Maldives

Health Protection Agency

Ministry of Health

Measles, Rubella and Congenital Rubella Syndrome Surveillance Guide to Health Professionals

Goal: Elimination

December 2016

Compiled by the

Public Health Surveillance Section
Health Protection Agency
Ministry of Health

Previous version March 2015

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Key Definitions

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

Measles elimination: the absence of endemic measles transmission in a defined geographical area (e.g. region or country) for ≥ 12 months in the presence of a well-performing surveillance system. However, verification of measles elimination takes place after 36 months of interrupted endemic measles virus transmission.

Rubella and CRS elimination: the absence of endemic rubella virus transmission in a defined geographical area (e.g. region or country) for >12 months and the absence of CRS cases associated with endemic transmission in the presence of a well-performing surveillance system. However, verification takes place after 36 months of interrupted endemic virus transmission.

Rubella and CRS control: a 95% reduction of rubella and CRS as compared with the 2008 baseline nationally and for the Region.

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

Re-establishment of endemic transmission: occurs when epidemiological and laboratory evidence indicates the presence of a chain of transmission of a virus strain that continues uninterrupted for ≥ 12 months in a defined geographical area where measles or rubella had previously been eliminated.

Measles/rubella outbreak in countries with an elimination goal: a single laboratory-confirmed case of measles or rubella.

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

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

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

Clinically compatible measles case: a case with fever and maculopapular (non-vesicular) rash and at least one of cough, coryza or conjunctivitis, for which no adequate clinical specimen was taken and which has not been linked epidemiologically to a laboratory-confirmed case of measles or another laboratory-confirmed communicable disease.

Clinically compatible rubella case: A case with maculopapular (non-vesicular) rash and fever (if measured) and one of arthritis/arthralgia or lymphadenopathy, for which no adequate clinical

specimen was taken and which has not been linked epidemiologically to a laboratory-confirmed case of rubella or another laboratory-confirmed communicable disease.

Suspected case of congenital rubella syndrome (CRS): an infant less than one 1 year of age in whom a health worker suspects CRS. A health worker should suspect CRS when an infant aged 0–11 months shows signs of heart disease and/or suspicion of hearing impairment and/or one or more of the following eye signs: white pupil (cataract), large eye ball (congenital glaucoma) or pigmentary retinopathy. A health worker should also suspect CRS when an infant's mother has a history of suspected or confirmed rubella during pregnancy, even when the infant shows no signs of CRS.

Clinically compatible CRS case: A case with Presence of ≥2 clinical features from group A or ≥1 feature from group A and ≥1 feature from group B:

> Group (A) cataract(s), congenital glaucoma, congenital heart disease, hearing impairment, pigmentary retinopathy
>
> Group (B) purpura, splenomegaly, microcephaly, mental retardation, meningoencephalitis, radiolucent bone disease, jaundice with onset within 24 hours after birth

Laboratory-confirmed CRS case: a suspected infant of CRS who meets the laboratory criteria for CRS case confirmation.

Congenital rubella infection (CRI): An infant who does not have clinical signs of CRS but has a positive rubella specific IgM test, which is classified as having CRI.

Non-measles, non-rubella discarded case: a suspected case that has been investigated and discarded as non-measles and non-rubella case using (a) laboratory testing in a proficient laboratory or (b) epidemiological linkage to a laboratory-confirmed outbreak of another communicable disease that is neither measles nor rubella.

Measles vaccine-associated illness: a suspected case that meets all five of the following criteria:

(i) the patient had a rash illness, with or without fever, but did not have cough or other respiratory symptoms related to the rash;
(ii) the rash began 7–14 days after vaccination with a measles-containing vaccine;
(iii) the blood specimen, which was positive for measles IgM, was collected 8–56 days after vaccination;
(iv) thorough field investigation did not identify any secondary cases; and
(v) Field and laboratory investigations failed to identify other causes.

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

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

Imported measles or rubella case: A case exposed to measles, or rubella, outside the region or country during the 7–21 days (12–23 days for rubella) prior to rash onset and supported by epidemiological or virological evidence, or both. (Note: for cases that were outside the Region or country for only a part of the 7–21 day interval [or 12-–23 days for rubella] prior to rash onset,

additional evidence including a thorough investigation of contacts of the case is needed to exclude a local source of infection.)

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

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

1. Introduction

Measles is one of the most infectious human diseases and can cause serious illness, life-long complications and death. By contrast to measles, rubella infections cause a relatively mild disease for children. However, rubella infection in women during early pregnancy can severely affects the foetus, resulting miscarriage, foetal death or congenital rubella syndrome (CRS) which includes heart disease, blindness and deafness[1].

The Global Measles & Rubella Strategic Plan 2012-2020 aligned with the Global Vaccine Action Plan which was endorsed in May 2012, at sixty sixth World Health Assembly maps the proven strategies required to achieve a world without measles, rubella or CRS. In 2013 WHO's South East Asia Region officially adopted measles elimination and rubella/CRS control goal by 2020.

In Maldives the incidence of measles gradually decreased after the introduction of measles immunization to the EPI in 1985. However, outbreaks of measles were reported in the years 2002 and 2005, reported incidence of 318 per 100,000 and 482 per 100,000 respectively. An outbreak of rubella was reported in the year 2000, with an incidence of 568 per 100,000 populations. Retrospective analysis in 2006 estimated CRS incidence of 0.2/1000 live births in endemic period and 1-4 cases per 1000 live births during epidemics[2]. Considering the measles and rubella epidemiology and burden, Ministry of Health had conducted a national wide catch-up campaign of Measles and Rubella (MR) in 2005-2006 with a target age group of 6 to 25 years for males and 6 to 35 years for female. The reported coverage was 82% and 85% for Dec 2005 and May 2006 round respectively. One dose of MMR vaccine had been introduced into national immunization schedule at the age of 18 months for April 2007[3]. As a result of MMR vaccination, the incidence of measles and rubella reduced to zero for the last five years and nine years respectively.

With the change progress from mortality reduction phase to elimination phase, Maldives required to update the strategies and surveillance system in align with the Global and Regional guidance. This guideline describes epidemiology, surveillance case definitions, reporting, investigation, samples collection and transportation protocols, laboratory diagnosis and data dissemination of measles, rubella and CRS.

1.1 Goal

There will be absence of endemic measles and rubella transmission in the population of Maldives by 2020.

1.2 Strategies

The key strategies for measles, rubella and CRS elimination include:

- Achieving and maintaining high ($\geq$ 95%) high vaccination coverage with two doses of measles- and rubella-containing vaccines (MCV) through routine immunization and, when required, supplementary immunization activities (SIAs);
- Develop and sustain a high quality sensitive laboratory case-based surveillance for measles, rubella and CRS that is sensitive and specific enough to detect imported and import-related cases

- Ensuring high quality laboratory contribution to surveillance through laboratory accredited to conduct timely and accurate testing of samples to confirm or discard suspected cases and detect viruses for genotyping and molecular analysis;
- Developing and maintaining outbreak preparedness, and rapidly responding to outbreaks and managing cases;
- Strengthening support and linkages of measles, rubella and CRS surveillance with other maternal child health interventions;
- Increasing and maintaining public confidence and demand for immunization.

1.3 Targets

The targets for achieving measles, rubella and CRS elimination set for Maldives are outlined in the table below align with the Regional targets[4]:

Targets	By 2015	By 2020
Disease burden	• Reduce measles mortality by 95%, compared to 2000 estimates • Reduce measles incidence to <5 cases per million population • 50% reduction in rubella/CRS cases compared to 2008 estimates.	• "Zero" endemic measles transmission in Maldives for at least 12 months in the presence of a well performing surveillance system • More than 95% reduction in rubella/CRS cases compared to 2008 estimates.
Immunization	• MCV1: At least 90% coverage at national level and at least 80% at atolls level • MCV2: At least 90% coverage at national level and at least 80% at atoll level.	• MCV1: More than 95% coverage at both national and atoll level • MCV2: More than 95% coverage at both national and atoll level.
Surveillance	• Reporting rate of at least 2 discarded non-measles and non-rubella cases per 100000 population • At least 80% of suspected measles cases tested for measles and rubella as per regional algorithm in a proficient laboratory. • At least 80% of outbreaks tested for virus detection and genotyping	• Reporting rate of at least 2 discarded non-measles and non-rubella cases per 100000 population • 100% of suspected measles cases tested for measles and rubella in a proficient laboratory • At least 80% of outbreaks tested for virus detection and genotyping

Targets	By 2015	By 2020
	• At least 80% of specimen with laboratory results within 4 days.	• At least 80% of specimen with laboratory results within 4 days.

2. The Diseases

2.1 Measles[5]

2.1.1 The organism

Measles is an acute illness caused by a virus of the genus *Morbillivirus* (a member of *Paramyxovirus* family); humans are the only reservoir.

2.1.2 Transmission

Transmission is primarily person-to-person via aerosolized respiratory droplets or by direct contact. Measles is highly infectious and the disease spreads easily in areas where infants and children gather, for example, in health care centres and schools. Individuals with measles are infectious from 2–4 days before until 4 days after rash onset. Conditions such as high birth rates, overcrowding and the influx of large numbers of susceptible children from rural areas can facilitate measles transmission. A small percentage of susceptible individuals are sufficient to maintain virus circulation in populations of a few hundred thousand. In areas with tropical climates, most cases of measles occur during the dry season, whereas in areas with temperate climates, the incidence peaks during late winter and early spring.

2.1.3 Clinical features

After an incubation period of approximately 10–14 days (range 8–15 days), from exposure to onset of rash, prodromal symptoms of fever, malaise, cough, coryza (runny nose) and conjunctivitis appear in non-immune persons exposed to the virus.

The rash appears behind the ears and on the face, accompanied by a high fever. Fever can be as high as 40.6°C (105°F). The rash is maculopapular, made up of large, blotchy red spots (macules are circumscribed areas of change in normal skin colour, with no skin elevation or depression; they may be of any size). The rash typically spreads from the head to the trunk and then extremities, lasts 3–7 days, and may be followed by a fine desquamation. Koplik spots may occur on the buccal mucosa shortly after the onset of rash and for about 1–2 days afterwards.

A modified form of measles, with generally mild symptoms, may occur in infants who still have partial protection from maternal antibodies and occasionally in persons who received only partial protection from the vaccine.

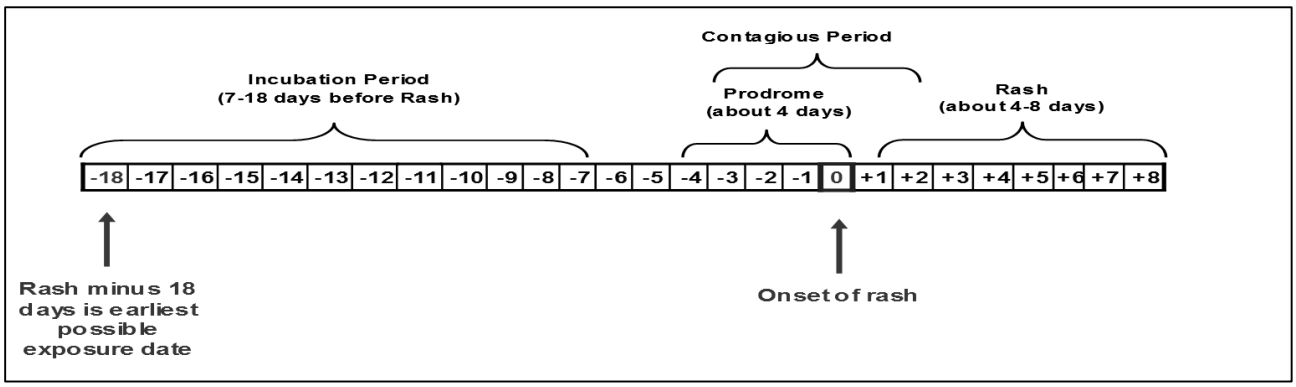


Figure 1- Clinical course of Measles infection

2.1.4 Differential diagnosis

Infections with a number of other viruses can present with a maculopapular rash resembling that of measles, including rubella virus, dengue, *parvovirus, enterovirus, adenovirus,* human *herpesvirus*.

2.1.5 Complications

Complications of measles include otitis media, pneumonia, diarrhoea, febrile seizure, blindness and encephalitis. Less common complications include protein energy malnutrition, convulsions and brain damage. Unless managed early and aggressively, these complications may lead to death within the first month after rash onset. The case-fatality rate from measles is estimated to be 3%–5% in developing countries but may reach more than 10% during epidemics in certain settings. Malnutrition and infection with human immunodeficiency virus (HIV) are risk factors for complications and mortality.

2.1.6 Immunity

Measles-specific immunoglobulin M (IgM) antibodies are detectable within 4 days after onset of the rash and can persist for up to 4–12 weeks. Natural infection produces lifelong immunity. Infants born to mothers who have either had measles or been vaccinated are protected by trans-placental acquired maternal antibodies. The protection from this passive immunity lasts 6 to 9 months on average. IgM can be positive after vaccination for upto 6 months.

2.1.7 Measles vaccines

Measles vaccines contain live, attenuated virus. Following vaccination, the long-term persistence of neutralizing measles antibodies (26–33 years) and long-lasting protection against measles have been demonstrated by several investigators. However, it is not definitively known whether a single dose of measles vaccine, without natural boosting by recurrent measles exposure, will result in lifelong protection. Studies using IgG avidity measurements to separate primary vaccination failures from secondary vaccination failures suggest that secondary failures may occur at least occasionally.

Measles-containing vaccine can be safely and effectively administered to children with mild acute illnesses, such as low-grade fever, diarrhoea and upper respiratory tract infections. However, severely-ill children with high fever should not be vaccinated until they have recovered. People who have experienced an anaphylactic or severe hypersensitivity reaction to a previous dose of measles/mumps/rubella (MMR) vaccine or its component vaccines or who have experienced an anaphylactic reaction to neomycin, gelatin or another component of the vaccine should not be vaccinated. In countries where HIV infection is prevalent, infants and children should be immunized with the EPI antigens according to standard schedules. However, measles vaccine is contraindicated in people who are severely immunocompromised due to congenital disease; severe HIV infection; advanced leukaemia or lymphoma; serious malignant disease; treatment with high-dose steroids, alkylating agents or antimetabolites; or who receive immunosuppressive therapeutic radiation. As vaccinated persons do not transmit vaccine virus, the risk to these patients of being exposed to measles may be reduced by vaccinating their direct susceptible contacts. Rubella-containing vaccine should not be administered to pregnant women. This contraindication is based on theoretical reasons, as there is currently no evidence to suggest that

children born to pregnant women who received measles or MMR vaccines during pregnancy are adversely affected.

2.1.8 Treatment

There is currently no specific treatment for measles infection. Administration of vitamin A to children with measles has been shown to decrease both the severity of disease and the case-fatality rate, and WHO recommends that vitamin A be administered to all children with acute measles.

2.2 Rubella

2.2.1 The organism

Rubella is an acute illness caused by a virus of the family Togaviridae.

2.2.2 Transmission

The rubella virus, while less contagious than that of measles, is also transmitted by respiratory droplets and by direct contact with the nasal and throat secretions of infected persons. While individuals with rubella may shed virus from 7 days before to 14 days after the onset of rash, 25% to 50% of infections are asymptomatic.

2.2.3 Clinical features

Rubella is a common cause of maculo-papular rash illness with low-grade fever. Symptoms in children and adults are often mild, and children often do not have fever. In addition to fever and rash, individuals with rubella frequently have lymphadenopathy, and up to 60% of adult women with rubella have joint symptoms. Up to 50% of rubella infections are subclinical or asymptomatic.

Congenital rubella syndrome

A rubella-infected fetus carried to term may be born with CRS. Some defects associated with CRS may be recognizable at birth, while others are detected months or even years later. CRS manifestations may be transient (e.g. purpura), permanent structural manifestations (e.g. deafness, central nervous system defects, congenital heart disease, cataract), or late-emerging conditions (e.g. diabetes mellitus).

At birth, the sera of infants with CRS contain maternally derived rubella-specific IgG antibodies, as well as IgG and IgM antibodies synthesized by the fetus. In contrast, only maternal rubella-specific IgG is found in the sera of normal infants born to women who are immune to rubella. Infants with CRS may shed rubella virus from body secretions for up to 27 months, although most infants stop shedding by one year of age. Infants who shed rubella virus are infectious, and rubella outbreaks have occurred among health care workers caring for infants with CRS.

2.2.4 Differential diagnosis

Other causes of rash illness with fever include measles, dengue, parvovirus B19, human herpesvirus 6, Ross River virus, Chikungunya virus, enteroviruses, adenoviruses and Streptococcus group A (beta hemolytic).

2.2.5 Complications

Rubella has few complications unless the virus is contracted by a susceptible pregnant woman. A primary rubella infection (i.e. infection of a susceptible woman) during pregnancy may result in spontaneous abortion, stillbirth or fetal death; an infant born with CRS; an infant born with congenital rubella infection (CRI) without congenital defects; or birth of a normal infant.

2.2.6 Immunity

Rubella-specific IgM antibody usually appears within 4 days after onset of the rash and can persist for up to 4–12 weeks. Rubella-specific IgG antibody begins to rise after the onset of the rash, peaks about 4 weeks later, and generally lasts for life; it is a long-term marker of previous rubella infection. Natural infection produces lifelong immunity.

2.2.7 Rubella vaccine

The rubella vaccine widely used around the world is based on the live attenuated RA27/3 strain of rubella virus. Protective antibodies against rubella develop in >95% of vaccines 21–28 days after vaccination. One dose of rubella vaccine probably confers lifelong immunity in more than 95% of people immunized. The primary purpose of rubella vaccination is to prevent the occurrence of CRS.

Rubella vaccine is very safe. Most adverse reactions reported following MMR vaccination (such as fever and rash) are attributable to the measles component. The most common complaints following vaccination are fever, lymphadenopathy and arthralgia. Rubella vaccination should be avoided in pregnancy because of the theoretical, but never demonstrated, teratogenic risk.

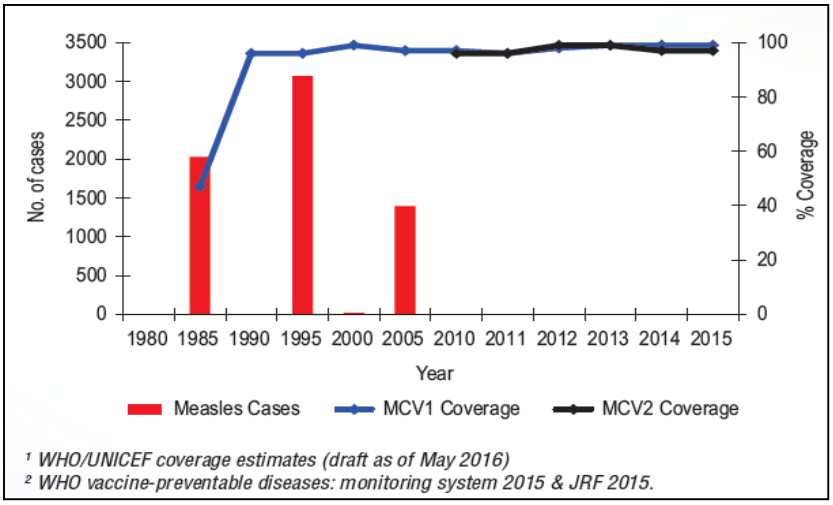
2.2.8 Treatment

There is no specific treatment for rubella or for CRS. Patients with rubella should drink plenty of fluids and may take medication to reduce mild fever. Infants with CRS should be treated for their specific problems.

3. Status of measles elimination and rubella/CRS control in Maldives

Measles remains a significant cause of morbidity and mortality worldwide. Of the estimated 134 200 global measles deaths in 2015, 41% (54 500) occurred in the South-East Asia Region. In Maldives, the incidence of measles gradually decreased after the introduction of measles vaccine into EPI in 1985. However, outbreaks have been reported in 2002 and 2005, with reported incidence of 318 per 100,000 and 482 per 100,000 population respectively. An outbreak of rubella was reported in the year 2000, with an incidence of 568 per 100,000 population. Since the 2005 outbreak Measles Rubella nationwide vaccination campaigns were conducted for 6-25 years age group in males and 6-35 years for measles. The campaign achieved 82% coverage. Following the campaign there was a reduction of measles incidence with only 47 cases reported in 2006. A follow up campaign was conducted in 2006 with a target population of 144, 997. The campaign achieved 85% nation-wide coverage. There were only 20 cases reported in 2007, 2 cases in 2008 and 6 cases in 2009.

Figure 2- Coverage of two doses of measles containing vaccine in Maldives 1980-2015



¹ WHO/UNICEF coverage estimates (draft as of May 2016)
² WHO vaccine-preventable diseases: monitoring system 2015 & JRF 2015.

Following up the nationwide catch up campaign, one dose of MMR vaccine was introduced into National Immunization schedule at the age of 18 months in 2007. As a result of the vaccination, the incidence of measles reduced to zero for the past six years. Maldives has not yet reported any cases of CRS.

Maldives has also moved to laboratory supported case based surveillance since 2015 and has been performing to meet the regional standards of surveillance performance.

Year	No. of Suspected Measles	Case classification (number)						Indicators					
		Measles			Rubella								
		Lab-confirmed	Epi-Linked	Clinically-confirmed	Lab-confirmed	Epi-Linked	Discarded non-measles non-rubella cases	Annual incidence of confirmed Measles cases per million total population	Annual incidence of confirmed Rubella cases per million total population	Proportion of all suspected measles and rubella cases that have had an adequate investigation initiated within 48 hours of notification	Discarded non-measles non-rubella incidence per 100 000 total population	Proportion of subnational administrative units reporting at least two discarded non-measles non-rubella cases per 100 000 total population	Proportion of sub-national surveillance units reporting to the national level on time
Target →								–	–	80%	2	80%	80%
2012	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	9	0	0	0	0	0	9	0	0	100	2.6	ND	100
2015	10	0	0	0	0	0	10	0	0	100	2.9	ND	100

Figure 3-Measles rubella case-based surveillance performance, Maldives, 2012-2015.

4. Components of Laboratory supported case-based surveillance for measles and rubella

The general objectives of measles, rubella and CRS surveillance are to immediate detecting any suspected cases, confirming cases by laboratory diagnosis and identifying importations and possible sources of infection so that can be used to plan, monitor and evaluate measles elimination and rubella/CRS control programme.

Specific objectives are:

- Documenting disease burden and describing the characteristic of measles and rubella cases in order to identify high-risk populations and to understand the reasons for the occurrence of the disease and to develop appropriate control measure;
- predicting potential outbreaks, detecting and investigating outbreaks and assessing implementation of vaccination strategies in order to prevent outbreaks;
- monitoring progress towards achieving disease control and elimination goals;
- Providing evidence that, in countries with low measles incidence, the absence of reported cases is attributable to the absence of the disease rather than to inadequate detection and reporting.

The main components of an effective surveillance system are: detection, notification and investigation of suspected cases using standard case definitions; specimen collection, shipment and testing at proficient laboratory with timely reporting of results; and linking laboratory and surveillance data, timely reporting, data analysis and taking action on data.

4.1 Case detection and reporting

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

The routine reporting of communicable diseases (e.g. the disease notification system) is the backbone of measles surveillance in the country. It is essential to maintain high quality measles and rubella surveillance within an integrated vaccine preventable disease (VPD) surveillance system.

All Atoll hospitals/Health centres and Public Health Units are considered as “Reporting Sites” for reporting on weekly basis. Prominent private hospitals or practitioners should also be included in the network since they may be the first one to see a suspected case. Reporting Sites are required to report all suspected cases immediately. Efforts should also be made by the Public Health Unit of the Atolls and islands to actively review the records and registers of the hospitals every week, looking for cases of fever and rashes in OPD/Indoor records before preparing the weekly report (Active Case Search). If any such case is found missed, it should be located, investigated and if it fits the suspected case definition, it is to be reported and sample collected for confirmation. However, if no suspected cases are identified, sites should still send a report to HPA, once a week, the so-called “zero-case reporting” or negative reporting on the prescribed format as attached herewith as *annexure 9.4.*

All suspected dengue cases with fever and rash confirmed as negative by rapid diagnostic test should also be reported for investigation as a suspected Measles or Rubella case. This includes filling in of Measles and Rubella(MR) case investigation form(CIF) and sending serum samples to laboratory for Measles rubella IgM along with the throat swab.

4.2 Case Investigation

Epidemiologists/ clinician or specially trained health staff are responsible for case investigation preferably within 48-hours of case reporting in each Atoll. A reported suspected case is investigated using standard Measles Rubella Case Investigation Form (MR-CIF) attached herewith as *annexure 9.1*

At first contact, both serum sample (blood) and throat-swab for virology are collected from the suspected case and is shipped to the MR lab at Male' (IGMH). Serum sample are best if collected within 28 days of onset of rash and throat swab for virology are best if collected within 5 days of onset of rash.

4.3 Unique Case Identification Number:

A unique case identification number will be given to each suspected case by the Health Protection Agency. This case number begins with three-letter combination to designate the country (**MAV**), two-three letters to represent the geographic location (**Atoll**), followed by disease indication (e.g. **MR** for measles and rubella), and followed by two letters for the **year** and the **case number** in three digits. All communications and forms related to the case should cite the unique case identification number. Even the lab will use this number for record and communication.

e.g.: MAV-BAA-MR-16-001

4.4 Specimen collection and transportation

Whenever measles/rubella is suspected, health care workers should secure specimens for laboratory confirmation.

Serology: A blood sample should be collected on first contact with the patient on each Atoll. As the likelihood of detecting IgM antibodies decreases with time, blood specimens must be collected within 28 days of rash onset. Shipment of the serum sample after separating from the whole blood to IGMH laboratory should take place as soon as possible with all due care.

Virology: Data on viral genotypes are critical for tracking transmission pathways, investigating suspected vaccine-related suspected cases, documenting the elimination of endemic strains, and supporting the hypothesis of importations from other Regions. Therefore, specimens for viral detection and isolation should also be collected on first contact with the patient. Throat swabs are the preferred sample for viral detection/isolation for both measles and rubella viruses and are best if done within 5 days of the onset of rash. For further genotyping, the samples should be sent to Regional Reference Laboratory in Bangkok.

The details of sample collection procedure are outlined in Annex 9.5

4.5 Case classification

Classification of a suspected case of measles and rubella is done by the HPA at National Level. The classification is done on the following basis:

- Based on Laboratory Confirmed or Epidemiologically Linked or Clinical
- Based on Origin as Endemic, Imported, Import related or Unknown

All classification of cases should have both the above mentioned components.

Based on Laboratory Confirmed or Epidemiologically Linked or Clinical

a. Laboratory-confirmed measles, or rubella, case: a suspected case of measles, or rubella that has been confirmed by a proficient laboratory.
b. Epidemiologically -linked confirmed measles, or rubella, case: a suspected case of measles, or rubella, that has not been confirmed by a laboratory but was geographically and temporally related, with dates of rash onset occurring between 7 and 21 days apart for measles (or 12–23 days for rubella) to a laboratory-confirmed case or, in the event of a chain of transmission to another epidemiologically confirmed measles, or rubella, case.
c. Clinically compatible measles case: a case with fever and maculopapular (non-vesicular) rash and at least one of cough, coryza or conjunctivitis, for which no adequate clinical specimen was taken and which has not been linked epidemiologically to a laboratory-confirmed case of measles or another laboratory-confirmed communicable disease. Large number of clinical compatible measles cases are indication of failure of laboratory supported surveillance system
d. Clinically compatible rubella case: A case with maculopapular (non-vesicular) rash and fever (if measured) and one of arthritis/arthralgia or lymphadenopathy, for which no adequate clinical specimen was taken and which has not been linked epidemiologically to a laboratory-confirmed case of rubella or another laboratory-confirmed communicable disease.
e. Non-measles, non-rubella discarded case: a suspected case that has been investigated and discarded as non-measles and non-rubella case using (a) laboratory testing in a proficient laboratory or (b) epidemiological linkage to a laboratory-confirmed outbreak of another communicable disease that is neither measles nor rubella.

Based on origin of the virus:

a. Endemic measles, or rubella, case: a laboratory or epidemiologically- linked confirmed case of measles or rubella resulting from endemic transmission of measles, or rubella, virus.
b. Imported measles, or rubella, case: A case exposed to measles, or rubella, outside the region or country during the 7–21 days (12–23 days for rubella) prior to rash onset and supported by epidemiological or virological evidence, or both. (Note: for cases that were outside the Region or country for only a part of the 7–21 day interval [or 12-–23 days for rubella] prior to rash onset, additional evidence including a thorough investigation of contacts of the case is needed to exclude a local source of infection.)
c. Import-related measles, or rubella, case: a locally acquired infection occurring as part of a chain of transmission originating from an imported case as supported by epidemiological or virological evidence, or both. (Note: if transmission of measles cases related to

importation persists for ≥ 12 months, cases are no longer considered to be import-related, they are considered to be endemic.)

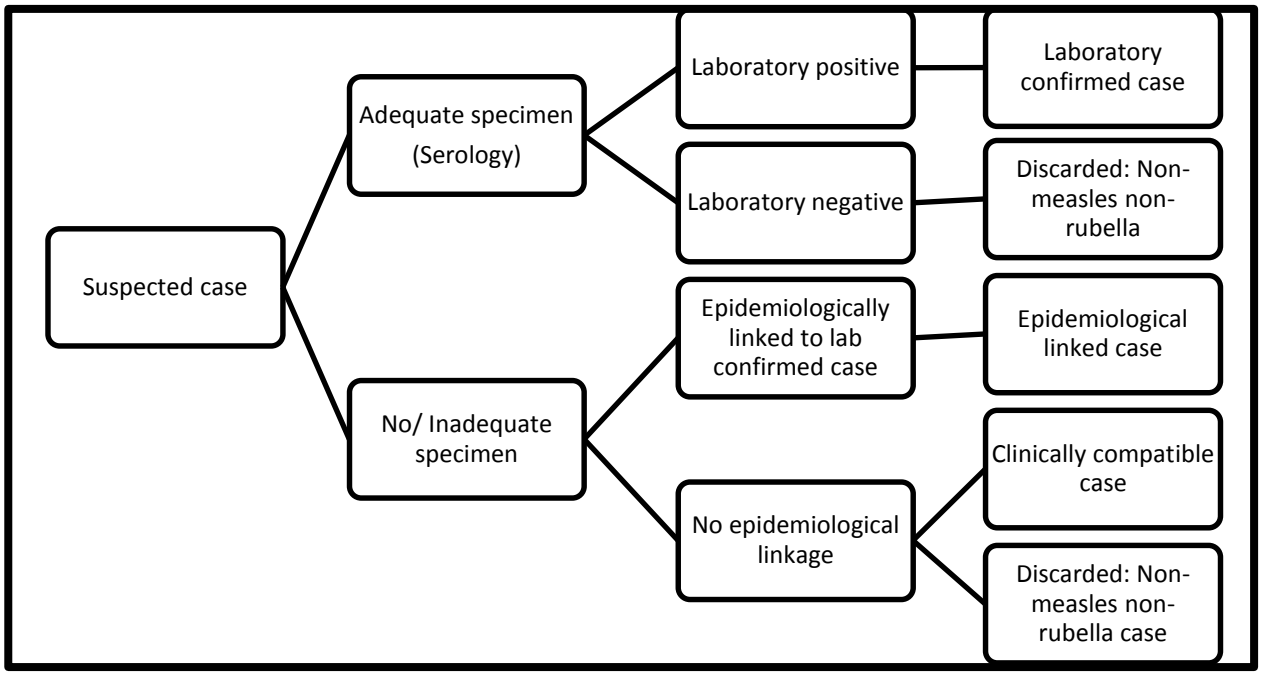
d. Unknown source measles, or rubella, case: a confirmed case for which an epidemiological or virological link to importation or to endemic transmission cannot be established after a thorough investigation.

Sometimes health workers may also encounter cases of fever and rashes around the date of immunization of the child and thus is important to identify if it is vaccine associated or due to natural measles infection. The following criteria apply:

Measles vaccine-associated illness is diagnosed when a suspected case that meets all five of the following criteria:

(i) the patient had a rash illness, with or without fever, but did not have cough or other respiratory symptoms related to the rash;
(ii) the rash began 7–14 days after vaccination with a measles-containing vaccine;
(iii) the blood specimen, which was positive for measles IgM, was collected 8–56 days after vaccination;
(iv) thorough field investigation did not identify any secondary cases; and
(v) Field and laboratory investigations failed to identify other causes.

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



4.6 Case management

There is currently no specific treatment for measles infection. Administration of vitamin A to children with measles has been shown to decrease both the severity of disease and the case-fatality rate, and WHO recommends that vitamin A be administered to all children with acute measles. One dose (50,000 I.U. for infants aged less than 6 months, 100,000 I.U. for infants aged

6–11 months, and 200,000 I.U. for children aged ≥ 12 months) should be administered on the day of suspected measles diagnosis and one dose should be administered the following day. If the child has clinical signs of vitamin A deficiency (such as Bitot's spots), a third dose should be given 4–6 weeks later.

Supportive treatment should be provided for a number of measles complications. All cases of measles don't require hospitalization and can be managed at home. For uncomplicated cases, fluids (such as oral rehydration solution), antipyretics, and nutritional therapy are commonly indicated. Many children require four to eight weeks to fully recover their pre-measles nutritional status. Other measles complications, such as diarrhoea, pneumonia, and otitis media, should be treated as per the national guidelines.

All hospitalized cases of measles should be isolated to prevent further transmission inside the hospital.

4.7 Public health response to a case/outbreak of measles/rubella

Every single case of measles or rubella is considered as an outbreak and evokes public health response. The public health response should include:

a. Contact tracing: Conduct contact tracing to identify the source of infection and determine whether other areas have been exposed or are also experiencing outbreaks. Identify all people the case had contact with during the time he/she was contagious; make a line-listing of these contacts, including their names and addresses, and determine whether they are or were ill (Use form in *Annexure 9.2*). This could include school mates, frequent visitor to the family like maids, teachers, etc. who came to the house within the most infectious period (4 days before and after the eruption of rash). Follow-up should be done to determine if a contact subsequently became ill. If so, laboratory specimens should be collected.

b. Community survey to Enhance case based surveillance and Active case-searches: In response to confirmed cases of measles or rubella active case searches should be conducted to detect unreported cases to ensure that all cases are identified and reported. Such searches should be conducted in the entire island or a perimeter of an entire atoll depending upon a local epidemiological assessment mostly within the radius of 100-–1000 meters from the confirmed case. In addition, health facilities should also be included for active case searches. In health facilities, health staff interview and review registration records, discharge diagnoses, and hospital charts etc. should be performed to identify patients with fever and rash illnesses and their final diagnosis. Any cases that report to have measles or rubella in the last 30 days should be included as a case of measles in the community survey. (*Annexure 9.3*)

c. Survey of population immunity/gaps: review of coverage trend for MCV1 and MCV2, review coverage of MCV SIA or other Periodic Intensification of Routine Immunization (PIRI) if any in the area, identify any immunity gaps, specially focus on any hard-to reach population.

d. Enhancing population immunity against measles and rubella: conduct an ORI or SIA based on epidemiological data. All individuals (up to 45 years of age) who were found to be unimmunized and those who cannot produce immunization card or records during the **community survey** should be vaccinated with measles and rubella containing vaccine according to the national recommendation.

e. Isolation of suspected cases: Children with mild illness may preferably be managed at home without compromising on access to health care and avoiding contact with other vulnerable children. Seriously ill children should preferably be hospitalized for proper management. Since measles virus is highly infectious, all hospitalized children with suspected measles should be cared in isolation facility. School going children and adults working should avoid public places and remain confined at home for at least five days after the onset of the rashes.

4.8 Data collection and interpretation

It is important that the data is systematically collected and compiled at every level and completed data is made available for verification. Whether or not the information system is computer-based, it should cover case tracking and site reporting. At the national and atoll levels there should be a system that is capable of tracking all reported suspected cases until they are either confirmed or discarded (case tracking). At the national level, essential information, as presented in the *Suspected Case Line-listing*, should be available for monitoring the basic surveillance indicators of the program.

At the national level a system capable of keeping track of the reporting sites/Atolls should be in place. At a minimum, the submission of weekly reports, including negative reporting, and the timeliness of those reports (on time or late) should be regularly recorded for each unit/atoll.

At the island level, the public health unit will send the “weekly Health Facility Report”(annexure 9.4) on every Sunday, after conducting active case search, to the Atoll Public Health Unit on regular basis even when no suspected case of measles/rubella is identified.

At the Atoll level, the public health unit will conduct active case search in the hospital OPD and indoor case records looking for any missed suspected cases and will prepare the “weekly Health Facility Report” on every Sunday using Annexure 9.4. The atoll PH unit will compile the report of islands and Atoll hospital on Annexure 9.5 and will sent to HPA on every Tuesday. Thus, every Atoll PH Unit will maintain the record of weekly reporting (Zero reporting) for every island under them along with the case investigation forms of suspected measles/rubella cases duly completed at every step, Laboratory results and the line list of suspected cases reported.

The Reporting sites at Atoll and Island level will use the surveillance calendar (*Annexure 9.6*) for determining the period of the week under reporting.

At the national level the HPA will monitor the timeliness of weekly reporting and will maintain the line list of all the suspected measles/rubella cases reported. HPA will also ensure that the laboratory results are entered in the CIF and line listing and the cases are finally classified. They will be maintaining the distribution of suspected cases on spot maps. The performance of all

Atolls/Reporting Sites will be assessed on various indicators of surveillance on regular basis so as to maintain the high quality of surveillance necessary for the elimination verification and certification.

4.9 Data analysis

Each Atoll will be part of the weekly reporting system and should report on suspected measles/rubella occurrence on a regular basis. Data should be analysed and presented in a standardized format. At a minimum, it should include: weekly numbers of reported cases and case rates; laboratory results; final diagnoses of discarded cases; age distribution of cases; vaccination status; geographic distribution (urban versus rural).

Data from the case investigation forms and line-listings should be analysed to monitor reported suspected and confirmed cases by age, sex, location, and vaccination status as well as to determine whether standards for case reporting and investigation are being met.

- Age distribution: Age distribution of cases permits health authorities to detect any changes in the epidemiology of the disease and to establish which age groups to target for vaccination.
- Geographic location: Cases should be plotted on a map according to their place of residence, and the map compared with vaccination coverage data and sites reporting in the surveillance system. These maps can be useful for coordinating activities, such as setting up vaccination sites.
- Source of infection: This information will help to identify areas where the measles/rubella virus is still actively circulating.
- Source of notification: This information will help to determine whether improvements are needed regarding personnel notifying suspected cases. For example, if cases are being notified only from public health facilities, then additional contacts with private medical doctors and private clinics are required.
- Vaccination history of cases: Accurate information on the vaccination history of confirmed cases is essential for evaluating vaccine effectiveness and detecting potential problems with the cold chain.

At the National level, periodically a bulletin should be issued with results on suspected and confirmed cases. In addition, this bulletin should indicate the number of units reporting each week (including negative reporting). Information about the current epidemiology of acute flaccid paralysis, neonatal tetanus, and other EPI target diseases could also be included, and bulletins should be distributed to all health care providers and other interested health care personnel on a weekly or monthly basis.

5. Role and responsibilities for measles and rubella surveillance

In establishing and conducting measles, rubella and CRS surveillance activities, the role and responsibilities of health workers and authorities at different levels of health care system need to be defined and reporting procedures developed.

5.1 Role of Ministry of Health

To provide a stewardship role and ensure all support required for the measles and rubella elimination goal is available to the program.

5.2 Role of Health Protection Agency

Public Health Surveillance Section of Health Protection Agency is the responsible body for co-coordinating and strengthening measles, rubella and CRS surveillance in the Maldives. Main roles include:

- Develop and distribute surveillance guidelines including case definitions, reporting forms and case investigation
- Support data management and electronic reporting from atoll to national level and send weekly report to WHO and ensuring consistency and validity of national data; maintain all case details and results of measles, rubella and CRS cases for reference and reporting;
- Monitor surveillance performance using standard indicators;
- Supportive supervision
- Facilitate training and awareness on measles, rubella and CRS surveillance to clinicians and public health units;
- Report cases and outbreaks, Investigate suspected cases of measles, and manage cases appropriately collect, consolidate, analyse and interpret surveillance data; monthly bulletin
- Liaise with Laboratories and Public health units in facilitating sample collection and sending samples.

5.3 Role of public health units

Public Health units in Islands and Atolls are responsible for overall coordination of measles, rubella and CRS surveillance within the health facilities and liaise with lab and HPA. Roles include:

- Active case search through weekly review of hospital medical records and meeting with the hospital management, nursing department and medical services team (doctors/clinicians) and laboratory team to review any suspected case of fever and rash has been missed on a weekly basis.
- Ensure weekly reporting to HPA even when no suspected cases are reported.
- Ensure detection and reporting of cases and outbreaks using the standard case definition, Investigate suspected cases of measles, rubella and CRS, and manage cases appropriately;
- Collect, consolidate, analyse and interpret surveillance data.
- Even though there are no cases, evaluate Daily Surveillance data to ensure zero reporting of measles and rubella and CRS on a daily basis to SIDAS or atoll hospital;
- Ensure blood specimens are collected for serologic confirmation from all suspected cases of measles, rubella and CRS. Serum is separated from the whole blood and transported to the national laboratory.
- Ensure that throat swabs are taken for purposes of determining the circulating viral strains for all suspected cases;

- Conduct good quality measles outbreak investigation; includes prompt investigation once the outbreak, conducting active case finding in the community and line listing of all cases with essential variables like age, vaccination status and address,
- Conduct public health response as outlined in the guide for all confirmed cases of measles or rubella.
- Produce routine reports; maintain all case details and results of measles, rubella and CRS cases and feed data forward to the next level (i.e. HPA or Atoll PHU).

5.4 Role of clinicians at health facilities

Clinicians have vital roles in establishing surveillance for measles, rubella and CRS in Maldives.

- Identification of suspected case- physician starts surveillance by identification of suspected cases based on case definition;
- Notification- inform public health unit once a case is suspected so that active case search can be carried out by the public health unit in the community to find out more of similar cases;
- Investigation- fills up the case investigation form (CIF) at first contact. Date of investigation is when the case investigation form of measles, rubella/CRS is filled by the clinician. Inform Public Health Unit to ensure that samples have been collected and sent to national laboratory at IGMH.
- Participate in the weekly meeting with public health unit to review medical records and identify any case of fever and rash missed during the week.

5.5 Role of peripheral/atoll laboratory

- Sample collection as per the guidelines
- Preparation of sample, storage and packaging for transport
- Liaison with HPA /IGMA laboratory for sample transport
- Participate in the weekly meeting with the Public Health Unit to review records and identify any cases of fever and rashes missed during the week.

5.6 Role of Laboratory

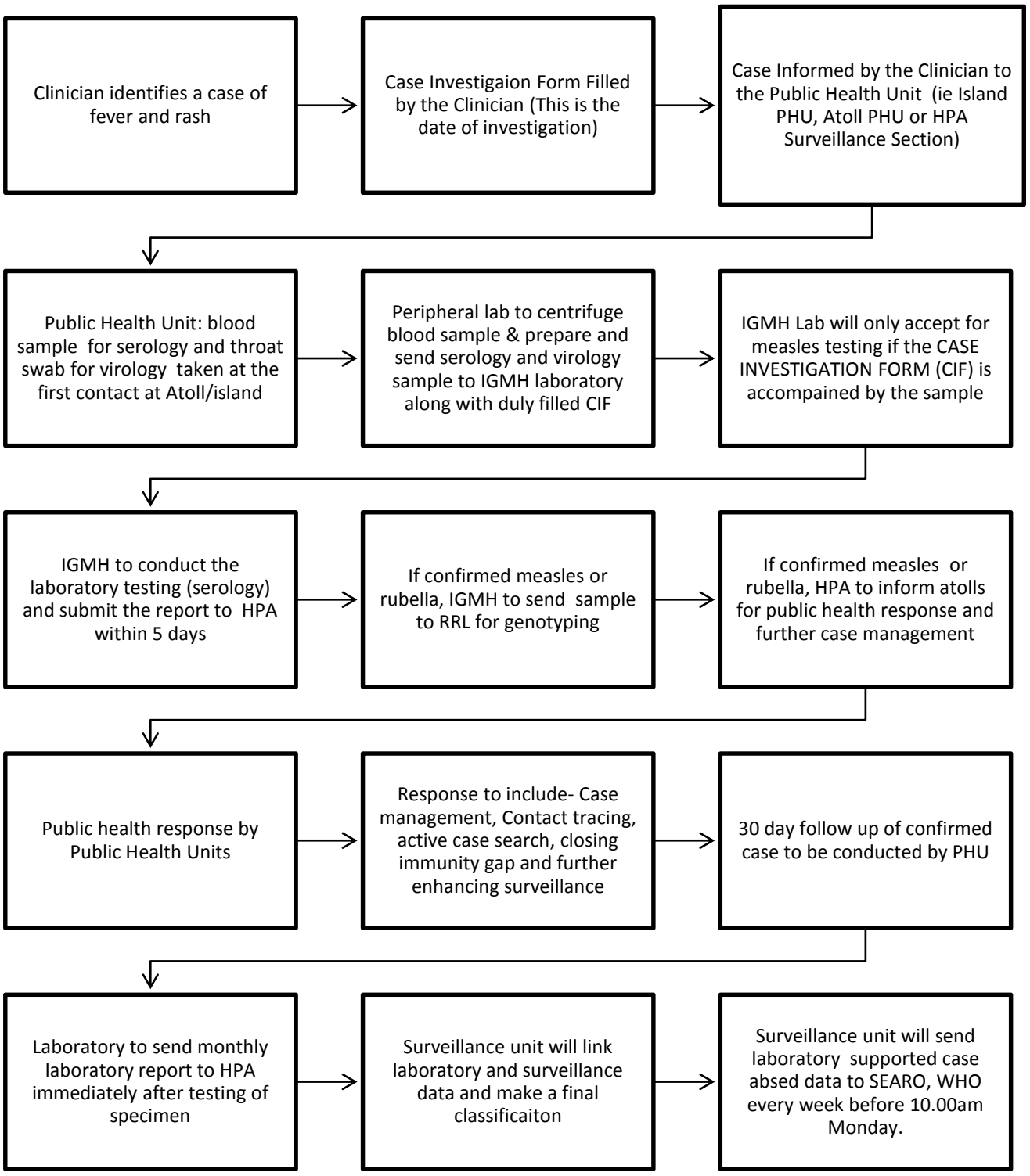
The laboratory plays a central role in the confirmation of suspected measles, rubella/CRS cases and outbreaks, and in the identification of circulating strains of measles and rubella viruses. Information regarding the circulating strains is useful to track importations of measles virus when a country is in the elimination phase. Laboratory at IGMH is WHO accredited and proficient laboratory for measles and rubella testing. All samples must be sent to IGMH Laboratory.

Molecular analysis is important to provide information on the origin of virus and to distinguish between wild type virus infection and infection related to recent vaccination. The key roles of IGMH laboratory are:

- Testing of samples of suspected cases of fever and rash according to guidelines
- Reporting of laboratory results of serology and virology to HPA
- Packaging and liaising with HPA for transporting positive samples to RRL, Thailand for genotyping

- Report any suspected cases of measles or rubella to HPA that directly present to the laboratory for further investigation of the case. (Cases of fever and rash from private sector or personally for testing directly presenting to IGMH)

6. Flow-Chart for Maldives Measles and rubella surveillance



7. Measles and rubella surveillance performance indicators[1]

Monitoring and evaluation of surveillance system over time is necessary to identify areas that need strengthening and to verify the relevance and quality of the information obtained.

WHO has defined a set of core indicators for monitoring surveillance performances of measles and rubella. Together with surveillance indicators, indicators for monitoring progress towards elimination are helpful in determining the current status and activities needed for elimination.

Indicator	**Description**
Disease incidence (i) Annual incidence of confirmed measles cases (ii) Annual incidence of confirmed rubella cases	The numerator is the confirmed number of measles or rubella cases for the year and the denominator is the population in which the cases occurred multiplied by 1 million. When the numerator is zero, the target incidence would be zero.
Indicators for high quality of epidemiologic surveillance of measles and rubella	
Proportion of surveillance units reporting measles and rubella data to the national level and on time (target: ≥ 80%)	The ***numerator*** is the number of surveillance units reporting on time and The ***denominator*** is the total number of surveillance units in the country multiplied by 100. *[Remember that each reporting unit will report 52 times a year].*
reporting rate of non-measles non-rubella cases at the national level (target: ≥ 2 per 100 000 population)	The ***numerator*** is the number of discarded non-measles non-rubella cases (also include all dengue positive cases with fever and maculopapular rash reported at national level as discarded) The ***denominato***r is the total population of the country multiplied by 100 000.
proportion of second administrative level units reporting at least two non-measles non-rubella case per 100 000 (target: ≥ 80% of second-level administrative units)	The ***numerator*** is the number of subnational units reporting at least two discarded non-measles non-rubella cases per 100 000 and (also include all dengue positive cases with fever and maculopapular rash reported at national level as discarded) The **denominator** is the total number of subnational units multiplied by 100.

[1] (Ref WHO SEAR Elimination verification guideline)

Indicator	Description
	Note: If the administrative unit has a population < 100 000, the rate should be calculated by combining data over more than 1 year for a given administrative unit to achieve ≥ 100 000 person–years of observation.
proportion of suspected cases with adequate investigation[2] (target: ≥ 80% of suspected cases)	The **numerator** is the number of suspected cases of measles or rubella for which an adequate [2] investigation was initiated within 48 hours of notification and The **denominator** is the total number of suspected measles and rubella cases, multiplied by 100.
proportion of suspected cases with adequate specimen collection[3] (target: ≥ 80% of suspected cases, excluding epidemiologically linked cases)	The **numerator** is the number of suspected cases from whom adequate specimens[3] for detecting measles or rubella were collected and tested and The **denominator** is the total number of suspected measles or rubella cases multiplied by 100. [Epidemiologically linked cases should be removed from the denominator].
Proportion of specimens received at the laboratory within 5 days of collection (target: ≥ 80%)	The **numerator** is the total number of specimens received in the laboratory within 5 days of collection and The **denominator** is the total number of specimens received by the laboratory multiplied by 100.
Proportion of laboratory-confirmed chains of transmission (defined as two or more confirmed measles cases) with specimens adequate for detecting measles virus collected and tested in an accredited laboratory (target: ≥ 80%)	The **numerator** is the number of chains of transmission for which adequate samples have been submitted for viral detection and The **denominator** is the number of chains of transmission identified. Note: Where possible, samples should be collected from at least 5–10 cases early in a chain of transmission and every 2–3 months thereafter if transmission continues. For virus

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

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

Indicator	Description
	isolation, adequate throat or urine samples are those collected within 5 days after rash onset. For virus detection using molecular techniques, adequate throat samples are those collected up to 14 days after onset of rash, and adequate oral fluid samples are those collected up to 21 days after onset of rash.
Indicators and suggested targets for laboratory performance	
Proportion of measles and rubella network laboratories that are WHO-accredited [4] for serologic and, if relevant, for virology testing (target: 100% of laboratories)	The ***numerator*** is the total number that is WHO-accredited for virology and serologic testing and the ***denominator*** is the total number of labs (private and public) testing for MR in the geographic region.
Completeness and timeliness of monthly reporting (including zero reporting) to the WHO Regional Office for specimens received for serologic and virology testing (target: ≥ 80% of specimens received in the laboratory)	
Proportion of specimens with serologic results reported by the laboratory within 4 days of receiving the specimen (target: ≥ 80% of specimens received)	The ***numerator*** is the total number of specimens for which laboratory results were available within four days of receiving the specimen and The ***denominator*** is the total number of specimen received for testing multiplied by 100, in the given year.
Proportion of laboratories (government and private) that conduct measles and rubella diagnostic testing that have adequate quality assurance mechanisms in place (target: 100% of laboratories)	The ***numerator*** is the total number of laboratories (government and private) that conduct measles diagnostic testing that have adequate quality assurance mechanisms in place and The ***denominator*** is the total number laboratories (government and private) that conduct measles diagnostic testing multiplied by 100, in the given year.

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

Indicator	Description
Proportion of virus detection and genotyping results (where appropriate) that are completed within 2 months of receipt of specimen (target: ≥ 80% of specimens received)	The ***numerator*** is the total number of virus detection and genotyping results (where appropriate) that are completed within 2 months of receipt of specimen and The ***denominator*** is the total number of specimen received for testing multiplied by 100, in the given year.

8. Contact List

Organization	Name of Member	Contact Details	Email
Health Protection Agency	Ibrahim Nishan Ahmed Public Health Surveillance Section	+960 7512240 +960 3014496 +9603014333	nishan.ahmed@health.gov.mv
IGMH Laboratory	Sadha Senior Lab Technologist	+9609766877	sa@mhsc.gov.mv

9. Annex

9.1 Measles /Rubella Case Investigation Form

Measles and Rubella Case Investigation Form
Health Protection Agency, Maldives

Part A: To be filled in by Clinicians reporting the case

This form should be completed for each case of fever and maculopapular rash on first contact

Reporting Institution:		**Case ID (HPA)** MAV- __ __- MR – 17 - __ __ __
Date of investigation: ___/____/_____		**Date of notification PHU/HPA:** ___/____/____
Patient National ID card Number Foreigners Passport number	**Date of Birth:** ___/____/_____ **,Age:** (yy/mm)	**Sex:** ☐ Male ☐ Female Pregnant: Yes ☐ No☐ NA☐ If Yes, No of weeks……..
Name of the patient: **Father's name:**		**Contact Number:**
Address:		**Atoll:** **Island:**

Criteria for suspected Measles/Rubella case:
1. Fever ☐Yes ☐No ☐Unknown
2. Date of onset of fever: ___/____/____
3. Maculopapular rash onset date ___/____/_____

Other findings if any;
1. Cough ☐Yes ☐No ☐Unknown
2. Coryza ☐Yes ☐No ☐Unknown
3. Conjunctivitis ☐Yes ☐No ☐Unknown
4. Adenopathy ☐Yes ☐No ☐Unknown
5. Arthralgia ☐Yes ☐No ☐Unknown

Any other _____

Vaccination History (by card/history):

Measles containing vaccine (MCV) ☐ Yes: ☐No: reason:_____ No of doses _____, Date of last ose:_____ **Vitamin A:** _____	**Rubella containing vaccine (MMR)** ☐ Yes: ☐No: reason:_____ No of doses _____, Date of last dose:_____ **Vitamin A:** _____
Travel History (7-21 days before the onset of rash): ☐Yes ☐No. If yes, place/country visited …….. from…….. …… to ……..	**Hospitalization:** Yes☐ No☐ If Yes, Name of hospital…….. DOA……. DOD …….. **Final Status:**☐ Recovered ☐ Referred ☐ Died ☐Unknown

Case notified by: Name of the Notifier: **Position :**
Signature: **Date:**

Part B: To be filled by peripheral and IGMH laboratory

Serum Sample collection	**IGMH Lab ID:** _____	**Virology Sample collection**	**IGMH Lab ID:** _____
Specimen collected	☐Serum ☐No	Specimen collected	☐Throat swab ☐No
Collected at		Collected at	
Date of collection		Data of collection	
Date sent to IGMH lab		Date Sent to IGMH lab	
Date Received by IGMH lab		Date Received by IGMH lab	
Adequate sample	☐Yes ☐No	Adequate sample	☐Yes ☐No
Date of result		**Date of result**	
Result (IgM): **☐Measles** ☐Negative ☐Positive ☐ Equivocal ☐Pending ☐not tested **☐Rubella** ☐Negative ☐Positive ☐ Equivocal ☐Pending ☐not tested		**Result :** **☐Measles** ☐Negative ☐Positive **☐Rubella** ☐Negative ☐Positive	
		Genotype Result	**☐Measles ☐Rubella**
		Date of result sent to HPA	

Part C: To be filled by Health Protection Agency

Final Classification: ☐ Confirmed Measles ☐ Confirmed Rubella ☐ Discarded **Basis for classification:** ☐Laboratory ☐Epidemiological Linked ☐ Clinical **Source of infection:** ☐Endemic ☐ Imported ☐Import-related ☐Unknown Reason for discard…….	**FOLLOW UP for confirmed cases:** Contact tracing done? ☐Yes ☐No If yes, number of additional suspected cases detected: _____ Active case search done? ☐ Yes ☐No If yes, number of additional suspected cases detected: _____ Outcome at 30 days follow-up for confirmed cases: ☐Alive ☐Died ☐ Lost to follow-up

Contact Health Protection Agency Surveillance 3014496 or 3014333

9.2 Measles rubella contact tracing form

Annex 9.2: Contact Tracing form

Atoll:_____ Health Centre:_____ Block:_____

Date of investigation:_____ Supervisor name:_____ Investigator name:_____

Outbreak ID:____ ____ ____ ____ Survey Dates:_____

ALL HOUSEHOLD MEMBERS / WORKERS AND REGULAR VISITORS						ONLY SUSPECTED CASES (Onset between _____ & _____)						
(1) Name	(2) Birth date	(3) Sex (M/F)	(4) Total number of measles vaccine doses	Date of last dose	(5) Suspected measles case (Yes/No)	(6) Date of rash onset	(7) Samples taken: serum, naso-pharyngeal aspirate, throat swab, urine	(8) Places visited 7-21 days before rash onset (possible exposure sites)	(9) Date(s) of investigation of places described in column 8	(10) Places visited four days before to four days after rash onset	(11) Date(s) of investigation of places described in column 10	(12) Other information (e.g., death, occupation, contact with tourist)

NOTE: This form is to be used for contact tracing of every confirmed Measles/Rubella case.

9.3 Measles rubella community survey form

RESPONSE TO A CASE OF CONFIRMED MEASLES/RUBELLA : COMMUNITY SURVEY

Locality name: _____ **Date of search:** _____ **Team No.:** _____

Health Centre: _____ **Atoll:** _____

Search done by: _____ **Surveyors Names:** _____

Outbreak ID: _____ **Supervisor's Name:** _____

	House No. :											Total
Age Group	**Category**	**Vaccinated**										
<1 year	Measles											
	Non-measles											
1-4 years	Measles											
	Non-measles											
5-9 years	Measles											
	Non-measles											
10-14 years	Measles											
	Non-measles											
≥ 15 years	Measles											
	Non-measles											
Age Group	**Category**	**Unvaccinated**										
<1 year	Measles											
	Non-measles											
1-4 years	Measles											
	Non-measles											
5-9 years	Measles											
	Non-measles											
10-14 years	Measles											
	Non-measles											
≥ 15 years	Measles											
	Non-measles											
Age Group	**Category**	**Vaccination status unknown**										
<1 year	Measles											
	Non-measles											
1-4 years	Measles											
	Non-measles											
5-9 years	Measles											
	Non-measles											
10-14 years	Measles											
	Non-measles											
≥ 15 years	Measles											
	Non-measles											

Note: 1) All persons who presently have measles or in the recent past (last 3 months) had measles should be recorded as measles case

2) Number of death due to measles should be counted as measles case also. Give details of deaths on the reverse of the form

3) This form should be used for selected outbreaks

Weekly Health Facility Report

Measles/Rubella and Acute Flaccid Paralysis (AFP) Surveillance

(This report is to be prepared after Active case search of indoor and OPD records in Atoll and Island hospitals or private/Govt. Hospitals.
If no case is reported, Mention "Nil" and send the Zero report on every Sunday.)

Disease under Surveillance	Presenting Symptoms	Week No.	Period included in the reporting week (From … to …. Using surveillance calendar)	Number of cases reported during the week	Date case notified to HPA	Name of the case reported & National ID Number	Address of the case reported
Measles/Rubella	Fever with maculopapular rash (any age)						
Poliomyelitis	Acute Flaccid Paralysis (AFP) < 15 yrs of age						

This report has been prepared after conducting active case search in indoor and outdoor patient record registers of the health facility

Date Report sent: ..... Name ..... Signature .....

Note: Weekly report is to be submitted by each Island PH Unit to the Atoll Hospital PH Unit on every Sunday for the preceding week, even if there are no suspected cases with fever and rash (for Measles/Rubella) or AFP are identified or reported. The Atoll hospital will compile the report from Islands and send to HPA on every Tuesday.
(The report should include all cases of fever with maculopapular rash irrespective of diagnosis, including suspected cases of dengue, chikunguniya etc. if they have fever with maculopapular rash.)

9.5 Measles Rubella Weekly Surveillance Zero reporting forms

Weekly Atoll Report Annexure 9.4.b

Measles/Rubella and Acute Flaccid Paralysis (AFP) Surveillance

(This report is to be compiled from the weekly report of Atoll and Island hospitals and submitted to HPA
If no case is reported, mention "Nil" and send the report every week)

Name of the Atoll/Island Hospital: ..... Year

Week Period included in the report: From To

Number of: **Cases with Fever and Rash** **AFP**

1. Give details of the cases of Fever with Maculopapular Rash reported this week:

Name of atoll/island hospital	Number of cases reported	Date case notified	Date case investigated	Name of case with father's name	Address of the case/s reported

2. Fill up the information of all the Acute Flaccid Paralysis (AFP) cases reported this week:

Name of atoll/island hospital	Number of cases reported	Date case notified	Date case investigated	Name of case with father's name	Address of the case/s reported

Date Report sent: ..... Name and Signature .....

Note: *Weekly health facility report is to be submitted by each Island PH Unit to the Atoll Hospital PH Unit on every Sunday for the preceding week, even if there are no suspected cases of Measles/Rubella or AFP are reported or identified. The atoll PH Unit will compile the report and send to HPA on every Tuesday of the week.*

(The report should include all those cases with fever and maculopapular rash, irrespective of diagnosis, including suspected cases of dengue, chikunguniya etc. if they have fever with maculopapular rash.)

9.6 Weekly surveillance calendar

WEEKLY SURVEILLANCE CALENDAR for Measles and AFP

2017

1st Quarter

Week Number	Beginning Sunday	Ending Saturday
1	01-01-2017	07-01-2017
2	08-01-2017	14-01-2017
3	15-01-2017	21-01-2017
4	22-01-2017	28-01-2017
5	29-01-2017	04-02-2017
6	05-02-2017	11-02-2017
7	12-02-2017	18-02-2017
8	19-02-2017	25-02-2017
9	26-02-2017	04-03-2017
10	05-03-2017	11-03-2017
11	12-03-2017	18-03-2017
12	19-03-2017	25-03-2017
13	26-03-2017	01-04-2017

2nd Quarter

Week Number	Beginning Sunday	Ending Saturday
14	02-04-2017	08-04-2017
15	09-04-2017	15-04-2017
16	16-04-2017	22-04-2017
17	23-04-2017	29-04-2017
18	30-04-2017	06-05-2017
19	07-05-2017	13-05-2017
20	14-05-2017	20-05-2017
21	21-05-2017	27-05-2017
22	28-05-2017	03-06-2017
23	04-06-2017	10-06-2017
24	11-06-2017	17-06-2017
25	18-06-2017	24-06-2017
26	25-06-2017	01-07-2017

3rd Quarter

Week Number	Beginning Sunday	Ending Saturday
27	02-07-2017	08-07-2017
28	09-07-2017	15-07-2017
29	16-07-2017	22-07-2017
30	23-07-2017	29-07-2017
31	30-07-2017	05-08-2017
32	06-08-2017	12-08-2017
33	13-08-2017	19-08-2017
34	20-08-2017	26-08-2017
35	27-08-2017	02-09-2017
36	03-09-2017	09-09-2017
37	10-09-2017	16-09-2017
38	17-09-2017	23-09-2017
39	24-09-2017	30-09-2017

4th Quarter

Week Number	Beginning Sunday	Ending Saturday
40	01-10-2017	07-10-2017
41	08-10-2017	14-10-2017
42	15-10-2017	21-10-2017
43	22-10-2017	28-10-2017
44	29-10-2017	04-11-2017
45	05-11-2017	11-11-2017
46	12-11-2017	18-11-2017
47	19-11-2017	25-11-2017
48	26-11-2017	02-12-2017
49	03-12-2017	09-12-2017
50	10-12-2017	16-12-2017
51	17-12-2017	23-12-2017
52	24-12-2017	31-12-2017

Note: This calendar is to be used to define week numbers in all Measles & AFP surveillance forms. All weeks begin on Sunday at 00:00 hrs. and end on Saturday at 24:00 hrs.

9.7 Laboratory sample collection, storage and shipment SOPs for measles and rubella

Collecting and handling of blood specimen for serologic confirmation

- Collect 5 ml blood for adults and older children and 1 ml for infants and younger children by venepuncture into a sterile tube labelled with the patient's identification and collection date;
- Fill in case investigation forms completely. Three dates are very important: date of rash onset, date of collection of samples and date of last measles vaccination;
- To separate the serum from red cells, one of the following three methods described below can be employed. To prevent bacterial growth, ensure that the serum is aseptically transferred to a sterile test tube:

1. Let the blood sit at an angle for at least 60 minutes (without shaking or being driven in a vehicle), then pour off carefully or remove the serum by using Pasteur pipette to pour into a sterile test tube and level with patient ID;
2. If a refrigerator is available, put the sample in a refrigerator for 4-6 hours until the clot retracts, then pour off the serum the next morning Don't freeze whole blood;
3. If a centrifuge is available, let the blood sit for 30 minutes, then centrifuge the specimen at 2000 RPM for 10-20 minutes and pour off the serum into a sterile test tube.

Storage and shipment of serum specimens

- Store serum at 4°C −8°C until it is ready for shipment. The serum can be stored in a refrigerator for a maximum 7 days. As a general rule, serum specimens should be shipped to the laboratory as soon as possible.
- Place specimens in plastic bags. Specimens from different patients should never be sealed in the same bag. Place specimen form and investigation form in another plastic bag and tape to inner top of the specimen transport box.
- If using ice packs (these should be frozen), place ice packs at the bottom of the box and along the sides, place specimens at the centre, then place more ice packs on the top. When shipping arrangement is finalized, inform receiver of time and manner of transport.

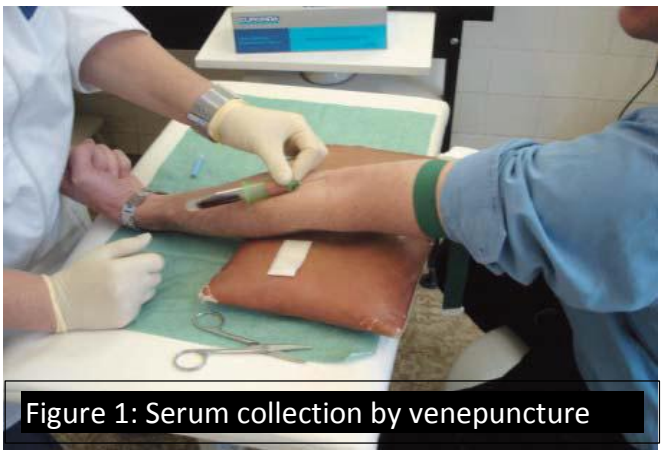
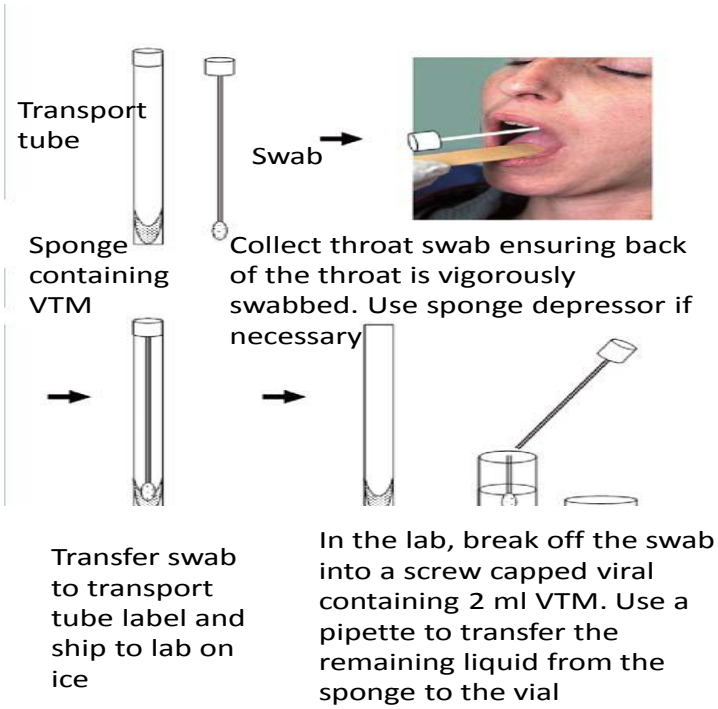


Figure 1: Serum collection by venepuncture

(Photo Courtesy of David Featherstone, World Health Organization)

Handling and transporting throat- swabs for viral isolation

- Nasopharyngeal specimens for viral isolation must be collected as soon as possible after onset and not longer than 5 days after appearance of the rash, when the virus is present in high concentration.
- The patient is asked to open mouth wide and say “ah”. The tongue should be depressed with a spatula and nasopharyngeal swab is obtained by firmly rubbing the nasopharyngeal passage and throat with sterile cotton swabs to dislodge epithelial cells. The swab is then placed in a labelled viral transport tube ensuring that the swab is immersed in the sponge containing the viral transport medium.
- The tube is transported to the laboratory at 4°C – 8°C, using frozen ice packs and appropriate insulated shipping container within 48 hours



Courtesy of David Featherstone, WHO
Figure 3: Technique of nasopharyngeal

9.8 Sentinel site CRS Surveillance

Routine surveillance for CRS should focus on identifying infants less than 1 year of age, although some defects associated with CRS surveillance may not be detectable until older ages. The most common congenital defects related to CRS are cataracts, heart defects, and hearing impairment. These are the primary conditions under CRS surveillance. These conditions are most likely to be seen at secondary and tertiary health care facilities, which should be included as sentinel sites for CRS surveillance.

Case definitions for CRS

Classification of cases for CRS surveillance purposes is based on clinical, epidemiological and laboratory data. The case definitions for CRS surveillance include the following categories:

Suspected CRS case: Any infant less than one year of age in whom a health worker suspects CRS. A health worker should suspect CRS when an infant aged 0-11 months presents with heart disease and/or suspicion of hearing impairment and/or one or more of the following eye signs: white pupil (cataract), or larger eye ball (congenital glaucoma) or pigmentary retinopathy. A health worker should also suspect CRS when an infant's mother has a history of suspected or confirmed rubella during pregnancy, even when the infant shows no signs of CRS.

Clinically confirmed CRS case: An infant in whom a qualified physician detects at least two of the complications listed in (a) below or one in (a) and one in (b):

(a) Cataract(s), congenital glaucoma, congenital heart disease, hearing impairment, pigmentary retinopathy;

(b) Purpura, splenomegaly, microcephaly, developmental delay, meningocephalitis, radiolucent bone disease, jaundice that begins within 24 hours after birth.

Laboratory confirmed CRS case: An infant who is a suspected case (who has 1 condition from group A) who meets the laboratory criteria for CRS case confirmation.

Congenital rubella infection (CRI): An infant who does not have clinical signs of CRS but who has a positive rubella-specific IgM test is classified as having congenital rubella infection (CRI).

Criteria for Laboratory Confirmation of CRS

Laboratory criteria for confirmation of suspected CRS cases include the following:

- Rubella IgM antibody detected, ***or***

- Sustained rubella IgG antibody level as determined on at least two occasions between 6 and 12 months of age in the absence of receipt of rubella vaccine; ***or***
- Rubella virus detection (e.g. nucleic acid detection by RT-PCR or rubella virus isolation) in an appropriate clinical sample (best results come from throat swabs, but nasal swabs, blood, urine, or cerebrospinal fluid specimens are also acceptable).

Efforts should be made to obtain clinical specimens for antibody levels and for viral isolation from infants at the time of the initial investigation. The clinical and laboratory data will be used to determine the final classification of each of the suspected CRS case. Depending of the age of the suspected CRS case at initial testing, the following consideration should be made interpreting laboratory results and determining final classification of suspected CRS cases.

Figure 4-Flow chart for classification of suspected CRS cases less than six months of age

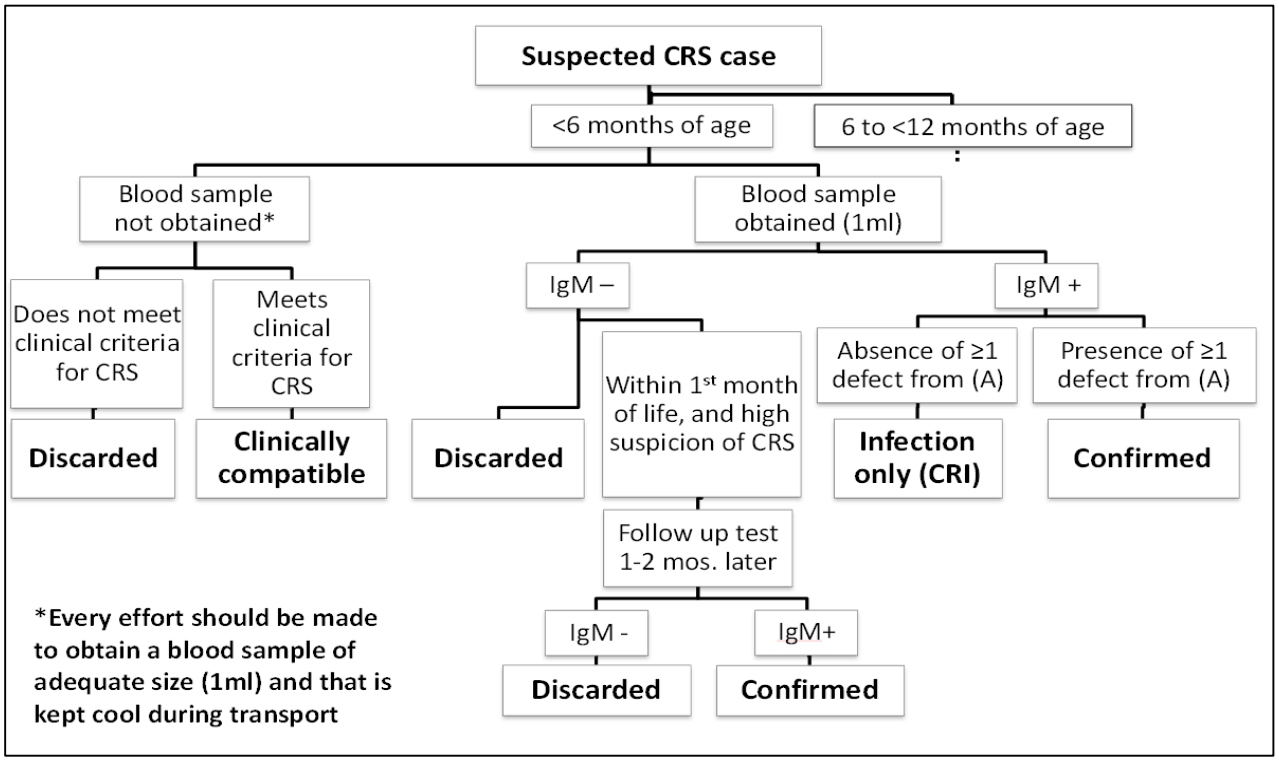
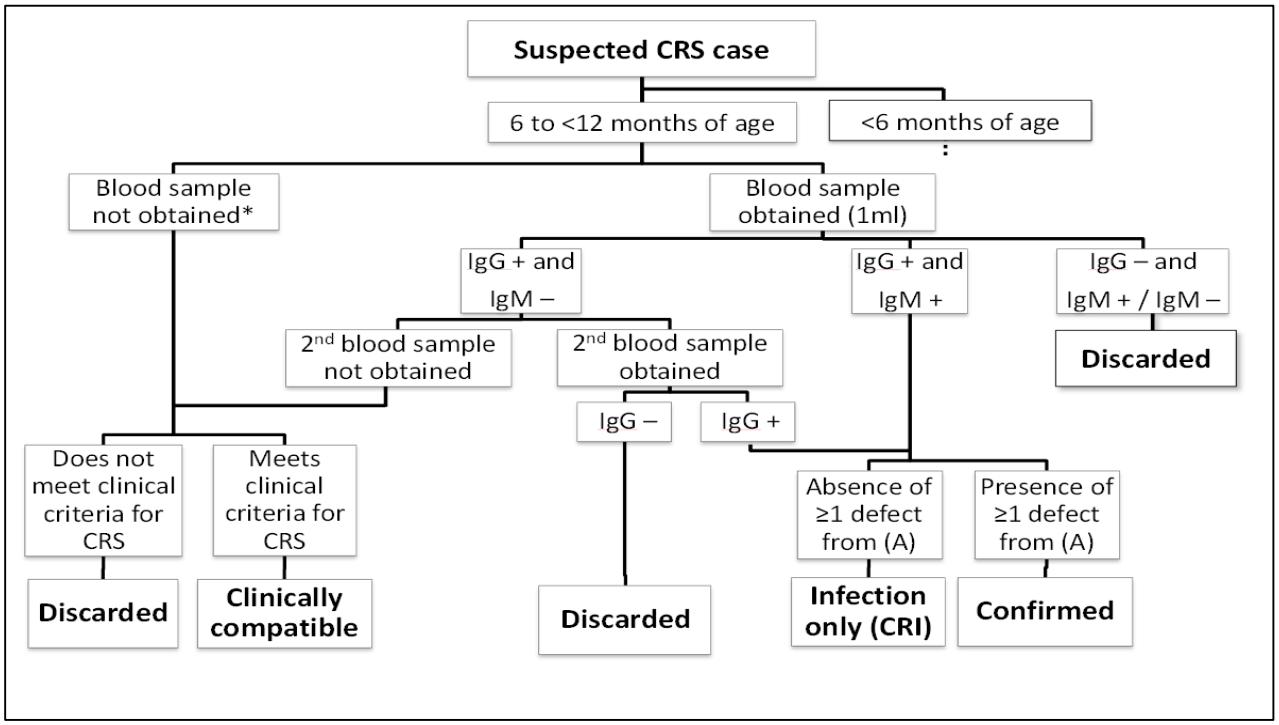


Figure 5-Flow-chart for classification of suspected CRS cases 6-12 months of age.



Steps to establish Sentinel Site CRS Surveillance

1. Identify national CRS surveillance coordinators responsible for epidemiologic and laboratory components of the system.

2. Determine facilities at which infants with CRS are most likely to be seen.

   2.1. Consideration for determining facilities

   2.2 Responsibilities of local surveillance coordinators at sentinel sites include to:

3. Conduct initial and refresher trainings for participating providers

4. Initiate CRS surveillance activities

5. Conduct surveillance quality assessment and monitoring.

6. Expand CRS surveillance and include other sites, as appropriate.

7. Analyse the CRS surveillance data on an annual basis, or more frequently if necessary.

8. Provide feedback to stakeholders involved in the CRS surveillance system.

9. Ensure infection control measure for CRS cases

Additional approach to identify CRS cases: Rubella in pregnancy registries

Rubella in pregnancy registry can be used for follow-up of pregnant women exposed to rubella and their pregnancy outcome(s), as well as for identification of CRS cases. Rubella in pregnancy registries should be maintained at the local level so that comprehensive follow-up of pregnant women can occur, and infants born with CRS can be identified and diagnosed immediately and receive early interventions for any associated defects. The registry should include maternal contact and demographic data and pregnancy outcome (e.g. miscarriage, termination, infant with CRS, etc.).

Key Indicators for CRS Surveillance

Indicator	Description
Reporting rate of suspected CRS cases at the national level (target: ≥ 1 per 10 000 live births)	The ***numerator*** is the number of suspected CRS cases for the year and The ***denominator*** is the live birth cohort of the population in which the cases occurred multiplied by 10 000. When numerator is zero, the target incidence would be zero.
Proportion of suspected CRS cases with adequate investigation (target: ≥ 80% of suspected cases)	The ***numerator*** is the number of suspected CRS cases for which an adequate investigation was initiated after 3 months of age of the child and the ***denominator*** is the total number of suspected CRS cases, multiplied by 100. Adequate investigation defined as the collection of the following data points: name and/or identifier; place of residence; sex; date of birth; date of reporting; date of investigation; date of specimen collection; history of rash illness of mother; travel history of mother; vaccination history of mother; age of mother; clinical examinations for hearing impairment, cataract, and congenital cardiac/heart defects and clinical outcome of the CRS case (alive or dead).
proportion of suspected cases with adequate specimen collection (target: ≥ 80% of suspected cases)	The ***numerator*** is the number of suspected cases from whom adequate specimens [5] for detecting CRS (IgM/IgG) were collected and tested and The **denominator** is the total number of suspected CRS cases multiplied by 100 [epidemiologically linked cases].
proportion of confirmed cases with adequate specimen analyzed for virus	The ***numerator*** is the number of lab-confirmed CRS cases for the year for whom adequate specimen was analyzed for viral detection and

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

Indicator	Description
detection (target: ≥ 80% of confirmed cases)	The ***denominator*** is the total number of lab-confirmed CRS cases, multiplied by 100.
proportion of lab-confirmed cases with at least two negative tests for virus detection after 3 months of age, with at least a 1-month interval between tests (target: ≥ 80% of confirmed cases)	The ***numerator*** is the number of lab-confirmed CRS cases with at least two negative tests for virus detection after 3 months of age, with at least a 1-month interval between tests for the year and The ***denominator*** is the total number of lab-confirmed CRS cases, multiplied by 100.
Proportion of confirmed CRS cases detected within 3 months of birth.	The ***numerator*** is the number of confirmed CRS cases (clinical compatible and laboratory confirmed) detected within 3 months of birth and The ***denominator*** is the total number of lab-confirmed CRS cases, multiplied by 100.

CIF for CRS Surveillance

Congenital Rubella Syndrome (CRS) Case Investigation Form

Health Protection Agency
Male', Maldives

Reporting Institution:

Instructions:

1. This form should be completed for each clinically suspected case of CRS.
2. All cases must have samples collected and sent to IGMH laboratory for testing.
3. Please put dates in DD/MM/YYYY format

Case ID: _____ **Date of notification :** _____/_____/_____

Date of investigation: ____/_____/_____ **Date of reporting :** _____/_____/_____

Case identification

1. **Patient ID Card Number (Foreigners passport number):**
2. **Date of Birth:** ___/____/_____ **4. Age:** _____ (yy/mm) 5**. Sex:** ☐ Male **or** ☐ Female
3. **Name of patient:** **6. Contact Number:**

Address: **Atoll:** **Island:**

7. Place infant delivered: **8. Name of mother:**

Clinical Information

Group A (Please complete all)	**Group B** (Please complete all)
▪ Congenital Heart Disease: ☐Yes ☐No ☐UK	▪ Purpura : ☐Yes ☐No ☐UK
▪ Cataract: ☐Yes ☐No ☐UK	▪ Microcephaly : ☐Yes ☐No ☐UK
▪ Congenital glaucoma: ☐Yes ☐No ☐UK	▪ Meningoencephalitis : ☐Yes ☐No ☐UK
▪ Pigmentary retinopathy: ☐Yes ☐No ☐UK	▪ Jaundice : ☐Yes ☐No ☐UK
▪ Hearing impairment: ☐Yes ☐No ☐UK	▪ Splenomegaly : ☐Yes ☐No ☐UK
	▪ Developmental delay : ☐Yes ☐No ☐UK
	▪ Radiolucent bone disease: ☐Yes ☐No ☐UK

▪ Other abnormalities: ☐Yes ☐No, if Yes please describe:

Maternal history/Antenatal care

▪ Mother age : _____ years	▪ No of previous pregnancies:_____
▪ Vaccinated against rubella: ☐Yes ☐No ☐UK	▪ If yes, date: ___/____/_____
▪ Maculopapular rash: ☐Yes ☐No ☐UK	▪ If yes, date of onset: ___/____/_____
▪ Wes rubella laboratory confirmed: ☐ Yes ☐No ☐UK	▪ If yes, when (date): ___/____/_____
▪ Exposed during pregnancy to any ☐ Yes ☐No ☐UK	▪ If yes, when (date): ___/____/_____

person of any age with maculopapular rash	Where_____

Vaccination History

MMR vaccination status: ☐Yes ☐No If YES Date: ___/____/_____ if NO reason:_____

Measles vaccination status ☐Yes ☐No If YES Date: ___/____/_____ if NO reason:_____

Laboratory test of infant/child

Specimen collected: ☐Yes ☐No ☐UK

If yes type of specimen: ☐ Serum, ☐ Throat Swab, ☐ Urine, ☐ Cerebrospinal fluid, ☐ Other

Date of specimen collection: ___/____/_____; Date of specimen sent to IGMH Lab: ___/____/_____

Date lab received sample: ___/____/_____; Date lab reported result: ___/____/_____;

Rubella IgM : ☐ Not tested, ☐ Positive, ☐ Negative, ☐ Equivocal, ☐ In process

Sustained Rubella IgG Level* : ☐ IgG not tested, ☐ Yes, ☐ No, ☐ In process

*(sustained IgG level on at least 2 occasions between 6 and 12 months of age)

Rubella virus isolation : ☐ Not tested, ☐ Positive, ☐ Negative, ☐ In process

Rubella PCR: ☐ Not done, ☐ Positive, ☐ Negative, ☐ In process, Genotype_____

Final classification:

☐ CRS, ☐ Discarded, If discarded, please specify_____

Case classification as ☐ Laboratory confirmed, ☐ Epidemiologically linked, ☐ Clinically confirmed,

Classification by origin: ☐ Endemic, ☐ Imported, ☐ Import-related, ☐ Unknown

Date of final classification: ___/____/_____;

Name of the investigator:	Position:
Date : ___/____/_____;	Signature:

Reference

Key reference document available at :

http://www.measlesrubellainitiative.org/wp-content/uploads/2013/06/Guidelines-surveillance.pdf

[1] World Health Organization, 2007, Global measles and rubella strategic plan: 2012-2020
[2]DPH, Maldives, 2007, National guideline on introduction of measles, mumps and rubella vaccine into the EPI in Maldives
[3]WHO SEARO, 2014, EPI Fact Sheet Maldives 2013
[4] WHO, Measles vaccine: WHO Position paper. WER No. 35, , 2009, 84, 349-360 http:www.who.int/wer, accessed 28 February 2015

[5] World Health Organization, Regional Office for Eastern Mediterranean, 2011,Field guidelines for surveillance of measles, rubella and congenital rubella syndrome
World Health Organization. 2007, Manual for the laboratory diagnosis of measles and rubella virus infection (http://www.who.int/ihr/elibrary/manual_diagn_lab_mea_rub_en.pdf)