World Health Organization

REGIONAL OFFICE FOR Europe

Guidelines for measles and rubella outbreak investigation and response in the WHO European Region

ABSTRACT

The World Health Organization (WHO) European Region has a goal of eliminating measles and rubella by 2015. Despite substantial progress towards elimination due to the widespread use of measles- and rubella-containing vaccines, outbreaks of measles and rubella continue to occur in the Region. As the elimination target date of 2015 approaches, timely investigation and response to outbreaks becomes increasingly important.

To help Member States address challenges to reaching elimination, the WHO Regional Office for Europe developed the following recommendations for investigation and response of measles and rubella outbreaks. National public health officials and health authorities should develop similar national documents, to ensure implementation of appropriate response measures and interruption of virus transmission during outbreaks as soon as possible.

Keywords

OUTBREAK
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MEASLES – outbreak control, elimination
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Acknowledgments

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VPI welcomes any comments and suggestions with regard to this publication at vaccines@euro.who.int.

Acronyms

CRS	congenital rubella syndrome
IG	Immunoglobulin
IgG	immunoglobulin G
IgM	immunoglobulin M
MMR	measles/mumps/rubella
MR	measles/rubella
PCR	polymerase chain reaction
RNA	ribonucleic acid
RT	reverse transcription
SIA	supplementary immunization activity
VPI	Vaccine-preventable Diseases and Immunization Programme

1. Introduction

The World Health Organization (WHO) European Region has the goal of eliminating measles and rubella by 2015 *(1)*. Owing to the widespread use of and overall high coverage with measles- and rubella-containing vaccines in Member States, substantial progress has been made towards achieving this goal *(2)*. However, outbreaks of measles and rubella, including large-scale outbreaks, continue to occur in the Region *(3,4)*. The reasons for continuing transmission of measles and rubella viruses in the European Region include:

- accumulation of susceptible individuals among older children and young adults who were not included in immunization schedules or missed routine vaccination in their childhood, and did not get the natural diseases due to reduced opportunities for exposure with the decline of measles and rubella incidence after vaccine introduction;
- existence of pockets of low vaccination coverage in some population groups due to lack of access to health services or resistance to vaccination based on religious or philosophical beliefs;
- declining public acceptance of immunization particularly in western Europe, due to the lack of concern about disease severity and unfounded perceptions of the risks and benefits of vaccination;
- lack of strong provider recommendations to vaccinate during the patient encounter, leading to missed opportunities and contributing to suboptimal vaccination coverage in some countries of the Region; and
- ongoing reforms in the health systems of countries in transition, affecting funding, organization and availability of immunization services and surveillance activities.

Previous WHO guidelines for responding to measles outbreaks were developed and prepared in 2009 for use in measles mortality reduction settings and do not include rubella outbreaks *(5)*. Therefore, the WHO Regional Office for Europe developed the following guidelines to assist with investigation of and response to measles and rubella outbreaks in elimination settings, i.e. in Member States that are striving for and approaching measles and rubella elimination. The guidelines are based on existing WHO documents *(1,6,7)* and experience with recent outbreaks in the Region.

The purpose of this document is to provide guidance to European Member States in developing similar national documents, in order to facilitate early detection and a rapid and appropriate response to outbreaks of measles or rubella, with the ultimate goal of reaching measles and rubella elimination in the Region. The document is targeted for use by public health authorities and technical experts at the national level in the Member States of the Region. The document provides guidance on:

- definitions of cases and outbreaks;
- confirming, investigating and managing an outbreak, including appropriate vaccination strategies; and
- learning lessons from the outbreak and developing plans for prevention of future outbreaks.

1.1 Disease epidemiology

Both measles and rubella are highly contagious outbreak-prone acute viral diseases characterized by maculopapular rash. The epidemiology of these diseases (age and sex distribution of cases) has many similarities (Table 1, based on references *5*, *6* and *8–18*).

Table 1. Characteristics of infection with measles and rubella viruses

	Measles	**Rubella**
Etiologic agent	Measles virus	Rubella virus
Genus (family)	Morbillivirus (Paramixoviridae)	Rubivirus (Togaviridae)
Incubation period, range	7–18 days	12–23 days
Infectious period		
Before the rash onset	4 days	7 days
After the rash onset	4 days	5 days
With congenital infection	NA	Up to 1 year
Epidemic cycles in endemic settings	Yes; typically epidemics every 2 to 4 years	Yes; typically small epidemics every 3 to 4 years, and larger epidemics every 6 to 9 years
Seasonality	Yes, in endemic settings; in temperate areas, incidence is usually higher in late winter and spring	

NA, not applicable

Both viruses are transmitted via the respiratory route (aerosolized in respiratory droplets) or by direct or indirect contact with nasal and throat secretions of infected persons. Measles virus is particularly contagious, with >90% secondary attack rates among susceptible individuals. Infected persons shed virus and are contagious shortly before the onset of clinical symptoms and several days afterwards. Rubella virus infections are asymptomatic or subclinical in >50% of instances, but infected persons can still shed and transmit the virus. Both diseases are prone to epidemics. In settings with endemic transmission, they are characterized by winter–spring seasonality and periodic epidemics every few years, followed by inter-epidemic intervals with lower incidence. As disease incidence declines, the inter-epidemic periods become longer with eventual disappearance of a cyclical pattern. Also, the infections tend to occur at a later time in life and the average age of cases increases because of reduced opportunities for exposure due to less widespread transmission. In elimination settings, where most cases result from importations, the infections can occur any time during the year and, therefore, the seasonal pattern of measles and rubella infections is no longer present.

Measles and rubella transmission with subsequent outbreaks can occur in communities and congregate settings such as households, workplaces, the military, schools and universities. The setting, extent of spread and size of the outbreak will determine the magnitude of the response. Because measles virus is highly contagious and the infection is normally accompanied by an evident rash, measles outbreaks may be more easily identifiable than outbreaks of rubella, which is less contagious and often asymptomatic.

Due to successful implementation of routine childhood immunizations and, in some countries, supplementary immunization activities (SIAs), measles incidence in the WHO European Region decreased during 2003–2009, from 28 203 to 7499 (*19*, updated as per national WHO/United Nations Children's Fund Joint Report Form, data available at http://apps.who.int/immunization_monitoring/globalsummary/timeseries/tsincidencemeasles.html, accessed on 17 June 2013).

However, since then, there has been a substantial increase in measles transmission, mostly in western and central-eastern parts of the Region, with the largest outbreaks occurring in Bulgaria (2009–2010), France (2009–2011), Romania (2011–2012) and Ukraine (2012) *(4,20–26)*. The number of measles cases reported to the WHO European Region was 30 625 in 2010, 37 073 in 2011 and 26 188 in 2012 (as reported by 17 June 2013). Recent outbreaks of measles in the Region have been characterized by changing age distribution related to increased proportion of older children and adults among cases *(4,19,20,27,28)*. Epidemiologic patterns of these outbreaks are consistent with the history of measles vaccination policies and programme performance in the given country. Some recent outbreaks predominantly affected certain groups with low population immunity (Roma in the Bulgaria outbreak, followers of anthroposophic beliefs *(29,30)*, religious groups *(31)*, etc.), while others spread through the general community (e.g. widespread outbreaks in France and Ukraine). Importation-related outbreaks in countries with high population immunity normally resulted in little secondary transmission and were successfully interrupted *(32)*.

Most cases and outbreaks of rubella in the European Region in recent years were reported from a few Member States, following a nearly 97% decline in cases reported to WHO between 2003 and 2011 (from 304 390 to 9672 cases). This decline resulted from introduction of rubella-containing vaccine into routine childhood immunization programmes of all Member States by 2009 and successful SIAs, particularly in countries of the former Soviet Union. However, in 2012 there was a three-fold increase in reported cases of rubella. Over 92% of cases occurred in Romania and Poland. The epidemiology of rubella in the Region usually reflects the history of national rubella immunization policies. For example, recent outbreaks in Poland in 2007–2008 and 2011–2013, and in Romania in 2011–2012, predominantly affected gender and age groups not previously targeted by rubella immunization programmes (according to reports from WHO missions to these countries, *33–35*).

1.2 Rationale for investigating measles and rubella outbreaks

In general, the primary reason for an outbreak investigation and response is to control the outbreak and help prevent future outbreaks. In countries striving to achieve measles and rubella elimination, the objective for outbreak investigation is to facilitate rapid implementation of control measures to reduce the extent of disease spread and associated morbidity and mortality and ensure that virus transmission is interrupted as soon as possible. As the elimination target date of 2015 approaches, timely investigation and response to outbreaks becomes one of the most important measures for reaching elimination.

Secondary goals for measles and rubella outbreak investigation and response in the European Region include:

- monitoring the changing epidemiology of measles and rubella;
- identifying high-risk population subgroups/geographic areas, and thus immunity gaps, that call for targeted immunization strategies;

- assisting in the identification and correction of weaknesses in immunization and surveillance systems; and
- raising community and health care professionals' awareness about these diseases and their prevention.

Importations of measles and rubella viruses are common and can lead to outbreaks and even re-established endemic transmission in areas that have successfully interrupted transmission *(36–38)*. To reduce the risk of virus spread following importations, rapid and appropriate investigation and response measures must be taken. Adoption of the International Health Regulations in 2005 by the Member States of the European Region highlighted the importance of timely detection and response to events that are of potential international public-health concern *(39)*.

2. Case definitions and classifications for measles and rubella surveillance and outbreak investigation purposes

Case definitions are designed to standardize case identification and reporting across health facilities and various levels of the health system – subnational, national and international. This facilitates identification of outbreaks, aggregation, analysis and interpretation of data, as well as a comparison between geographic areas and over time. Case definitions and classifications for measles and rubella surveillance and outbreak investigation in the European Region are listed below.

2.1 Definitions for measles

The clinical criteria for measles are:

- fever *and*
- maculopapular rash (i.e. non-vesicular rash) *and*
- cough *or* coryza (runny nose) *or* conjunctivitis (red eyes).

The laboratory criteria for measles surveillance case confirmation are:

- measles immunoglobulin M (IgM) antibody detection *or*
- measles virus isolation *or*
- measles viral ribonucleic acid (RNA) detection by reverse transcription- (RT)-PCR *or*
- a significant rise in measles immunoglobulin G (IgG) antibody in paired sera.

2.2 Definitions for rubella

The clinical criteria for rubella are:

- maculopapular rash *and*
- cervical, suboccipital or post-auricular adenopathy, *or* arthralgia/arthritis.

The laboratory criteria for rubella surveillance case confirmation are:

- rubella IgM antibody detection *or*
- rubella virus isolation *or*
- rubella viral RNA detection by RT-PCR *or*
- a significant rise in rubella IgG antibody in paired sera.

The measles and rubella case classifications for surveillance are given in Boxes 1 and 2, respectively.

Box 1. Measles case definitions for surveillance purposes

Case category	Definition
Suspected	A case with signs and symptoms consistent with measles clinical criteria.
All suspected cases have to be investigated and classified based on clinical, laboratory and epidemiologic data as one of the following:	
Laboratory confirmed	A suspected case which meets the laboratory criteria for measles case confirmation.
Epidemiologically linked	A suspected case which has not been adequately tested by laboratory and was in contact with a laboratory-confirmed measles case 7–18 days before the onset of symptoms.
Clinically compatible	A suspected case which has not been adequately tested by laboratory and has not been epidemiologically linked to a confirmed measles case.
Discarded	A suspected case which was investigated and discarded, either through negative results of adequate laboratory testing for measles or by an epidemiologic link to a laboratory-confirmed case of another disease.

Box 2. Rubella case definitions for surveillance purposes

Case category	Definition
Suspected	A case with signs and symptoms consistent with rubella clinical criteria.
All suspected cases have to be investigated and classified based on clinical, laboratory and epidemiologic data as one of the following:	
Laboratory confirmed	A suspected case which meets the laboratory criteria for rubella case confirmation.
Epidemiologically linked	A suspected case which has not been adequately tested by laboratory and was in contact with a laboratory-confirmed rubella case 12–23 days before the onset of symptoms.
Clinically compatible	A suspected case which has not been adequately tested by laboratory and has not been epidemiologically linked to a confirmed rubella case.
Discarded	A suspected case which was investigated and discarded, either through negative results of adequate laboratory testing for rubella or by an epidemiologic link to a laboratory-confirmed case of another disease.

2.3 Definition of an outbreak

In the WHO European Region, outbreaks of measles and rubella are defined as follows:

- measles outbreak – 2 or more laboratory-confirmed cases which are temporally related (with dates of rash onset occurring between 7 and 18 days apart) and epidemiologically or virologically linked, or both; and
- rubella outbreak – 2 or more laboratory-confirmed cases which are temporally related (with dates of rash onset occurring between 12 and 46 days apart) and epidemiologically or virologically linked, or both.[1]

[1] In the case of rubella, 46 days (two incubation periods) are recommended due to high proportion of asymptomatic and subclinical cases.

3. Surveillance for measles and rubella

Measles and rubella surveillance systems in Member States should be capable of detecting and investigating any suspected case of measles and rubella, and consequently outbreaks, in a timely manner. WHO recommends integrating measles and rubella surveillance; and rubella surveillance should be coordinated with congenital rubella syndrome (CRS) surveillance activities. Early warning about outbreaks through surveillance systems allows prompt initiation of response and control measures to prevent further spread of disease.

According to the *Surveillance guidelines for measles, rubella and congenital rubella syndrome in the WHO European Region (6)*, all countries should implement case-based surveillance to ensure detection, investigation and confirmation of every suspected measles and rubella case in the community and to ensure availability of information for monitoring progress and documenting achievement of measles and rubella elimination. Nationwide surveillance systems based on standardized case definitions and protocols are essential to ensure that all necessary (e.g. clinical, epidemiologic and virological) information on individual cases is collected, reported and used as a trigger for timely initiation of response measures to single cases or outbreaks.

National surveillance systems should establish well-defined standard operating procedures integrating routine surveillance and detection and reporting of outbreaks. Ideally, Member States should develop guidelines to address specific responsibilities of health care providers (e.g. general practitioners, clinicians) and public health authorities (e.g. epidemiologists and public health laboratories) during outbreaks. Member States should report all cases and outbreaks of measles and rubella using existing mechanisms and timeframes for reporting to the WHO Regional Office for Europe *(6)*.

High-quality surveillance system and immunization coverage monitoring provide reliable information to assess risk of measles and rubella outbreaks in a country or particular population. This information should be used in developing national preparedness and outbreak response plans for measles and rubella. These plans should be consistent with existing surveillance and immunization protocols and capacities, and include the following core elements:

- roles and responsibilities of stakeholders in the health system, among partners, and in administrative authorities and community, including creation of the outbreak response coordinating team;
- standard operating procedures and protocols for investigation and response activities;
- plans for outreach and outbreak communication;
- assessment and mobilization of human and financial resource and vaccine supplies; and
- logistics and support.

4. Recommendations for outbreak confirmation and investigation

In order to enhance capacity to respond to a measles or rubella outbreak, facilitate effective coordination of outbreak response activities and ensure timely flow of information, an outbreak response coordinating team or working group consisting of stakeholders (public health officials, clinicians, local government and community representatives, etc.) should be established at the appropriate level, depending on the extent of the outbreak and existing structure of the health system. The function of this group will be to plan and coordinate all aspects related to outbreak investigation and response and to ensure adequate communication and feedback.

The steps described below are recommended for the management of suspected measles and rubella outbreaks, including their confirmation, investigation and response. The order of these steps does not necessarily indicate the chronological order of their implementation. Many of these actions will have to be undertaken concurrently as soon as the outbreak is suspected or confirmed.

4.1 Identify potential outbreak

National health authorities in the WHO European Region should consider one laboratory-confirmed case of measles or rubella with one or more temporally related suspected cases as a potential outbreak. Outbreak investigation and response should be initiated as soon as the outbreak is suspected.

In elimination settings, where endemic virus transmission is absent, countries can choose to introduce a more sensitive definition of an outbreak, such as presence of one laboratory-confirmed case of measles or rubella.

4.2 Confirm the outbreak

Because measles and rubella have many symptoms in common with each other as well as other rash illnesses, all suspected measles or rubella outbreaks, particularly in settings with an elimination goal, should be confirmed by laboratory. For individual case confirmation, laboratory confirmation or epidemiologic linkage with a laboratory-confirmed case should be sought. The outbreak is considered confirmed if there is epidemiologic and/or virologic evidence of linkage between two or more laboratory-confirmed cases.

During an outbreak, laboratory confirmation should be sought for the initial 5–10 cases in a given district (or equivalent administrative unit). In addition to collecting specimens for antibody detection, laboratory confirmation should include obtaining specimens for virus characterization to allow identification of the involved strain and its origin (endemic versus imported). Once the outbreak is confirmed as measles or rubella, subsequent cases can be primarily confirmed based on epidemiologic linkage to a laboratory-confirmed case *(6)*. However, laboratory confirmation should be sought for all suspected cases of measles and rubella in pregnant women, even if the outbreak is confirmed and regardless of the background incidence or number of previously confirmed cases. If suspected cases are reported outside the initially affected geographic area and **there is no clear epidemiologic linkage with the initial outbreak**, the first 5–10 suspected cases in these other districts should also be tested to confirm the cause. If the outbreak continues, another 5–10 suspected cases should be tested every 2–3 months, including virus

characterization, to confirm that the illness in question is still measles or rubella and to monitor the implicated virus genotype/s. However, in outbreaks when measles and rubella are both circulating, laboratory testing may be required for more cases as establishing reliable epidemiologic linkage in mixed outbreaks is difficult and creates challenges to final classification. This situation should be assessed and addressed with specific protocol by the national public health system, considering its capacities and resources.

Following laboratory confirmation of initial measles or rubella case(s), emphasis should be given to epidemiologic investigation, aimed at confirmation of new cases by epidemiologic linkage with the confirmed case. However, sometimes a situation may arise in which some clusters of suspected measles or rubella cases are not confirmed either by laboratory or by epidemiologic linkage. In such situations, the cases from these clusters, which cannot be discarded based on the criteria described in Chapter 2 and reference *(6)*, should be classified as clinically compatible and included in overall case count for the outbreak and incidence calculations.

4.3 Intensify surveillance

Surveillance should be intensified to ascertain the size and geographic extent of the outbreak. Surveillance measures should be primarily directed to identify cases prospectively. This usually involves implementation of active surveillance (i.e. active finding of cases), in addition to passive surveillance systems which are routinely in place. However, the investigation should also include efforts to retrospectively find any cases that preceded the first reported case to help determine the time and circumstances of the beginning of the outbreak and better assess its full extent.

Confirmation of the first measles or rubella case should be followed by official communication from the public health authorities to health care workers or reporting units of the surveillance system. This notice should emphasize the appropriate surveillance activities, including increasing awareness and intensifying surveillance to detect any suspected cases, and outbreak response measures. Surveillance units that already reported cases should be reminded to follow up on contacts of the cases. Similar messages should be shared with laboratories, to increase their awareness of the current epidemiologic situation and the possible increase in laboratory workload.

Once the outbreak is suspected, the frequency of reporting should be increased and weekly reporting of cases from health facilities to district and from districts to higher levels should be introduced, regardless of frequency of reporting prior to the outbreak. Weekly reporting, including zero reporting in the absence of cases, should continue for the duration of the outbreak and for at least two incubation periods after the onset of the last laboratory confirmed or epidemiologically linked case. If timely case-based reporting during an outbreak is not feasible due to large number of cases, case-based data should still be collected as part of the outbreak investigation and entered into a database as soon as possible.

Along with increased frequency of reporting, active case finding by regular visits and record review at health facilities (both public and private), and other settings as appropriate and feasible, should be implemented. Surveillance should include population groups at high risk of disease transmission and congregate settings, such as schools and day-care centres. If adolescents and adults are affected by the outbreak, enhanced surveillance should be expanded to include affected universities, the military or workplaces. Thorough follow-up investigation of

patient contacts, including household residents, classmates and teachers, may help identify additional cases. The review of available vaccination coverage data and community demographics information can help to determine if there are high-risk groups in the area of the outbreak. Comprehensive epidemiologic investigation during outbreaks requires significant human and financial resources. Having adequate protocols and outbreak response guidelines may help to facilitate mobilization of existing resources and engagement of additional resources.

Neighbouring geographic regions and countries should be notified of the confirmed outbreaks so that they can assess the need for enhanced surveillance and targeted vaccination activities on their territory. Sharing of information with neighbouring countries is important in prevention and response to multicountry outbreaks.

See Annex 1 for more information on intensifying surveillance measures.

4.4 Conduct case investigations

Efforts should be made to conduct case investigations and identify contacts for all suspected cases of measles and rubella. Case investigation should be initiated immediately (no later than 48 hours) after notification and include collection of demographic, epidemiologic, immunization and clinical data about the case. The details of information to be collected are included in the integrated measles/rubella case investigation form (Annex 2). Persons who have been in contact with cases of measles or rubella during their infectious period should be located and interviewed to determine their vaccination status and offer immunoglobulin prophylaxis or vaccination, as appropriate. Pregnancy status should be determined for each case and contact so that appropriate follow-up of pregnant women exposed to rubella can be conducted.

In an outbreak situation, cases may occur among recently vaccinated persons, if they were infected before or shortly after vaccination. Suspected cases of measles or rubella occurring in vaccinated persons within 7–14 days after vaccination need to be investigated, and, where possible, specimens should be obtained for virus isolation to determine if the rash is attributable to vaccine virus or wild virus. Cases with only the vaccine, but not a wild strain of measles or rubella virus do not warrant further investigation and should be discarded *(6)*.

For more information on case investigations, see Annex 3.

4.5 Perform ongoing descriptive analysis of the outbreak data

Analysis of outbreak data allows health agencies to guide the outbreak response activities, especially vaccination, and helps to focus the response on groups most in need. To maximize the impact and minimize delays, the analysis should be performed not only at the national, but at district and provincial levels as well. The basic analysis should describe cases by person, place and time and include case distribution and incidence over time (for example weekly) and by age group, sex, immunization status and geographic area. Any additional information to help identify the most severely affected groups and reasons for their susceptibility should also be reviewed and analysed.

4.6 Reporting outbreaks to WHO

All outbreaks of measles and rubella should be reported to the WHO Regional Office for Europe. As measles and rubella elimination is the regional target, timely sharing of information on outbreaks of these diseases with countries in the European Region, using the Regional Office's mechanisms, is important for promptly enhancing surveillance activities and responding to cross-border transmission. Achieving measles and rubella elimination in at least five WHO regions by 2020 is a goal of the global measles and rubella strategic plan *(40)*. Use of the International Health Regulations' notification and reporting procedures may become more relevant and measles outbreaks may more often be classified as events of potential international public-health concern, due to the documented capacity of measles to spread internationally.

Member States should provide information about individual cases in the outbreak by submitting the data included in the integrated measles/rubella case investigation form (Annex 2), as per routine surveillance. In addition, countries should provide to WHO information describing the outbreak, including data on affected populations and response measures implemented, using the measles/rubella outbreak report form (Annex 4). All classification categories of measles and rubella, including discarded cases, should be reported. The initial notification using the outbreak report form with information available at the time should be submitted early in the course of the outbreak. Subsequently, once the outbreak is over and the data analysis is completed, an updated final outbreak report form should also be submitted to WHO.

5. Recommendations for outbreak response

Member States should establish capacity for early detection and response to outbreaks with an overall goal of putting in place a rapidly responsive system to determine source of exposure, identify patients' contacts and detect additional cases through epidemiologic investigation, and to prevent further transmission by implementing timely and appropriate response measures. The primary strategy for control of measles and rubella outbreaks is to ensure a high level of immunity in the affected population. The response to measles and rubella outbreaks should include the following core activities: isolation of cases, contact management, immunization activities in response to outbreak, advocacy and communication to ensure effective community involvement and public awareness, and description of the outbreak and lessons learned. These activities are described below.

5.1 Isolation of cases

To minimize transmission of the virus, suspected cases should be isolated immediately upon identification. Isolation should continue until both measles and rubella are ruled out by laboratory, or for four days after the rash onset for measles and five days after the rash onset for rubella. Although isolation and social distancing are important components of outbreak control, they are not by themselves sufficient for controlling measles and rubella outbreaks and should be used in combination with other measures, such as immunization.

5.2 Contact management

Persons who have been in contact with cases during their infectious period (for measles – between four days before and four days after the rash onset; for rubella – between seven days before and five days after the rash onset) should be identified and followed up. Contact investigation should include assessment of their susceptibility to measles/rubella and their overall health status, including pregnancy status and risk factors for severe illness.

Persons without a history of laboratory-confirmed measles or rubella, and without immunization records demonstrating the receipt of the age-appropriate number of doses of measles- and rubella-containing vaccine or serologic evidence of immunity (presence of IgG antibodies to measles or rubella) should be considered susceptible. In some countries, persons born prior to a certain time are considered immune (e.g. in the United States of America those born before 1957). This determination is usually based on disease epidemiology and the history of the measles and rubella immunization programme in the country. However, if epidemiologic investigation of ongoing outbreak indicates susceptibility in these age cohorts, adequate interventions should be considered.

Contacts at high risk for severe measles disease (i.e. children aged <5 years and adults; persons living in crowded environments; persons with immunosuppression and/or malnutrition and/or vitamin A deficiency) should be evaluated and receive appropriate preventive measures.

Susceptible contacts, who are age-eligible and have no contraindications to measles- and rubella-containing vaccines, should be vaccinated as soon as possible. Even if the contact is already infected, vaccination within two days of exposure may help modify the clinical course of the disease or may even prevent symptoms. If indicated, the second dose should be given at least 28

days after the receipt of the first dose of the vaccine *(12,18)*. There is no upper age limit for immunization with measles- and rubella-containing vaccines.

For contacts for whom vaccination is contraindicated or who have been exposed to measles more than 2 days previously, administration of measles immune globulin (IG) within 3–5 days of exposure may also modify the clinical course of the disease or prevent symptoms *(12)*. Priority groups for *measles* IG prophylaxis include infants <12 months of age, pregnant women without evidence of immunity, severely immunocompromised persons, and persons exposed in settings with prolonged close contact (e.g., household, day care, classroom).

Administration of rubella IG after exposure to rubella does not usually prevent infection or viremia, but might modify or suppress symptoms and create an unwarranted sense of security. Infants with congenital rubella have been born to women who received IG shortly after exposure. Therefore, IG is not recommended for routine postexposure prophylaxis of rubella *(41)*. Administration of IG (20 ml IG intramuscularly within 72 hours of rubella exposure) should be considered only if a pregnant woman exposed to rubella will not consider termination of pregnancy under any circumstances *(41)*. Pregnant women who are exposed to rubella and do not have adequate proof of immunity should be serologically evaluated for rubella-specific IgM and IgG antibodies *(6,9)*. Those found susceptible to rubella but not infected, should be counselled regarding the risks for intrauterine rubella infection, advised to restrict their contact with persons with rubella and recommended to get vaccinated after delivery. Those found infected with rubella virus should be referred to a health care provider and followed up throughout their pregnancy according to existing surveillance guidelines *(6)*.

5.3 Immunization activities in response to an outbreak

Immunization efforts in an outbreak setting are aimed at reducing the extent and duration of the outbreak and helping with interrupting transmission by raising population immunity. When deciding on the need, target groups and the most appropriate strategies for outbreak response immunization, it is important to take into account the results of the assessment of risk of a large-scale outbreak, financial and human resources, vaccine availability, regulatory framework and the attitude towards immunization and the disease among potential target groups and health care workers. The potential impact of the intervention will be greater if implemented early in the course of the outbreak and in settings with a substantial number of susceptibles, where the risk of widespread transmission is higher.

To determine the most appropriate type of immunization response, it is important to assess the risk of a large-scale outbreak early on. This assessment can be done through evaluating outbreak epidemiology (age, gender, immunization status of cases, particular subpopulation or territory affected, etc.) in the light of population susceptibility, using current and historical data on immunization programme policies and performance, routine and SIA vaccination coverage (by age and sex), and serologic data on population susceptibility (if available). In addition, analysis of disease epidemiology in recent years, population characteristics (size, density, and movement), availability and access to health services and the existence of any special circumstances (e.g. reform of health system, changes of immunization and surveillance regulations, recent conflict situations or civil disturbances, issues with vaccine acceptance) should be taken into account.

Immunization of susceptible contacts will be a necessary intervention at a minimum. This may be sufficient for limiting the spread of the virus only in settings with uniformly very high coverage, where the risk of subsequent transmission is low. Usually, this applies to outbreaks following importations into countries/areas which have achieved uniformly high levels of population immunity through successful routine immunization programmes over prolonged periods of time and/or through SIAs, and may have interrupted endemic transmission. When considering the decision to limit response immunization to susceptible contacts, it is important to take into account that strong surveillance and contact follow-up capacity are critical for this approach to be successful.

In most settings, however, it will be necessary to expand outbreak response immunization beyond susceptible contacts. This can be done through selective or non-selective immunization of the most affected and/or at-risk populations.

Selective immunization of susceptibles implies the assessment of immunity of persons from the target group based on the disease or vaccination history, and providing vaccination to persons deemed susceptible, i.e. without a history of disease or proof of an age-appropriate receipt of vaccine for measles and rubella. This strategy should only be used for outbreak control purposes if the risk assessment does not indicate the need for wider, non-selective vaccination response, e.g. with small-scale outbreaks in certain settings (schools, colleges, workplaces, small geographic area, etc.). Availability of easily accessible and reliable individual immunization records and medical history is essential for successful implementation of selective immunization. This approach is not recommended for situations of transmission over large geographic areas or large populations, as conducting assessment of susceptibility on an individual basis is time consuming and very costly. Due to high costs and logistical burden, it is generally not recommended to perform serological screening to determine individual susceptibility with the purpose of identifying persons eligible for selective immunization during the outbreak.

Non-selective immunization implies providing a supplementary dose of the vaccine to all individuals in the target group regardless of their previous immunization or disease history. These are commonly referred to as SIAs. This approach allows immunization of large numbers of people without the need for reviewing individual immunization records and verifying disease history. For outbreak response purposes, SIAs are indicated in the case of large-scale outbreaks and have been shown to reduce their duration and extent. The necessity and extent of an SIA, as well as the target group and implementation strategies should be determined based on the outcome of the risk assessment and the epidemiology of the outbreak while also taking into account resource availability.

Information about planning and implementing measles and rubella SIAs can be found in the *Field guide for planning and implementing supplementary immunization activities for measles and rubella (42)*.

Outbreak response efforts may also include modifying immunization policies and schedules. For example, in many outbreaks, substantial proportions of cases occur among infants too young to be vaccinated. Young children, particularly infants, are at high risk of severe illness and death from measles. In the European Region, the first dose of measles/rubella-containing vaccine is usually not given to infants until 12 to 18 months of age, depending on the country. Therefore, to ensure earlier protection in an outbreak setting, the recommended age of administration of the first dose of vaccine can be moved up to nine months. In some circumstances measles- and rubella-containing vaccine can be given as early as six months of age. A dose administered

before 12 months of age should not be counted as a valid dose for routine immunization purposes and routine doses of measles/mumps/rubella (MMR) or measles/rubella (MR) vaccine should still be administered to these children, according to the national immunization schedule *(12,18,43,44)*.

Similarly, if most cases occur among preschool children and the second dose of vaccine is not given until the age of school entry (5–7 years) or even later, the recommended age for the second dose of MMR/MR can be moved forward to earlier ages, or as early as after a minimum of 28 days following receipt of the first dose.

When outbreaks are affecting adults, public health officials may recommend a vaccine dose for previously unvaccinated or undervaccinated adults with no history of the disease, if this is not already included in country-specific adult vaccination recommendations/policies.

Another key component that should be part of outbreak response activities is strengthening routine immunization. Outbreaks provide an opportunity to identify weaknesses of the immunization programme which may have contributed to the outbreak. The priority territories or groups within the outbreak area should be identified and targeted for corrective measures to ensure timely delivery and high quality of routine immunization services and to achieve high coverage. For example, if a selective approach is to be used in response to an outbreak, immunization activities should target all age cohorts (usually preschool and school age children) with missed or delayed routine doses.

For more information on measles and rubella outbreak control measures in specific settings, see Annex 5.

5.4 Advocacy and communication to ensure effective community involvement and public awareness

Advocacy and communication are outreach activities that should be part of the outbreak response from an early stage. Outreach to affected community or population groups helps to ensure effective community involvement and public awareness, to address public concern, and to encourage cooperation with public health authorities.

Outreach should be focused on communities or settings identified as most affected or at high risk of transmission. It is most effective when public health agencies form partnerships with local community groups, health care organizations, or groups or organizations (e.g. nongovernmental organizations) with a history of successful community involvement.

It is important to identify persons in the community who can serve as liaisons between public health agencies and the local population (e.g., community groups, health care workers who treat unique populations, and community and religious leaders). Liaisons should be informed about characteristics of the current outbreak and clinical symptoms of measles and rubella, as well as about recommended response measures. Public health officials should work with liaisons to develop targeted education messages and materials that address community members' knowledge, attitudes, practice and beliefs regarding health care. Messages and materials should be distributed where community members who are at risk are likely to have access to them. In some communities liaisons could take a role in surveillance activities (e.g., they could be aware of persons in the community who have missed activities because of illness).

Various means of communication can be used to transmit messages to the community, taking into consideration characteristics of the targeted population. In many outbreaks, involvement of health care workers in advocacy- and communication-related outreach activities is crucial for ensuring successful implementation of outbreak response measures.

Messages conveyed through the outreach should be clear and concise, tailored to targeted populations, and cover the following:

- inform about the existence of an outbreak;
- explain the seriousness of measles and rubella diseases;
- describe signs and symptoms of the disease;
- encourage persons with symptoms and signs of measles and rubella to seek medical advice as soon as possible;
- inform about the benefits of vaccination against measles and rubella;
- explain control efforts;
- provide information with regard to who should receive measles-rubella-containing vaccine (in accordance with target groups determined by relevant public health authorities) and where they can receive the vaccine; and
- highlight importance of evaluation of pregnant women in contact with rubella cases.

Partnership between the public health sector and media is critical for successful implementation of public health activities. Because disease outbreaks are often media topics, the media can be helpful with keeping the public informed about the outbreak, building public confidence and increasing demand for vaccination. Establishing good relations with media at the beginning of the outbreak is critical for managing the flow of information and preventing misinformation. Detailed information is available in the WHO documents *Outbreak communication guidelines* and *Outbreak communication planning guide (45,46).*

5.5 Description of the outbreak and lessons learnt

Analysis of outbreaks can provide useful information regarding factors that may have facilitated measles or rubella virus circulation. The investigation may help to identify risk factors for infection and provide information that can be used to refine and improve programmatic aspects of the elimination programme.

In addition to ongoing analysis during the outbreak, final analysis should be performed at the end of the outbreak, and should consist of the following components:

- descriptive analysis of the outbreak (similar to the one suggested in the above section Perform ongoing descriptive analysis of the outbreak data), including additional information available by the end of the outbreak, e.g. hospitalization, severe outcomes, case classification, genotyping;
- characterization of the most affected groups and separate analysis by subgroups, if needed;
- history of the measles and rubella surveillance and immunization programme, policies and performance in the country and in the affected territory/population;

- contributing factors to the outbreak (vaccine failure versus failure to vaccinate, gaps in susceptibility, nosocomial transmission, etc.);
- origin of the outbreak and genotype involved (imported virus versus endemic transmission);
- description and evaluation of measures implemented in response to the outbreak;
- surveillance system performance, both for routine and strengthened activities, during the outbreak (timeliness, completeness, “zero” reporting, etc.);
- strengths and weaknesses of the immunization system, based on the analysis of outbreak data and recognized gaps in immunity; and
- costs of the outbreak.

The findings, including recommendations on strategies for improving preparedness, surveillance, immunization coverage, specific high-risk areas and populations, should be disseminated as a written report to all stakeholders and partners, in order to prevent future outbreaks.

As mentioned, every Member State should have an outbreak response plan. Lessons learnt from an outbreak response can provide valuable information for updating and improving measles and rubella outbreak response plans.

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Annex 1. Enhance active and passive surveillance measures

Components of surveillance for measles and rubella in an outbreak setting

- Identify health care providers and facilities serving populations at risk and involve them in surveillance.
- Identify and establish surveillance in settings where cases may be identified, and involve these settings in the surveillance:
  - day-care centres, schools, places of worship and community organizations (particularly in neighbourhoods where many residents might lack measles and/or rubella immunity); and
  - workplaces with large numbers of persons who might lack measles and/or rubella immunity.
- Promote awareness among health care providers that measles, rubella and CRS still occur in the WHO European Region.
- Distribute written guidelines on surveillance and investigation procedures, instructing health care providers to obtain appropriate serology and specimens and to notify health departments of all suspected measles or rubella cases.
- Establish routine contact (e.g., daily or weekly) with hospitals, doctors' offices, clinics, schools and laboratories to obtain reports of persons with rash illness or other symptoms indicative of measles or rubella.

In addition to prospective surveillance, retrospective case finding should be conducted for 18 days (i.e. one incubation period) before the first identified case of measles, and for 46 days (i.e. 2 incubation periods due to the high rate of subclinical disease) before the first identified case of rubella. If evidence indicates that the outbreak was in progress during this time, continue retrospective searches until no further cases are identified.

Steps to identify cases retrospectively

- Review medical records in health care settings for measles or rubella-like illness.
- Review records of laboratories that conduct testing for the area.
- Review workplace or school absentee logs.

Annex 2. Integrated measles and rubella case investigation form

Recommended basic set of data for case-based reporting in national surveillance system

Case ID:_____Region:_____District: _____

Date of notification:___/___/___Date of investigation:___/___/____Date of report:___/____/_____

Initial clinical diagnosis: 1. Clinical measles ☐ 2. Clinical rubella ☐ 3. Others ☐ 9. Unknown ☐

Outbreak-related: 1. Yes ☐ 2. No ☐ 9. Unknown ☐ Outbreak ID: _____

A. Personal data and immunization status

Name*:*WHO Regional Office for Europe does not collect this information – please provide only case ID number

Sex: 1. Male ☐ 2. Female ☐ 9. Unknown ☐

Date of birth:_____/__/____if not available, age in years ____or for younger than a year, age in months__

Address*: _____* WHO Regional Office for Europe does not collect this information _____

For female cases

Is case pregnant? 1. Yes ☐ 2. No ☐ If yes, gestation age:_____weeks

Vaccination status

Measles: 1. Yes ☐ 2. No ☐ 3. Unknown ☐ If yes, no. of doses_____ | **Last vaccination date**:

Source of vaccination status: 1. Medical record ☐ 2. Parent or guardian ☐ | ____/____/____

Rubella: 1. Yes ☐ 2. No ☐ 3. Unknown ☐ If yes, no. of doses_____ | **Last vaccination date:**

Source of vaccination status: 1. Medical record ☐ 2. Parent or guardian ☐ | ____/____/____

B. Clinical information

Maculopapular rash: 1. Yes ☐ 2. No ☐ 9. Unknown ☐

Date of rash onset: _____/_____/_____ Duration of rash (days): _____

Other symptoms		Presence of complications	Yes ☐ No ☐
Fever	Yes ☐ No ☐ Unknown ☐	Pneumonia	Yes ☐ No ☐ Unknown ☐
Coryza	Yes ☐ No ☐ Unknown ☐	Malnutrition	Yes ☐ No ☐ Unknown ☐
Cough	Yes ☐ No ☐ Unknown ☐	Diarrhoea	Yes ☐ No ☐ Unknown ☐
Conjunctivitis	Yes ☐ No ☐ Unknown ☐	Encephalitis	Yes ☐ No ☐ Unknown ☐
Adenopathy or arthralgia or arthritis	Yes ☐ No ☐ Unknown ☐	Other (specify)	Yes ☐ No ☐ Unknown ☐

Hospitalized: 1. Yes ☐ 2. No ☐ 9. Unknown ☐ Name of hospital: _____

Clinical outcome: 1. Dead: date of death ____/____/____ 2. Survived ☐ 3. Lost to follow-up ☐ 9. Unknown ☐

Cause of death: _____

C. Epidemiologic investigation

Did the patient have contact with confirmed case of measles (within 7–18 days) or rubella (within 12–23 days) prior to rash onset? 1. Yes ☐ 2. No ☐ 9. Unknown ☐

If yes:

Who (case ID/name*):* WHO Regional Office for Europe does not collect this information – please provide only case ID number

Where (country/address*): * WHO Regional Office for Europe does not collect this information

When (dates): _____

Were there confirmed cases of measles and/or rubella reported in the area prior to this case?

1. Measles ☐ 2. Rubella ☐ 3. Both ☐ 4. No ☐ 9. Unknown ☐

Did the patient travel within 7–23 days before onset of rash? 1. Yes ☐ 2. No ☐ 9. Unknown ☐

If yes:

Where (country/address): _____

When (dates): _____

Travel details: _____

Is the case epidemiologically linked to an imported confirmed case? 1. Yes ☐ 2. No ☐ 9. Unknown ☐

If yes:

Who (case ID/name): _____

Where (country/address): _____

When (dates): _____

Was the case in contact with a pregnant woman since development of the symptoms?

1. Yes ☐ 2. No ☐ 9. Unknown ☐ If yes, please provide name and address _____

_____

D. Laboratory investigation

Specimen collected: 1. Yes ☐ 2.No ☐ 3. Unknown ☐

If yes, type of specimen:

Serum ☐ Saliva/oral fluid ☐ Nasopharyngeal swab ☐ Dry blood spot ☐

Urine ☐ EDTA whole blood ☐ Other ☐_____

Date of specimen collection: ___/___/___Date specimen sent to lab: _____/___/___

Measles IgM: Not tested ☐ Positive ☐ Negative ☐ In process ☐ Indeterminate ☐

Rubella IgM: Not tested ☐ Positive ☐ Negative ☐ In process ☐ Indeterminate ☐

Date of laboratory result (first validated result): _____/_____/_____

Measles virus detection: Not tested ☐ Positive ☐ Negative ☐ In process ☐ Genotype _____

Rubella virus detection: Not tested ☐ Positive ☐ Negative ☐ In process ☐ Genotype _____

E. Final classification

0 Discarded ☐

1 Measles – laboratory-confirmed ☐ 2 Measles – epidemiologically linked ☐ 3 Measles – clinically compatible ☐

6 Rubella – laboratory-confirmed ☐ 7 Rubella – epidemiologically linked ☐ 8 Rubella – clinically compatible ☐

Source of infection: 1. Imported ☐ 2. Endemic ☐ 3. Import-related ☐ 9. Unknown ☐

Date of final classification: _____/___/___

Investigated by: Name _____

Position: _____

Annex 3. Additional information on conducting case investigations

Any direct contact with a patient with measles and rubella during the infectious period (i.e., four days before to four days after rash onset for measles and seven days before to five days after rash onset for rubella) is defined as exposure. Contact can include (but is not limited to) living in the same household, attending the same class or social function or working side-by-side in a workplace environment.

Due to limited resources, investigation of contacts of patients with measles and rubella might need to be prioritized. The first priority should be persons who share households or persons in a congregate environment who share space with a patient (e.g., students in the same classroom). The next priority should be persons who share or have shared environments with a potential for contact (e.g., places of worship, parties, social gatherings), but who did not knowingly have direct contact with a patient. If resources allow, investigation of contacts can be extended to geographic areas or groups at risk where disease has been documented.

Steps for locating exposed contacts for further investigation

- Record symptom onset date and infectious period for patients on a calendar to determine in what setting the exposure might have occurred, where to look for other exposed persons, and who suspected patients had contact with during their infectious period. See Table 1 for assistance in this process.
- Follow up with contacts to assess symptoms of measles- or rubella-like illness; determine susceptibility and provide vaccination or IG prophylaxis as needed.
- Continue to investigate contacts of subsequently identified patients.

Annex 4. Measles/rubella outbreak reporting form

Outbreak Identification	Cases detail	Lab Detail
Outbreak ID	No. of suspected cases - Male	No. Suspected cases with specimen
Country	No. of suspected cases - Female	No. Lab conf. measles cases
1st admin level	No. of suspected cases - Total	No. Lab conf. rubella cases
2nd admin level	No. Deaths	Genotype
Date of rash onset of first case	No. Encephalitis	
Date of rash onset last case	No. Hospitalized	
Outbreak Notification Date	**Only rubella cases:** No. Pregnant Women	No. WCBA
Current Outbreak Status	Name and contact detail of the person reporting this outbreak	Date of this report to WHO Europe
Outbreak end date		
Importation (Y/N)		
If yes, from which country		

Epidemiological detail of confirmed cases (lab confirmed, epi linked and final clinical)

Vaccination Status \ Age Group	< 1 year	1–4 years	5–9 years	10–19 years	20–29 years	> 30 years	Unknown	Total
0 dose								
1 dose								
2+ doses								
Vaccination status not known								
Vaccinated with unspecified number of dose								
Total								

Description of outbreak

Measures taken to prevent/control further spread of outbreak

Sub-national outbreak spread detail (please provide this detail if available)					
Province	District	Date of first cases	Total reported cases	Cases investigated	comments

Instructions for completing the measles/rubella aggregate outbreak reporting form

Please report using routine channels – through the Regional Office or the European Centre for Disease Prevention and Control's TESSy, as you do for reporting individual cases of measles or rubella, or for sending monthly reports.

Please submit this form for each measles or rubella outbreak in your country. This form should be submitted as soon as an outbreak is reported, by the referent national health institution (the one in charge of the outbreak response). The second, final report should be submitted when the outbreak is finished (following national regulations and the epidemiology of the disease), and should capture the most accurate and updated data. A minimum of two reports per outbreak should be sent. Additional updates may be sent if the country wishes.

Outbreak identification

Outbreak ID: Outbreak ID is used to identify, trace, match and update outbreak information. The ideal outbreak ID is MEA (or RUB for rubella)-CCC-YYYY-99. (CCC is a three-character ISO3 code of the country, YYYY is year of outbreak and 99 is a series number starting from 01 to number the outbreaks sequentially).

Country: Enter the name of the country.

1st and 2nd admin level: Specify the location of the outbreak onset. Enter the name of the first and second administrative level in the country, according to territorial organization (e.g. 1st level region, 2nd district; 1st level province, 2nd municipality; 1st level oblast, 2nd rayon.)

Date of rash onset of first case: Indicate the date of rash onset for the index case.

Date of rash onset of last case: Indicate the date of rash onset for the last case notified in the outbreak. [NOTE: This information should be indicated only in the final outbreak report.]

Outbreak notification date: Indicate the date when the outbreak was notified to the adequate surveillance health institution (e.g. reported by a physician or health care institution). Considering differences between the surveillance and health systems in Member States, this date should be the actual date when the planning and performing of outbreak control measures started in the adequate institution.

Current outbreak status: Indicate "Ongoing" or "Finished".

Outbreak end date: Indicate the date when the outbreak finished. Considering differences between the surveillance and health systems in the Member States, as well different health regulations, the suggestion is to use the date of the last case notification as the outbreak end date (if in the period of one maximal incubation for the outbreak causing disease there are no other notified cases). [NOTE: This information should be indicated only in the final outbreak report.]

Importation (Y/N): Indicate with "Yes" or "No" whether outbreak is imported from another country. Imported measles cases are cases exposed outside the country during the 7 to 18 days prior to rash onset as supported by epidemiologic and/or virological evidence. If the index case came from or was exposed and infected by contact with a person from another administrative

territory in the same country, that is NOT an importation. In the following cell of the form enter the name of the country where the index case was exposed.

Cases detail

No. of suspected cases (three cells; male, female and total): Indicate the number of suspected cases of measles or rubella by gender and as a total. A suspected case is any person who is under epidemiologic, clinical and/or laboratory investigation during the outbreak, because of present clinical symptoms meeting the case definition for measles or rubella and/or a possible epidemiologic link with another suspected/confirmed case.

No. deaths: Indicate the number of deaths caused by disease during the outbreak.

No. encephalitis: Indicate the number of cases diagnosed with encephalitis during the outbreak.

No. hospitalized: Indicate the number of cases hospitalized due to measles or rubella during the outbreak.

Lab detail

No. suspected cases with specimen: Indicate the number of suspected cases from whom specimens were collected for laboratory diagnostic procedures (detection of IgM against measles or rubella). According to WHO guidelines for *Eliminating measles, rubella and congenital rubella syndrome*, we expect that cases from the beginning of investigation (when cluster of cases is recognized) will be tested for both diseases (IgM for measles and IgM for rubella). Later, when outbreak is confirmed by IgM results, countries with low incidence of both diseases should continue with testing of suspected cases for measles and rubella for differential diagnosis regardless of which disease is actually a cause of outbreak. Look for more information in the surveillance guidelines.

No. lab conf. measles cases: Indicate the number of measles cases that are confirmed IgM positive. No. lab conf. rubella cases: Indicate the number of rubella cases that are confirmed IgM positive. Genotype: Indicate the genotype of virus (with isolation or by PCR only), if performed.

Only rubella cases

This information should be provided for a rubella outbreak investigation and for cases that are lab confirmed rubella cases in measles outbreak investigation.

No. pregnant women: Indicate the number of pregnant women among the suspected rubella cases during the rubella outbreak or indicate the number of pregnant women among confirmed rubella cases during the measles outbreak.

No. WCBA: Indicate the number of women of childbearing age among the suspected rubella cases during the rubella outbreak or indicate the number of women of childbearing age among the confirmed rubella cases during the measles outbreak.

About report

Name and contact detail of the person reporting this outbreak: Enter the contact information of the person WHO Regional Office for Europe can contact if there is a need for additional information.

Date of this report to the WHO Regional Office for Europe: Indicate the date when this report was sent to the WHO Regional Office for Europe.

Epidemiologic detail of confirmed cases (lab confirmed, epi linked and clinically compatible)

Enter the age and immunization status of confirmed cases during the outbreak. This information should pertain only to the diseases causing the outbreak (for example, for a measles outbreak, do not include rubella lab-confirmed cases or provide rubella immunization status of cases). The row and column totals will be automatically calculated.

Description of outbreak

Indicate the main epidemiologic findings: any specificity regarding characteristics of affected institutions and communities, special populations, occupational or workplace exposure, immunization status, age of cases, most common diagnoses for hospitalization, high number of cases with severe form of disease or other epidemiologically important findings.

Measures taken to prevent/control further spread of outbreak

Indicate the main response measures taken to prevent/control further spread of the outbreak (e.g. school immunization). If it is possible, in the final closing outbreak report form indicate the risk management and potential long-term measures taken based on the lessons learnt during this outbreak.

Details of subnational spread of outbreak (please provide if available)

In the event that epidemiologic and laboratory findings link this outbreak with other measles or rubella outbreaks or clusters in other administrative territories of the country, please enter this information following the title row of the table. Depending on national regulations, these cases may be considered as clusters of the reported outbreak or as individual outbreaks. If they are considered as separate outbreak(s), please enter this information in the “Comments” field and fill in additional forms as needed.

Annex 5. Implementing measles or rubella control measures in specific settings

Congregate environments

Congregate environments include households, schools, day-care centres, prisons, military settings, workplaces, places of worship, athletic events and other social gatherings. Control measures recommended for these settings are as follows.

- Refer persons without adequate proof of measles or rubella immunity for vaccination or offer on-site vaccination clinics.
- Isolate patients during their infectious period (i.e. for measles: four days after rash onset, for rubella: five days after rash onset).
- Recommend for day-care centres and schools that persons exempt from measles or rubella vaccination for medical, religious, or other reasons be excluded from attendance until the outbreak is determined to be over.
- Recommend that all susceptible persons who were not vaccinated as part of the control efforts minimize contact with measles patients for four days after rash onset; and with rubella patients for five days after rash onset.
- Recommend that rubella-susceptible pregnant women avoid activities, particularly in the first trimester of pregnancy, where they might be exposed to rubella.

Health care settings

Health care settings include hospitals, doctors' offices, clinics, elder-care homes and other facilities where patients receive subacute or extended care. Control measures recommended for these settings are as follows.

- Continue to implement protocols, measures and procedures for prevention of hospital-acquired infections in a hospital/ward affected by an outbreak.[2]
- Vaccinate health care workers who do not have adequate evidence of immunity to measles or rubella, in order to protect the staff from infection and prevent further transmission to patients and others outside of the affected setting.
- Exclude susceptible health care providers who do not choose to receive vaccine from direct patient care until the outbreak is determined to be over.

General community

When community-wide outbreaks occur, the following steps are recommended.

- Attempt to ensure proper isolation procedures for all patients.
- In general, any person who could be exposed to a patient with measles or rubella or CRS and who cannot demonstrate proof of immunity should receive vaccine or restrict contact with patients with measles or rubella or CRS.

[2] *Prevention of hospital-acquired infections. A practical guide*, 2nd edition Geneva, World Health Organization, 2002 (http://www.who.int/csr/resources/publications/drugresist/en/whocdscsreph200212.pdf, accessed 20 August 2013).

- Ensure that persons at high risk for severe measles disease (i.e., children <5 years, adults, persons living in crowded environments, immunosuppressed individuals and persons with malnutrition and/or vitamin A deficiency) are identified and receive appropriate prophylaxis.
- Make every effort to identify susceptible pregnant women exposed to rubella. In community-wide outbreaks, health care workers who treat pregnant women need to be alerted to the outbreak and advised to verify rubella immunity in pregnant women.[3]

[3] *Surveillance guidelines for measles, rubella and congenital rubella syndrome in the WHO European Region. Update December 2012*. Copenhagen, WHO Regional Office for Europe, 2013 (http://www.euro.who.int/__data/assets/pdf_file/0018/79020/e93035-2013.pdf, accessed 17 June 2013).