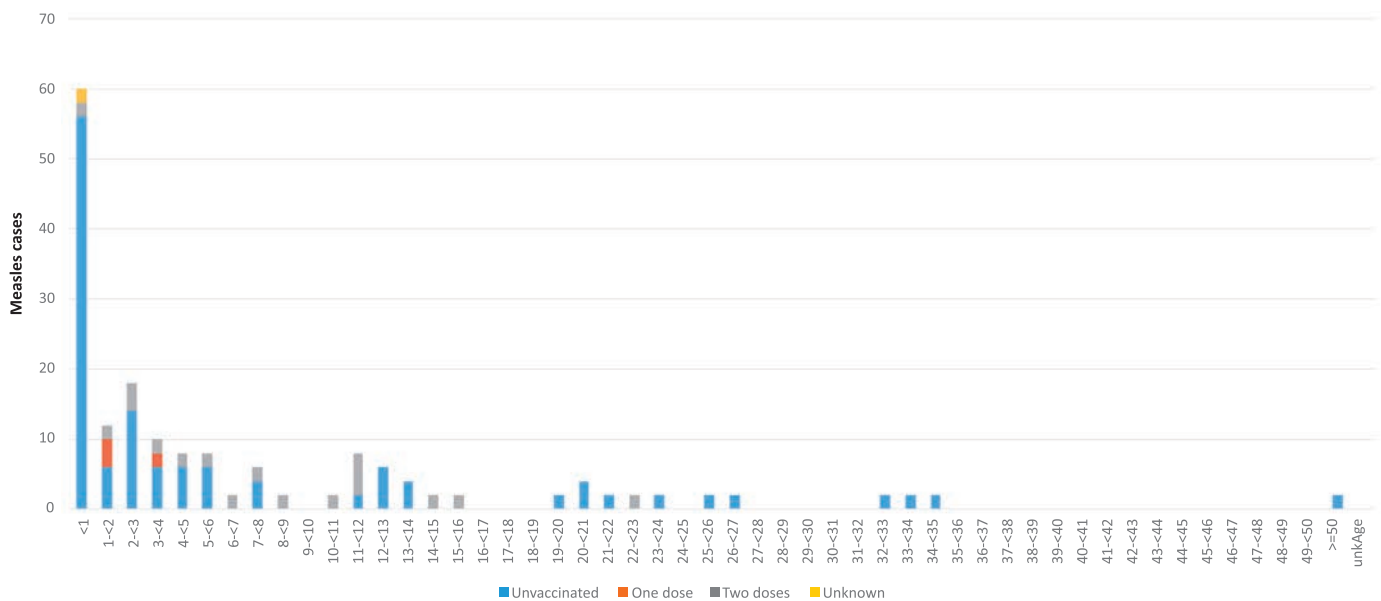


\*Please refer to the Excel sheet provided at:

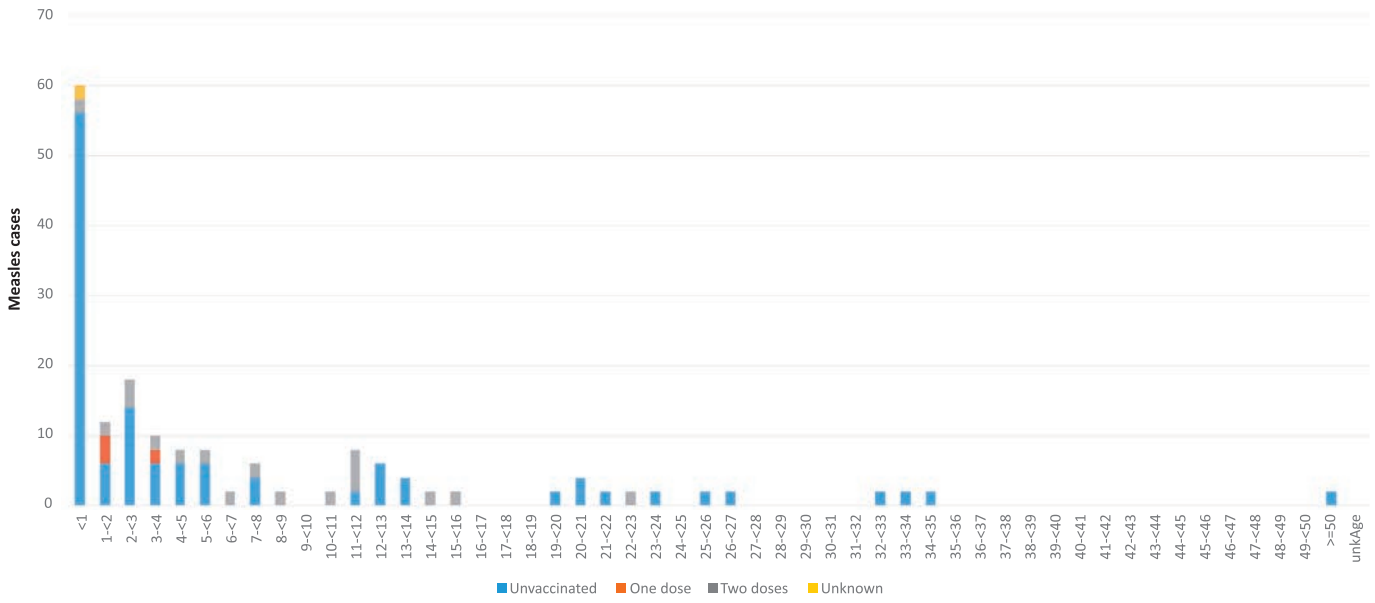
<http://www.emro.who.int/health-topics/measles/index.html?format=html#documentation-for-verification-of-elimination>.

e. Measles cases by age cohort and vaccination status for the last five years:

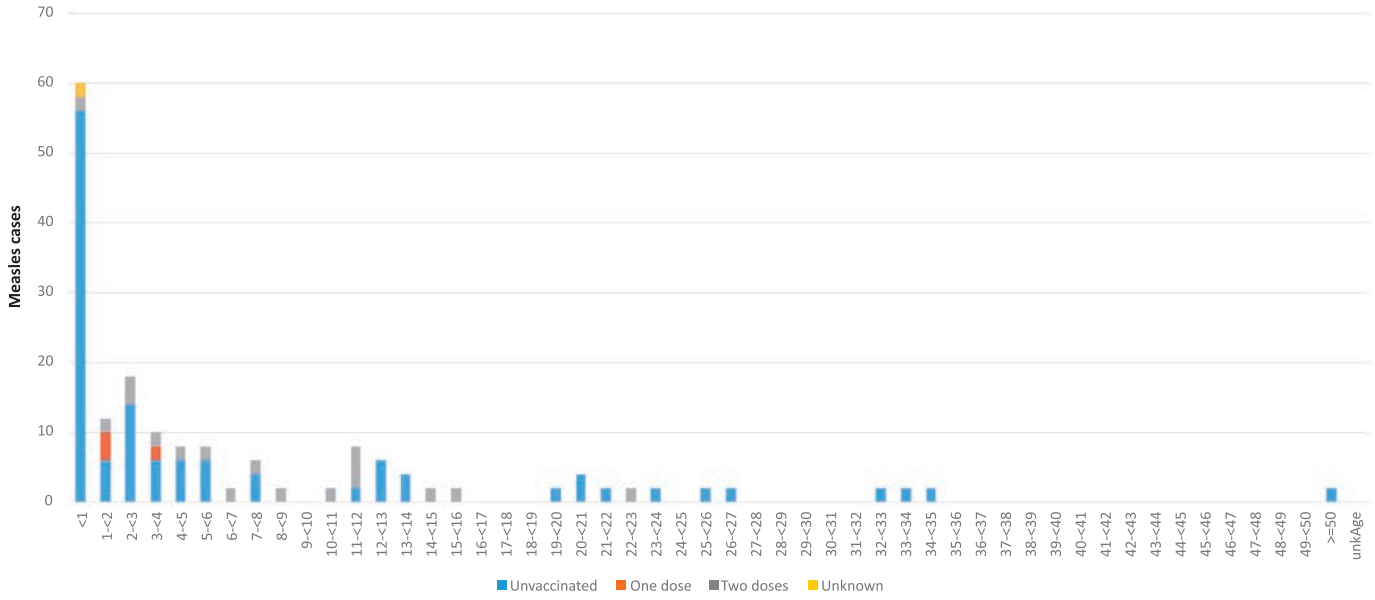
2019



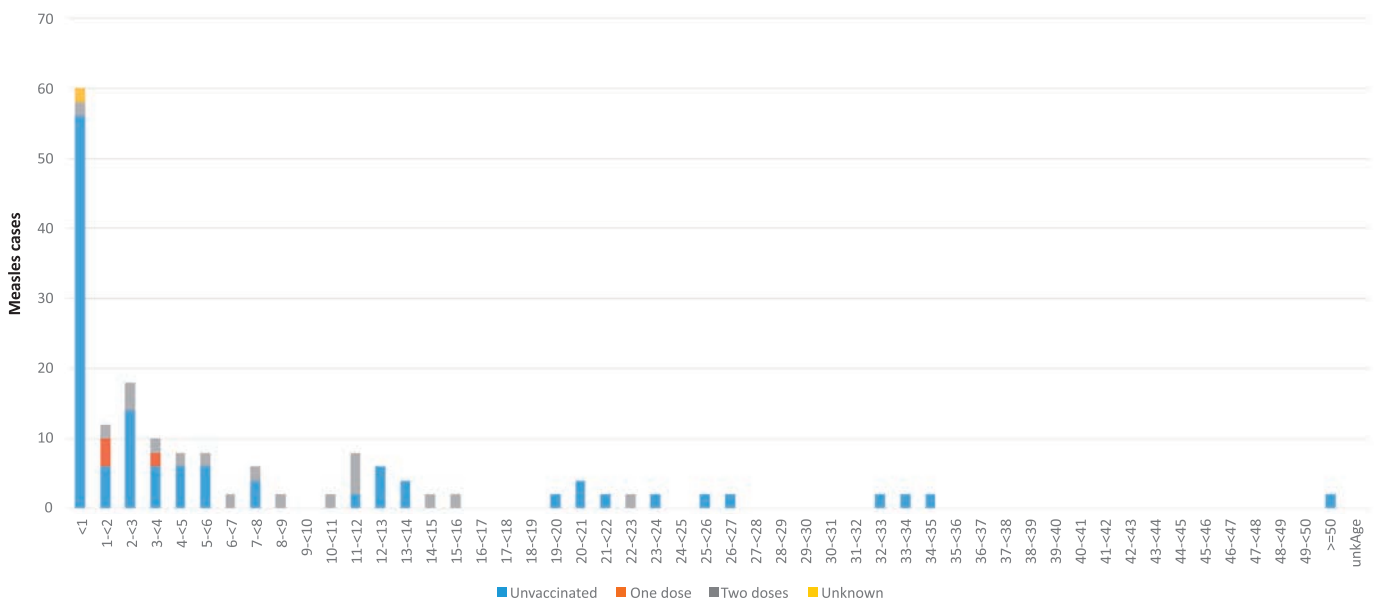
## 2018



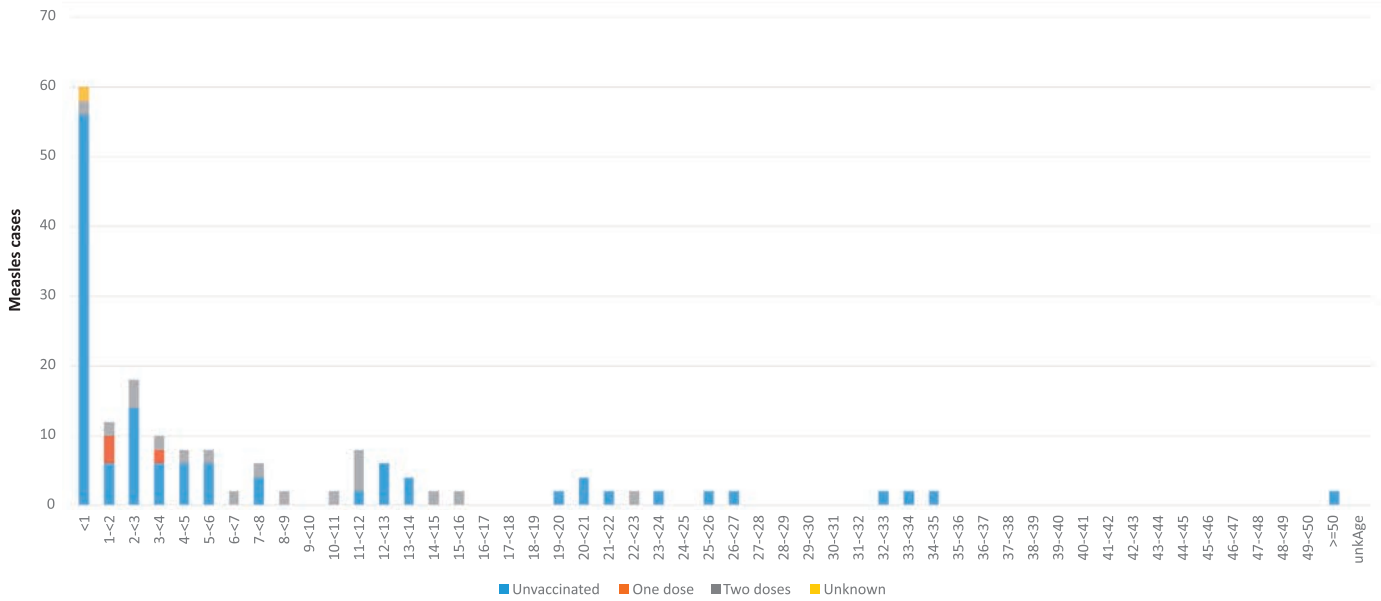
## 2017



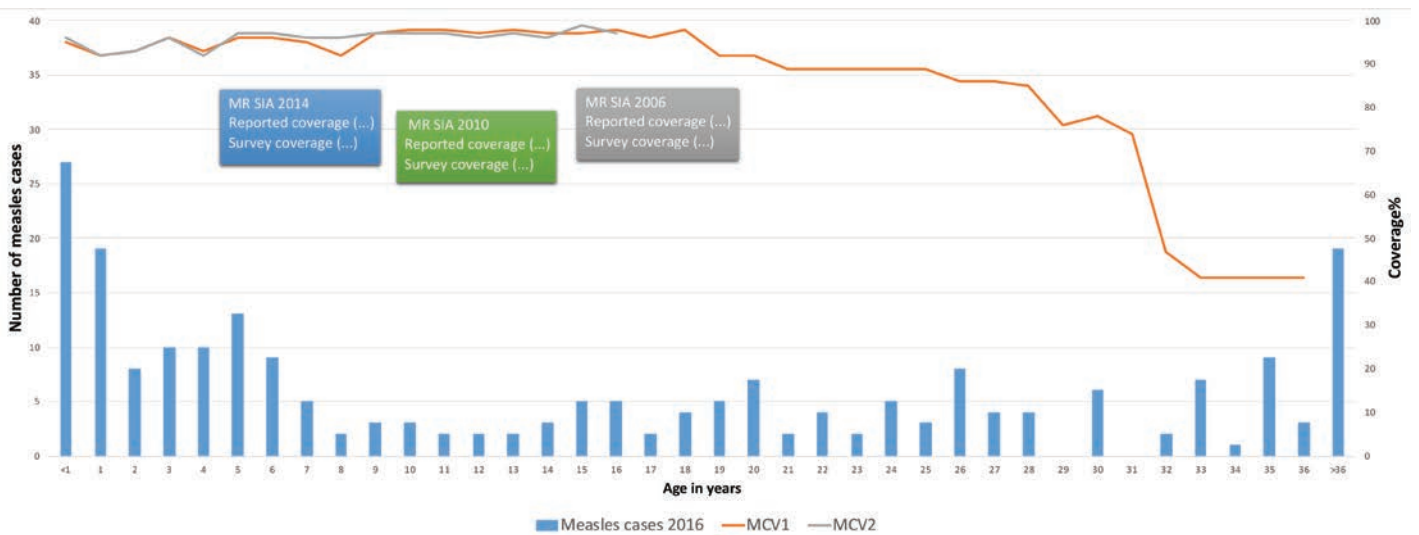
## 2016



2015



f. Analysis describing the epidemiology of measles\*



\*Please refer to the Excel sheet provided at:

<http://www.emro.who.int/health-topics/measles/index.html?format=html#documentation-for-verification-of-elimination>.

g. Review of any special cases in the past 5 years:

- Vaccine-associated:
- Equivocal:
- Clinically compatible (in elimination phase):



h. Measles outbreaks in the last 5 years: \*

Outbreak year*	Governorate/ District	Date of onset of the first case	Epi week of onset of first case	Date of onset of the last case or "ongoing"	Epi Week of onset of the last case	Total number of cases	Genotype/ Distinct sequence ID	MeaNS sample ID	WHO name	First case origin (source)	Comments

\*Please include each outbreak, even in the same year, in a separate line.

**Description of each outbreak:** (include the identified immunity gap and measures taken to address this gap to prevent future outbreaks; maps of cases or epidemic curves may be included.)

Please attach all detailed outbreak investigation reports as annex.

\*Please complete the measles outbreak summary tables in the Excel file provided at: <http://www.emro.who.int/health-topics/measles/index.html?format=html#documentation-for-verification-of-elimination>.

## 2. Rubella and CRS:

a. Rubella cases, incidence and genotype at the national level since the introduction of the RCV:\*

Rubella									
Total suspected cases									
Total confirmed cases									
Total discarded									
Pending classification									
Total deaths related to rubella/CRS									
Total incidence of cases									
Incidence of indigenous cases									
Genotype(s)									
Clinical CRS cases									
Confirmed CRS cases									

\*(Please add columns as needed.)

b. Rubella cases and incidence at subnational level (province and districts as applicable):

2019

Province	District	Population size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Incidence rate

2018

Province	District	Population size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Incidence rate

2017

Province	District	Population size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Incidence rate

2016

Province	District	Population size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Incidence rate

2015

Province	District	Population size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Incidence rate

Spot maps to present geographical distribution of total rubella cases by province/district for the last 5 years:

Colour code for spot map:

■ **Green:** Sporadic “imported” cases (unrelated to any other case in the country)

■ **Yellow:** Case is part of an outbreak (>1 case)

■ **Red:** Sporadic “unknown” case (unrelated to any other case in the country)

Spot maps to present geographical distribution of discarded rubella cases by province/district for the last 5 years:

Colour code for spot map:

■ **Red:** >2/100000

■ **Green:** <2/1000000

c. Rubella cases by final classification and source of infection at national level for the last 5 years:

2019

Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

2018

Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

2017

Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

2016

Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

2015

Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

d. CRS cases by final classification at national level for the last 5 years:

2019

Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

2018

Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

2017

Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

2016

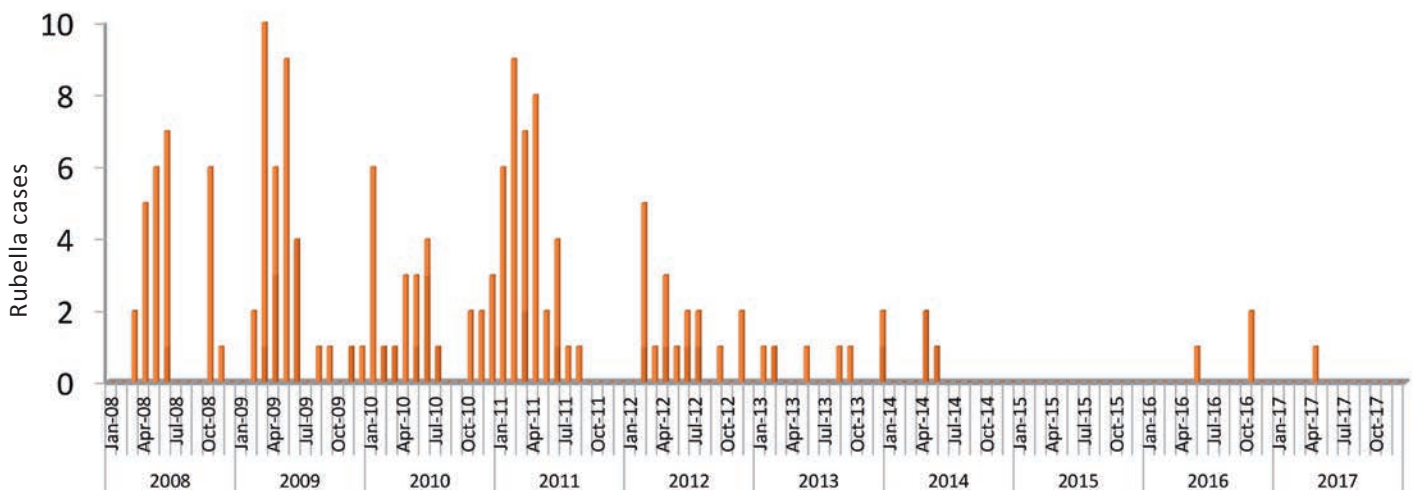
Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

2015

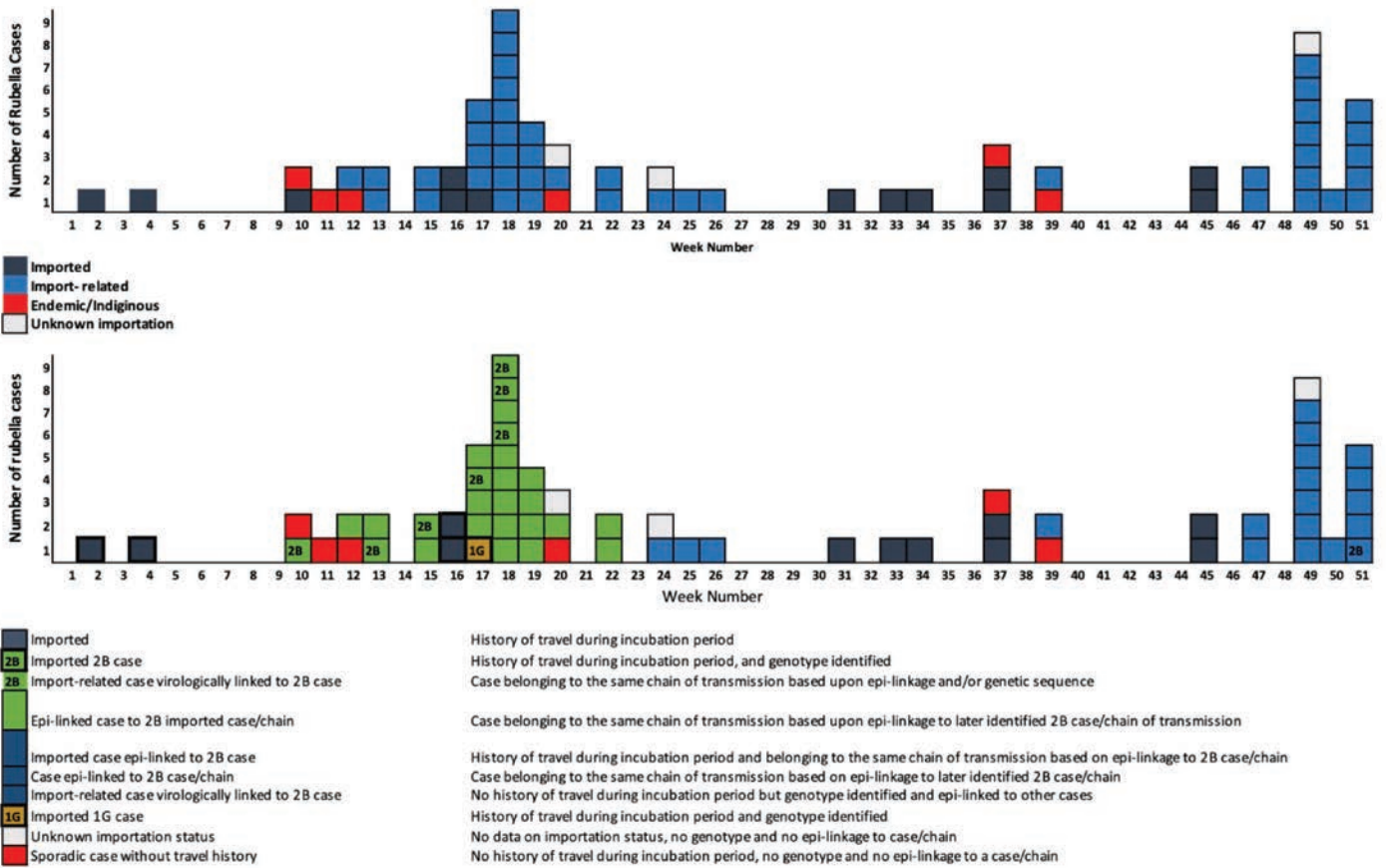
Confirmation Source of infection	Laboratory-confirmed	Epidemiologically linked	Clinically compatible	Total
Endemic				
Unknown				
Imported				
Import-related				
Total				

e. Rubella epidemic curve for the last 10 years:

- Rubella monthly epidemic curve for the last 10 years:

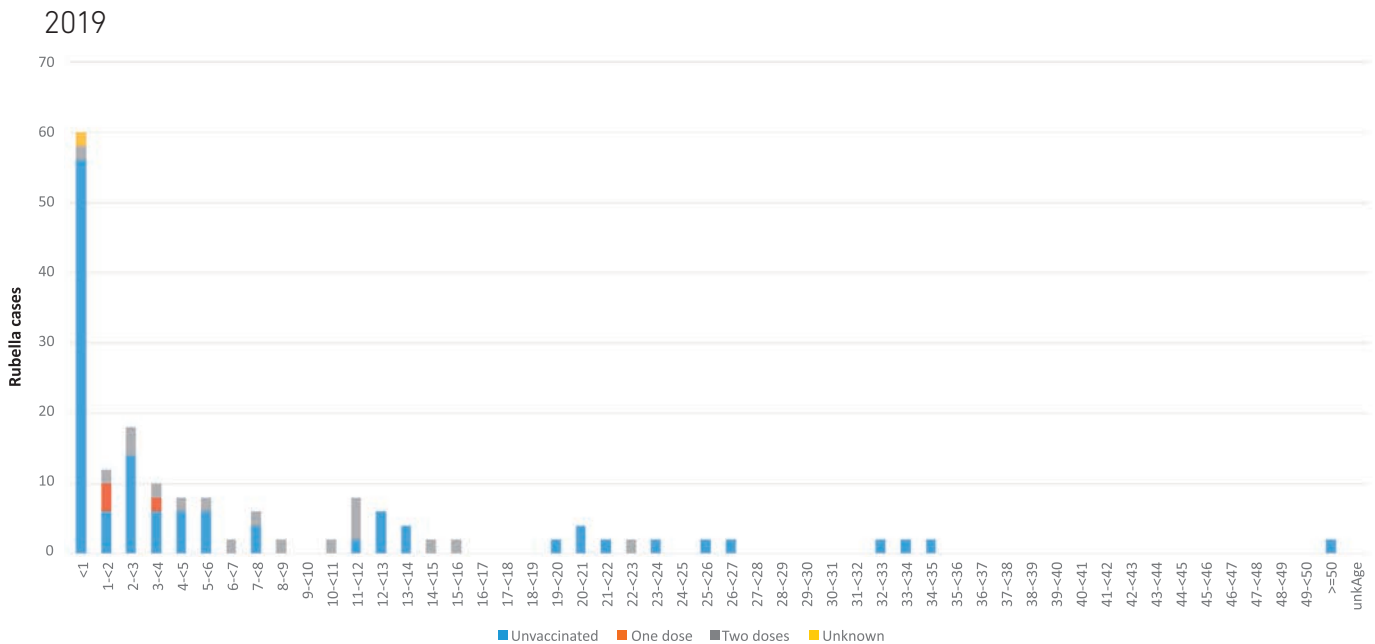


- Rubella weekly epidemic curve by source of infection and genotype\*



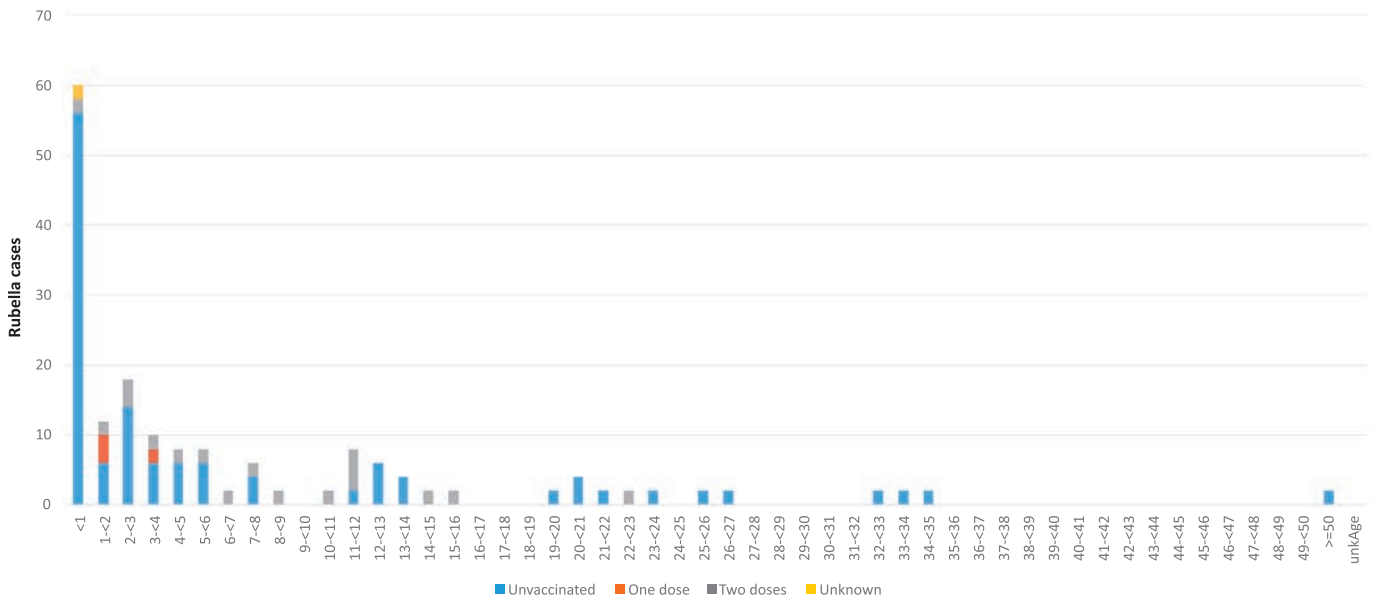
\*Please refer to the Excel sheet provided at: <http://www.emro.who.int/health-topics/measles/index.html?format=html#documentation-for-verification-of-elimination>.

f. Rubella cases by age cohort and vaccination status for the last 5 years:

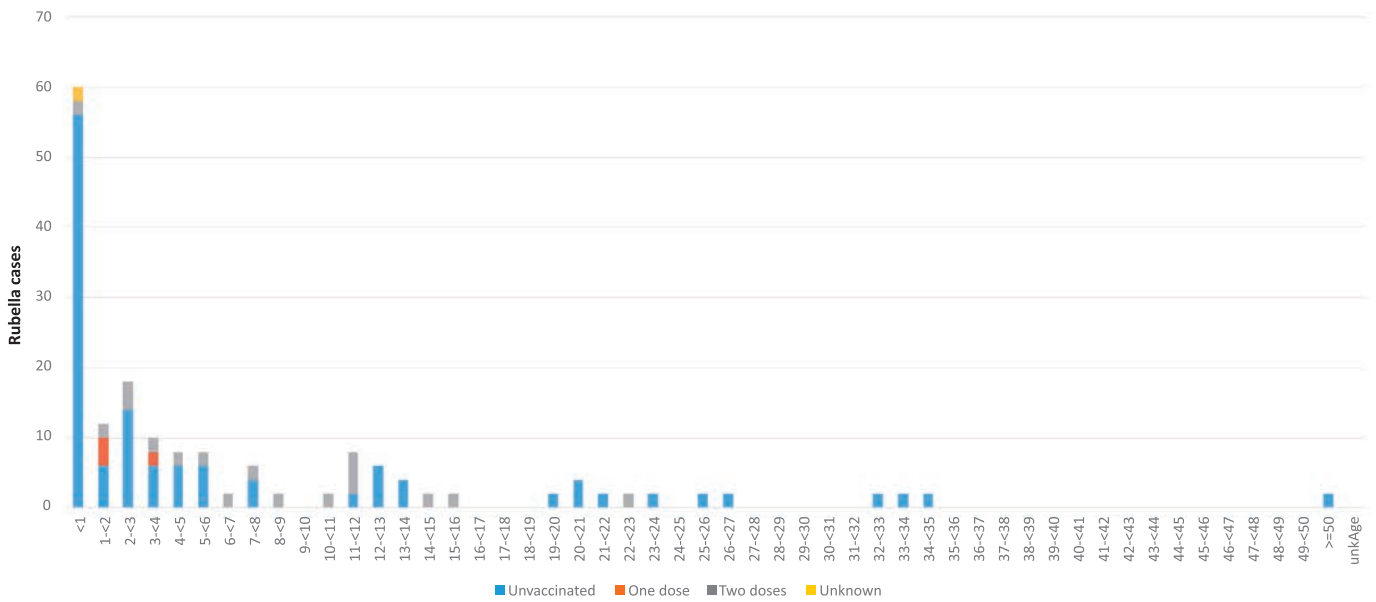




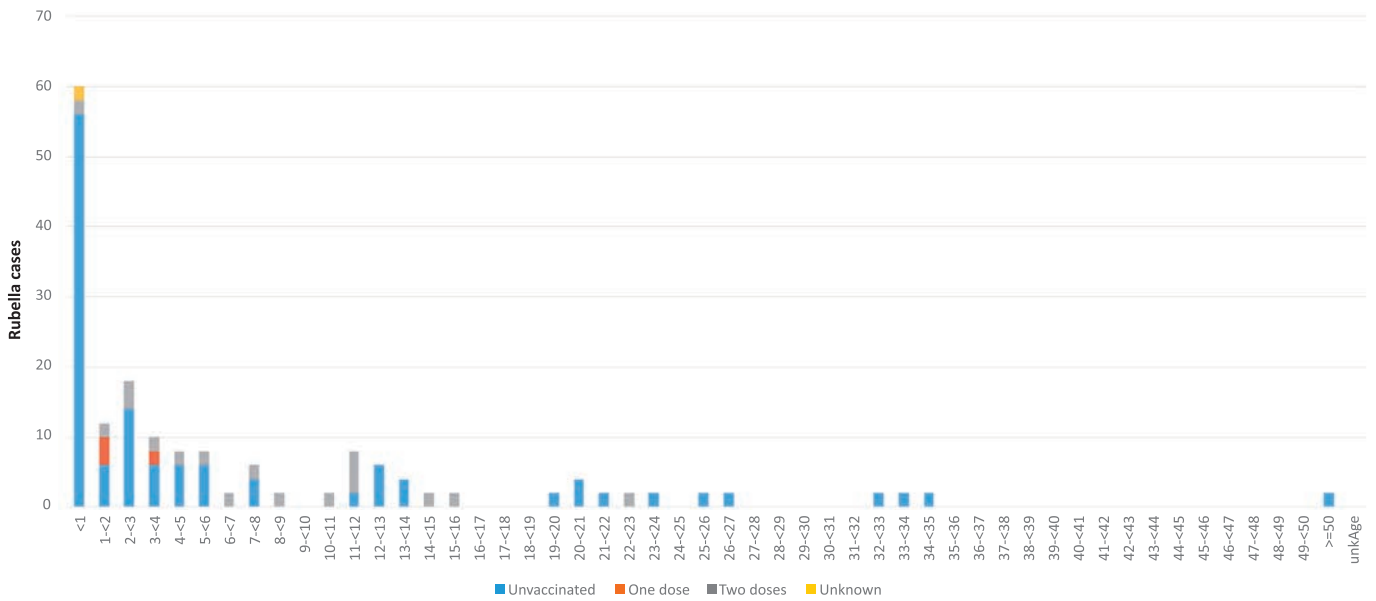
## 2018



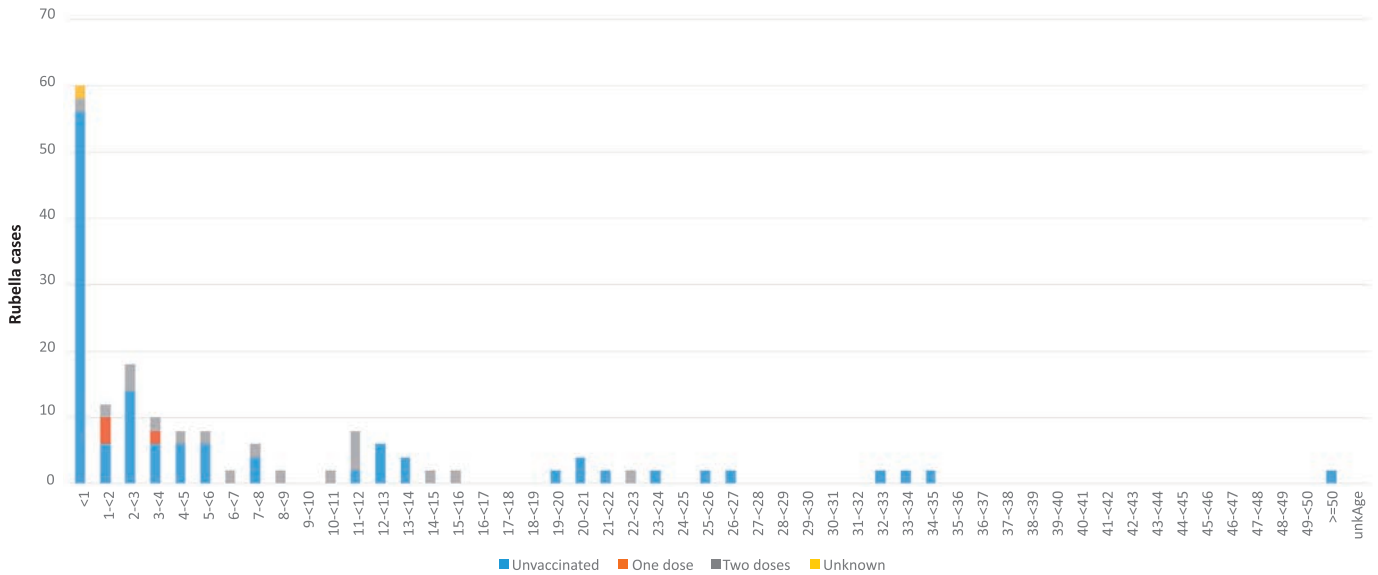
## 2017



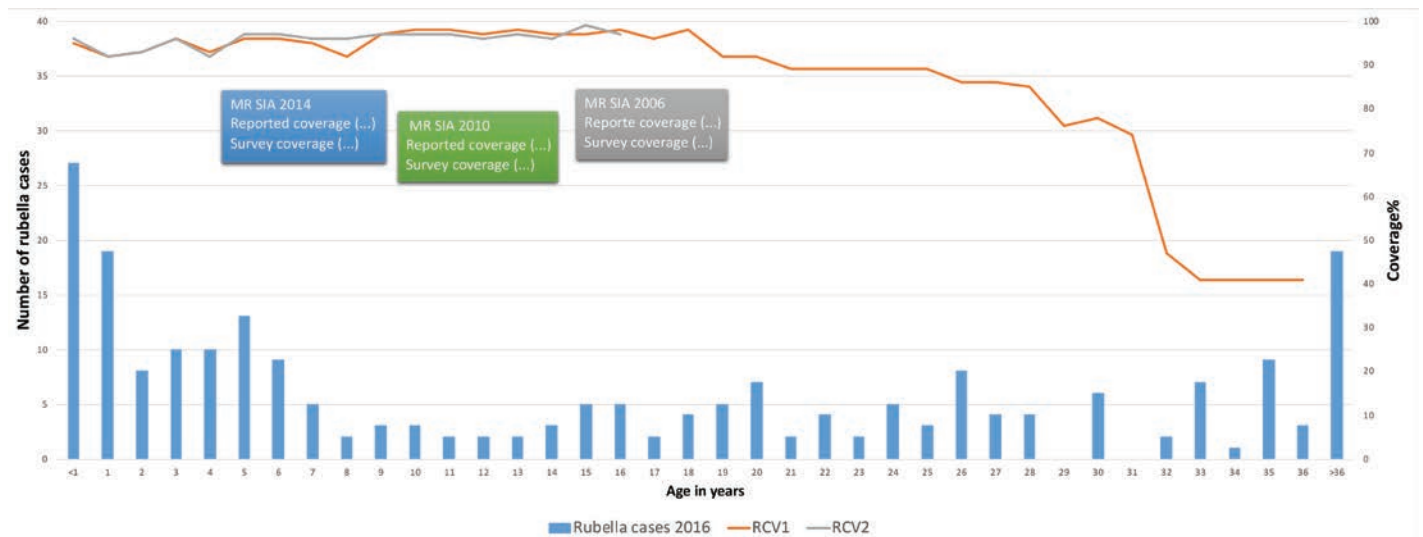
## 2016



2015



g. Analysis describing the epidemiology of rubella:\*



\*Please refer to the Excel sheet provided at:

<http://www.emro.who.int/health-topics/measles/index.html?format=html#documentation-for-verification-of-elimination>.

h. Review of any special cases in the past 5 years:

- Vaccine-associated:
- Equivocal:
- Clinically compatible (in elimination phase):

i. Rubella outbreaks in the last 5 years:\*

Outbreak year*	Governorate/ District	Date of onset of the first case	Epi week of onset of first case	Date of onset of the last case or "ongoing"	Epi Week of onset of the last case	Total number of cases	Genotype/ Distinct sequence ID	RubeNS sample ID	WHO name	First case origin (source)	Comments

\*Please include each outbreak, even in the same year, in a separate line.

**Description of each outbreak:** (include the identified immunity gap and measures taken to address this gap to prevent future outbreaks; maps of cases or epidemic curves may be included.)

Please attach all detailed outbreak investigation reports as annex.

\*Please fill the measles outbreak summary table in the Excel sheet provided at: <http://www.emro.who.int/health-topics/measles/index.html?format=html#documentation-for-verification-of-elimination>.

### 3.2 Second line of evidence: molecular epidemiology evidence that measles and/or rubella virus transmission is interrupted

This section describes the molecular epidemiology evidence of the interruption of transmission, noting the genotypes over time. Data should include all data collected since genotyping became available. The narrative should highlight the collection of specimens as well as what the genotypic data are currently showing.

**Instructions:** Please provide the following information:

Genotype, name strain or sequence variant and number of measles and rubella virus strains identified by year and month, for all years since genotyping became available, with a focus on the most recent 5 years in support of achieving measles and rubella elimination.

- Other information such as sequencing information of cases by date of onset, location and importation history and phylogenetic tree should be included, when available.
- Sequence name of matches in the MeaNS or RubeNS database, using the exact match strain, or, if available, the named strains for measles and rubella.
- For measles only, the detection of variant lineages within a genotype should be described if available, and the sequence differences presented as a phylogenetic tree or distance table. Sequence variants should be linked to closely related sequences in MeaNS.
- National reference laboratories should report all genomic sequence data to the global online databases:
  - MeaNS: WHO Measles Nucleotide Surveillance online database (<http://www.who-measles.org>)
  - RubeNS: WHO Rubella Nucleotide Surveillance online database (<http://www.who-rubella.org>)
  - An epi-curve including genetic sequence data (can refer to the previous curve).

1. Genotypic information of measles/rubella cases for the past 5 years

a. Measles

Year	Case ID	MeaNS ID	WHO name	First admin level	Country	City	Sample date	Date of onset of rash	Recent travel	First case origin (source)	Geno-type	Distinct Seq ID	Named strain	Tested in WHO-accredited lab? (Yes/No)

b. Rubella

Year	Case ID	RubeNS ID	WHO name	First admin level	Country	City	Sample date	Date of onset of rash	Recent travel	First case origin (source)	Geno-type	Distinct Seq ID	Named strain	Tested in WHO-accredited lab? (Yes/No)

2. Phylogenetic tree or identified transmission chains and sporadic cases:

3. Include genetic sequencing data into epi-curves (can refer to previous epi-curves):

### 3.3 Third line of evidence: measles and rubella surveillance system quality

Instructions: Please provide the following information:

- Detailed description of the design and extent of case-based surveillance for measles and rubella, in terms of case definition, specific population covered, representativeness, and sources of case reporting.
- Epidemiological and laboratory standard surveillance performance indicators for measles and rubella (Annex 2).
- Analysis against the standard surveillance system performance indicators,<sup>14</sup> conducted at the second administrative level (state/province/governorate) or third administrative level (for example, district, locality) in large countries and focusing on areas with poor performance illustrated in map/table for the past 5 years and action taken to address it.
- Description and results of active case search conducted in silent or high-risk areas.
- Documentation of special surveys, epidemiological and other research studies conducted.
- Detailed description of the characteristics of clinically compatible measles and clinically compatible rubella cases. When countries are approaching elimination and measles and rubella surveillance performs well, that is, adequate case investigations with contact tracing are routinely performed and adequate specimens routinely collected, the number of clinically compatible measles and rubella cases should be small. The following should be described for compatible cases:
  - map to show clustering, if present
  - age and immunization status
  - clinical signs and symptoms consistent with measles or rubella (yes or no)
  - cases discarded by the Expert Review Committee.
- A detailed description of the CRS surveillance system, including how cases are identified, confirmed and reported.
- Periodic retrospective searches for suspected CRS cases conducted when the standard surveillance system does not detect many suspect cases.
- Description illustrated in a table for the number of measles/rubella cases tested either through serology or molecular testing in the period 2015–2019.
- If there are surveillance and laboratory gaps, the report should include information on actions taken to identify and address them.
- Other supportive data, for example:
  - Surveillance activities or a survey may be added to provide further evidence on surveillance quality and can be illustrated in figure or narrative description.

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<sup>14</sup> WHO, Weekly Epidemiological Record, 2013; 9: 88, 89–100, <http://www.who.int/wer/2013/wer8809.pdf?ua=>; and WHO, Weekly Epidemiological Record, 2017: 9/10: 97–105, <http://apps.who.int/iris/bitstream/handle/10665/254652/WER9209-10.pdf;jsessionid=EAD8BC95A3F502924D29D9B3A087779C?sequence=1> (accessed 6 December 2018).

- Description of alternative indicators or methods used or available to evaluate surveillance performance (if any), and demonstrate high-quality surveillance, either to support a strong surveillance system, or explain how surveillance data can support the conclusions of the NVC.
  - Attach any reports of measles/rubella surveillance system review.
  - Description of the relationship between NIP, measles/rubella surveillance team and laboratory department: communication, coordination, information sharing, meetings, and so on.
- 

## 1. Surveillance system description

### a. Case definition:

■ Measles surveillance case definition:

■ Rubella surveillance case definition:

### b. Populations reached by surveillance:

### c. Representativeness of surveillance/involvement of non-ministry of health health care providers:

### d. Source of case reporting:

### e. Laboratory testing algorithm for case confirmation:

### f. Laboratory procedures capacity

Measles:

- Serology
- Detection RT-PCR
- Genotyping RT-qPCR
- Sequencing
- Cell Culture

Rubella:

- Serology
- Detection RT-PCR/RT-qPCR
- Genotyping RT-qPCR
- Sequencing
- Cell Culture

g. Laboratory proficiency

The three previous accreditations of measles/rubella laboratory:

Year	Accreditation status

2. Analysis of standard surveillance system performance indicators:

a. Measles/rubella surveillance system indicators:

Measles/rubella	Target	2015	2016	2017	2018	2019
Epidemiological/case report						
Proportion of surveillance units reporting measles and rubella data to the national level (completeness); large countries should report on third administrative level as well	≥80%					
Proportion of surveillance units reporting measles and rubella data to the national level on time (timeliness)	≥80%					
Reporting rate of discarded non-measles non-rubella cases at national level	≥2 /100 000					
Proportion of second administrative level units (province, governorate etc.) reporting at least two discarded non-measles non-rubella case per 100 000 population (Reporting on third administrative level in large countries)	≥80%					
Proportion of suspected measles and rubella cases with adequate investigation initiated within 48 hours of notification	≥80%					
Proportion of specimens received at the laboratory within 5 days of collection	≥80%					



Measles/rubella	Target	2015	2016	2017	2018	2019
Laboratory						
Proportion of suspected cases with adequate specimen collection for detecting acute measles and rubella infection collected and tested in a proficient laboratory	≥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%					
Proportion of serology results reported to national public health authorities by the laboratory within 4 days of specimen receipt	≥80%					

b. CRS surveillance indicators:

CRS	Target	2015	2016	2017	2018	2019
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 <sup>15</sup>	≥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%					
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%					

<sup>15</sup> Includes all key data points except travel history of mother. See guide page 25 for more details.

- c. Map/ table of key surveillance indicators at the subnational level for the past 5 years (district if possible):
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
- d. Description of action taken to address poor performance indicators for the past 5 years:
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
- e. Description and results of active search conducted in silent areas:
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
- f. Detailed description of the CRS surveillance system, including how cases are identified, confirmed and reported:

- g. Detailed description of periodic retrospective searches for suspected CRS cases:

3. Other supportive data:

- a. Description of any other surveillance activities, surveys or reviews (full reports should be attached if available):

- b. Description of any other alternative indicators used by the country to support a high-quality surveillance system:

4. Laboratory testing and molecular epidemiology of measles and rubella viruses in 2015–2019:

Year	Number of suspected cases	Serology							Virus detection and genotyping							
		Number of samples collected *(blood, oral fluid, DBS)	Number received at lab	Number tested	Positive	Negative	Equivocal	Results ≤ 4 days %	Number of viral samples collected	Measles virus isolation *(swab, urine)		Measles RT PCR *(swab, oral fluid)		Geno-type detected	Results ≤ 2 month %	WHO-accredited lab
										Number	Number of isolates	Number tested	Positive			
2015																
2016																
2017																
2018																
2019																

5. NIP/Surveillance team/laboratory networking or relationship:

### 3.4 Fourth line of evidence: population immunity

Instructions: Please provide the following information:

- Description of the source, denominator used and methodologies for calculating target population, vaccinated population and vaccination coverage by each level (health centre, district, province and country).
- Description of trends of routine MCV and RCV coverage over time from various data sources illustrated in table.
- A graph (or graphs) showing national MCV and RCV coverage, measles and rubella cases, and timing of SIAs over a period of time. (The graph should show trends over a number of years, for example, 10 years, if available.)
- A graph (or graphs) showing number and percentage vaccinated with MCV1, MCV2, MCV-SIA and RCV and RCV-SIA by the year of birth, and by sex if previous vaccination policies were sex-specific.
- Maps showing district MCV1, RCV1, MCV2, and RCV2 coverage over a number of years for which the data are available. Graph showing the same, but for age group instead of district.
- Consideration/evaluation of quality of vaccination coverage at each level and the representativeness of the reported vaccination coverage to population immunity by level, such as data quality assessment reports.
- Review of vaccination coverage in specific groups that may have higher levels of susceptibility, such as migrants, and nomadic populations.
- Detailed information on immunization coverage/status of domestic and international migrants.
- A summary of SIAs, including target population, target age group, geographic areas (national or subnational), implementation dates and implementation status (number of people immunized, reported coverage) presented in a table or graph.
- If available, the number of children without vaccination history who were vaccinated in each MCV-SIA.
- Results of coverage surveys conducted to assess routine or supplemental immunization, including sero-surveys to assess population immunity.
- If available, results of coverage surveys, sero-surveys and registries to assess RCV coverage, especially among women of reproductive age.
- Vaccination activities for protecting adolescents and adults against measles and rubella infection, for example the proportion/number of adolescents and adults vaccinated with measles- and rubella-containing vaccines by year of birth over a number of years for which the data are available.
- Modelling of the accumulation of measles- and rubella-susceptible individuals, if available.
- Assessment or consideration of the risk of large-scale outbreaks following importation, which may include assessment of the infrastructure for maintaining vaccine potency as well as an analysis of any gaps that may have compromised population immunity.

## **1. Routine immunization coverage:**

a. Description of the source of target population figures (denominator) and any concern related to the quality of these figures:

b. Description of the calculation of target population, number vaccinated:

c. Target population and vaccination coverage by each level for the previous 10 years:

- d. Routine MCV and RCV coverage over time from various data sources since the introduction of the vaccine:

Variable	Year									
Admin national MCV1 coverage										
Admin national MCV2 coverage										
WHO-UNICEF estimates of MCV1 coverage										
WHO-UNICEF estimates of MCV2 coverage										
% districts with $\geq 95\%$ coverage of MRCV1 <sup>16</sup>										
% districts with $\geq 95\%$ coverage of MRCV2 <sup>16</sup>										

\*Information available at: [http://apps.who.int/immunization\\_monitoring/globalsummary](http://apps.who.int/immunization_monitoring/globalsummary).

- e. Cohort analysis of routine coverage by males and females since the introduction of the vaccine, as applicable:

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<sup>16</sup> Service statistics/administrative data.

- f. Cohort analysis of routine coverage since the introduction of the vaccine, as applicable on the subnational level (province/district):
- g. Description of areas with low vaccination coverage
- Identify all areas at the first subnational administrative level where the coverage with first and/or second doses was less than 95% (by district if available):
  
  - Identify high-risk populations based upon vaccination coverage (for example, ethnic sub-groups, wealthy families):
  
  - Actions taken in recent years to improve routine immunization coverage in poor performing areas and the outcome:
- h. Results of any coverage surveys, serosurveys or data quality assessments performed (please attach the reports):



- i. If available, results of coverage surveys, serosurveys and registries to assess RCV coverage, especially among women at reproductive age:

## 2. Supplemental immunization activities (SIAs):

- a. Data regarding all MCV and/or RCV SIAs:

Year of SIA conducted as national or subnational	Vaccine (M, MR, MMR)	Dates (start-end)	Age (range) of target group	Target population size	Coverage (add columns to include admin and survey coverage in separate columns)				
					National admin coverage (%)	National survey coverage (%)	% districts with coverage <90% (specify admin or survey results)	% districts with coverage 90–94% (specify admin or survey results)	% districts with coverage ≥95% (specify admin or survey results)



f. Detailed information on immunization coverage/status domestic and international migration:

- Immunization coverage among domestic migration:

- Immunization coverage among international migration:

### **3. Immunity gaps:**

a. Results of coverage surveys conducted to assess routine or supplemental immunization, including serosurveys to assess population immunity (please attach the full report):

- b. Vaccination activities for protecting adolescents and adults against measles and rubella infection (for example proportion/number of adolescents and adults vaccinated with measles- and rubella-containing vaccines by year of birth):
  
- c. Cohort analysis of vaccination coverage in specific group:
  - Vaccination activities among adolescents:
  
  
  
  
  
  
  
  
  
  
  - Vaccination activities among adults:
  
- d. Modelling of the accumulation of measles and rubella-susceptible individuals (if available):
  
  
  
  
  
  
  
  
  
  
- e. Risk assessment on possibility of occurrence of large-scale outbreaks following importation:
  - Assessment of the infrastructure for maintaining vaccine potency:
  
  
  
  
  
  
  
  
  
  
  - Analysis of any gaps that may have compromised population immunity:

### 3.5 Fifth line of evidence: sustainability of national immunization programme

Instructions: Please provide the following information:

- Documents indicating the legal basis of the NIP and any other supporting documents demonstrating political commitment for the sustainability of elimination.
- Annual risk assessments at all levels.
- Developed action plan to address identified gaps in risk assessment.
- Comprehensive multi-year plan (cMYP), or similar, and an annual NIP plan of action where requirements of sustainability of elimination, the ability of government and partners to implement the plan, and sufficient funding are clearly reflected.
- A diagram illustrating NIP's interaction with partners and other governmental entities with their role.
- Evidence of sustainability in funding and monetary resources for both the epidemiological and laboratory surveillance components.
- Supporting documents indicating the financial support to fund vaccine procurement and surveillance activities.
- Evidence of government and partner commitment to providing adequate human resources for measles/rubella elimination components (epidemiological surveillance, laboratory surveillance and immunization).
- An updated NIP strategic plan updated with proof of dissemination, especially plans to improve coverage in low coverage areas, populations and other known immunity gaps as well as to strengthen surveillance in poor performing areas.
- Outbreak preparedness and response plan with adequate resources for implementation and lessons learned from previous outbreaks, where appropriate.
- Availability of updated, approved and disseminated standard operating procedure.
- Details of other strategies/national policies that will contribute to accelerating/sustaining measles elimination and their implementation, for example reducing nosocomial infection and transmission.
- Review of causes for vaccine stock-out and the indicators of vaccine availability such as zero stock-outs of MCV and RCV at the peripheral level and 100% of funding for MCV and RCV, by government.
- Monitoring systems for measuring public acceptance of vaccination.
- Advocacy and communication for raising public awareness and monitoring system for public acceptance of vaccines.





- b. Presence of plan of action to address immunity gaps in coming years, and maintain high-level surveillance currently and after elimination:
- c. Actions for outbreak investigation and response to identify and fill immunity gaps, including available resources to implement plan and responses:
- d. Details of other strategies/national policies that will contribute to accelerating/sustaining measles elimination and their implementation, for example reducing nosocomial infection and transmission:
- e. Indicators of vaccine availability such as zero stock-outs of MCV and RCV at the peripheral level and 100% of funding for MCV and RCV by government:
- f. Monitoring systems for measuring public acceptance of vaccination:



## Section 4. Verification, comments, conclusions and recommendations of the NVC

*Instructions: This section provides a summary of the NVC's assessment of the status of the country towards achieving elimination for measles and/or rubella including the categorization. The section should summarize the findings for each of the five lines of evidence described above as part of the justification for the NVC's conclusion regarding the status of elimination in the country (in addition to the executive summary submitted as a summary of the report).*

1. Description of the situation vis-à-vis the five lines of evidence:
2. Conclusion (*give a classification to the country as either endemic, re-established, near-elimination or elimination for both measles and rubella along with other conclusions*):
3. Challenges facing achieving elimination:
4. Recommendations:





Guide to the documentation and verification of measles and rubella elimination in the WHO Eastern Mediterranean Region aims to provide guidance to the Regional Verification Commission, National Verification Committees, health authorities, Expanded Programme on Immunization managers, medical officers, and other public health professionals involved in measles and rubella/ congenital rubella syndrome elimination, on the core principles for verifying measles and rubella elimination. It describes essential criteria and five lines of evidence that form the basis of the verification of measles and rubella elimination. It is intended to serve as a guiding document for the verification of the progress made towards measles and rubella elimination in the Region, in line with the global guidelines.

