Ministry of Health
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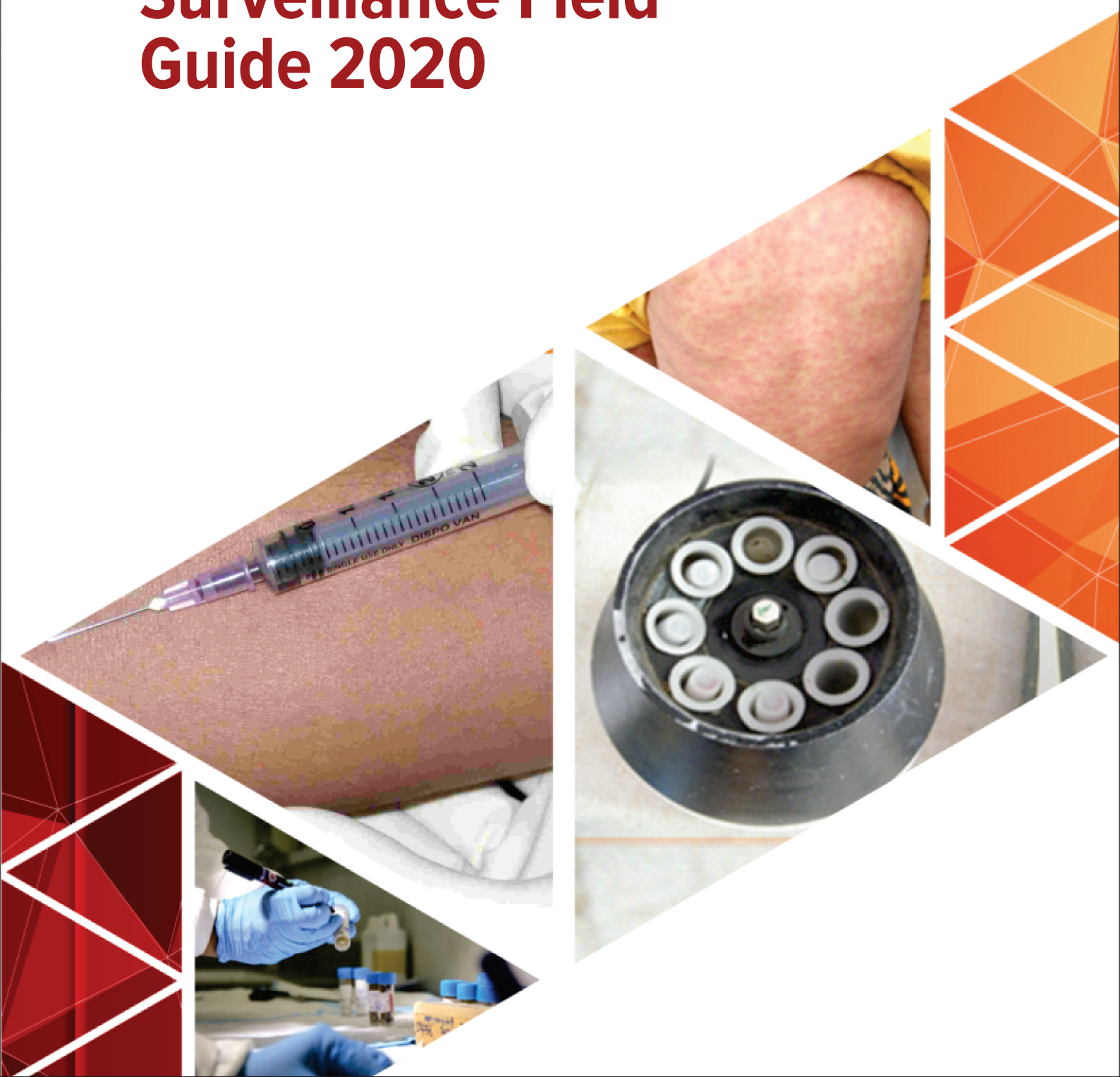
NATIONAL HEALTH MISSION

Measles and Rubella Surveillance Field Guide 2020



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Acronyms

ACS	active case search
AFP	acute flaccid paralysis
ANM	auxiliary nurse midwife
ASHA	Accredited social health activist
AWW	Anganwadi worker
BMO	Block Medical Officer
CES	Coverage evaluation survey
CFR	case fatality rate
CHC	community health centre
CIF	case investigation form
CMO	Chief Medical Officer
CRS	Congenital rubella syndrome
DC	District Collector
DIO	District Immunization Officer
DM	District Magistrate
EPI	Expanded Programme on Immunization
EWARS	Early Warning and Response Systems
FAQ	frequently asked questions
FR	fever with maculopapular rash
HP	high priority
IAP	Indian Academy of Pediatrics

ICDS	Integrated Child Development Services
IDSP	Integrated Disease Surveillance Programme
IgG	Immunoglobulin G
IgM	Immunoglobulin M
IMA	Indian Medical Association
IPC	infection prevention and control
LP	low priority
MCV	Measles-containing vaccine
MCV1	First dose of measles-containing vaccine
MCV2	Second dose of measles-containing vaccine
MLIS	Measles Laboratory Information System
MRCV	Measles-rubella-containing vaccine
MRCV1	First dose of measles-rubella-containing vaccine
MRCV2	Second dose of measles-rubella-containing vaccine
MR	Measles-rubella
MMR	Measles, mumps, rubella
MO	Medical Officer
NGO	non-governmental organization
NHM	National Health Mission
OPD	outpatient department
PHC	primary health centre
PHN	public health nurse
RCV	Rubella-containing vaccine
RI	Routine immunization
RNA	Ribonucleic acid
RS	reporting site
RU	reporting unit
SEAR	South-East Asia Region of WHO
SEPIO	State Expanded Programme Immunization Officer
SIA	Supplementary Immunization Activities

SIMS	Surveillance information management system
SOP	standard operating procedures
SMO WHO NPSP	Surveillance Medical Officer World Health Organization National Public Health Surveillance Project
SSPE	Subacute sclerosing pan encephalitis
TOT	training of trainer
VPD	vaccine preventable disease
WCD	Women and Child Development

1. Measles and rubella surveillance

1.1 Background

In September 2019, the seventy-second regional committee of WHO South-East Asia Region (SEAR), including India, resolved to eliminate measles and rubella by 2023 to prevent deaths and disabilities caused by these highly infectious childhood diseases [1]. Elimination of measles and rubella is one of the flagship priorities for the SEAR and linked to Sustainable Development Goal (SDG) 3 for health. Between January 2017 and December 2019, nearly 372 million children in the region were vaccinated through mass vaccination campaigns with measles-rubella (MR) containing vaccines, of which 324 million lived in India.

India is committed to the goal of measles and rubella elimination as stated in the National Strategic Plan for Achieving and Sustaining Measles and Rubella Elimination in India. The key strategies for achieving elimination are achieving and sustaining 95% coverage with two doses of measles and rubella containing vaccine (MRCV), establishing a sensitive and timely measles and rubella (MR) surveillance system, maintaining an accredited MR laboratory network, ensuring adequate outbreak preparedness and responding rapidly to measles and rubella outbreaks and strengthening support and linkages to achieve the above strategies.

MR surveillance started in India as laboratory supported outbreak-based surveillance in 2005 starting with one state, Tamil Nadu, and building upon the existing Acute Flaccid Paralysis (AFP) surveillance system supported by WHO National Public Health Surveillance Project (NPSP). It was expanded to all states by 2015 in a phased manner. In 2016, India began transitioning from MR outbreak-based surveillance to WHO laboratory supported MR case-based surveillance starting with the state of Karnataka and expanding to all states by 2019. A pilot of fever and rash (FR) surveillance, with a broadened case definition, started in Karnataka in 2018 and expanded to two additional states, Madhya Pradesh and Orissa, in 2019. The pilot will be evaluated in 2020 and any future expansion will be based on guidance from expert advisory groups.

As India progresses from accelerated measles control to implementation of elimination strategies, a sensitive case-based MR surveillance system is essential to monitor and sustain progress towards the elimination of measles and rubella. The goal of MR case-based surveillance is to detect, investigate, and classify all suspected cases and to respond to confirmed outbreaks. For case confirmation, laboratory testing is done at an accredited laboratory within the Global Measles and Rubella Laboratory Network.

Objectives of MR case-based surveillance

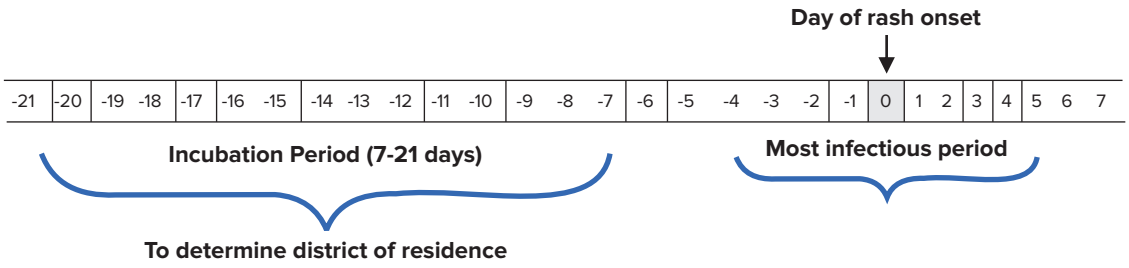
1. Detect, investigate, confirm cases and provide an appropriate public health response, including case management and surveillance strengthening.
2. Facilitate early detection of outbreaks and appropriate response.
3. Identify areas with low population immunity (populations and areas with low coverage) that are at higher risk of measles and rubella transmission requiring enhanced vaccination efforts.
4. Verify the absence of endemic measles and rubella cases to document elimination of endemic virus.

1.2 Measles disease

Measles is one of the world's most contagious diseases [2-5]. It is caused by a paramyxovirus virus, manifesting as a fever with reddish maculopapular rash illness. The incubation period for measles is usually 10–14 days (range 7–21 days) from exposure to symptom onset [2-5]. Initial symptoms (prodrome) generally consist of fever, malaise, cough, conjunctivitis, and coryza. The characteristic maculopapular rash appears two to four days after onset of the prodrome. Patients are usually contagious from about four days before rash onset until four days after its appearance when the levels of measles virus in the respiratory tract are highest [2-5]. The exact source of transmission is frequently unknown because the patient is often infected by someone in the pre-rash prodrome stage. Measles complications such as pneumonia, diarrhoea and encephalitis can occur in up to 30% of persons, depending on age and predisposing conditions, such as young age, malnutrition and immunocompromising conditions [2]. These complications usually occur two to three weeks after rash onset.

Measles can infect anyone of any age, but most of the burden of disease globally is still among children < 5 years of age [2,3]. The measles vaccine is a live attenuated virus vaccine; WHO recommends two doses to provide protection from disease [2].

Figure: Clinical course of measles



Clinical features and complications

Towards the end of the incubation period, patients develop prodromal symptoms of high fever, cough, coryza, and conjunctivitis. The typical maculopapular rash appears after another 3–4 days, often accompanied by a fever that peaks at 39–40°C. During the prodrome, bluish-white Koplik's spots, which are pathognomonic of measles, may be seen in the oral mucosa and they usually disappear by the time of rash onset. Patients normally improve by the third day after rash onset and are fully recovered 7–10 days after onset of disease [2,3].

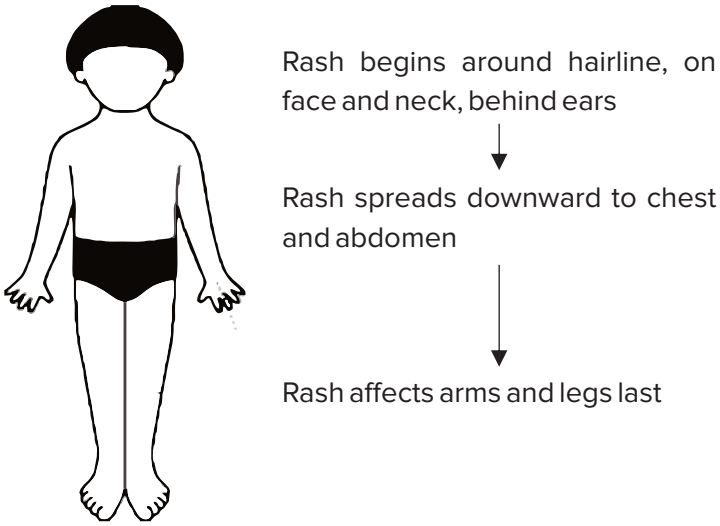


Figure: Course of rash

Approximately 30% of reported cases experience complications, depending on age and predisposing conditions [2]. Common complications of measles include otitis media, laryngotracheobronchitis (croup), diarrhoea and pneumonia. In children in developed countries, otitis media occurs in 7–9% of cases, diarrhoea in 8% of cases, and pneumonia in 1–6% [3]. Post-infectious measles encephalitis occurs in about 1–4 per 1000–2000 cases, and subacute sclerosing panencephalitis (SSPE), a slowly progressive infection of the central nervous system, develops several years after the infection in about 1 per 10 000–100 000 cases [2, 3, 6]. Particularly severe complications of measles which occur in immunocompromised individuals are an acute progressive encephalitis (measles inclusion-body encephalitis), and a characteristic giant cell pneumonia [2-5].

In developing countries, persistent diarrhoea with protein-losing enteropathy may ensue, particularly in infants. In these countries, where malnutrition, particularly vitamin A deficiency, and exposure to other infectious diseases are common, the case-fatality rate for measles is usually 3–6%, but can be as high as 30%, particularly among displaced or isolated, immunologically naïve populations [2].

Measles and vitamin A

Due to vitamin A deficiency, recovery from measles may be delayed. In addition, vitamin A deficiency contributes to higher rates of post-measles complications [2]. Measles infection may precipitate acute vitamin A deficiency and xerophthalmia. Measles also accounts for a large proportion of preventable childhood blindness [2]. The beneficial impact of two doses of vitamin A during treatment of measles is well established. WHO's current policy advocates administering two doses of vitamin A, administered 24 hours apart to all acute cases, irrespective of previous doses [2, 4, 5].

Measles vaccines and immune response

Measles vaccine consists of live, attenuated strains of measles virus and is available, either as monovalent measles vaccine or as measles-containing vaccine (MCV) in combination with rubella, mumps or varicella vaccines [2,3]. Measles vaccine induces both humoral and cellular immune responses comparable to those following natural infection, although antibody titers are usually lower [2,3]. Measles vaccine protects

equally well against all wild measles virus genotypes [2]. Although a live vaccine, virus does not spread from vaccinated to the unvaccinated. Following vaccination, transient measles-specific immunoglobulin IgM antibodies appear in the blood. IgA antibodies appear in mucosal secretions, followed by appearance of IgG antibodies in blood which last for long periods, hence protective immunity, persists for decades. Vaccination also induces measles virus-specific CD4+ and CD8+ T lymphocytes [2].

Vaccinating infants before or at the age of 6 months often fails to induce seroconversion due to the immaturity of the immune system as well as the presence of neutralizing maternal antibodies. Hence the recommended ages for measles rubella vaccination in the UIP are first dose at 9–12 months age and second dose at 16–24 months. The second dose is needed to protect children who have not developed protective immunity after the first dose.

When using the combined measles–rubella containing vaccine (MRCV), such as the measles-rubella vaccine, measles–mumps–rubella vaccine or measles–mumps–rubella–varicella (MMRV) vaccine, the protective immune responses to each individual vaccine antigen as well as vaccine-associated adverse events remain largely unchanged [2].

Measles elimination

Measles elimination is defined as the absence of endemic measles transmission in a defined geographical area > 12 months. It is verified after it has been sustained for at least 36 months in the presence of a high quality surveillance system [7,8].

1.3 Rubella disease

Rubella, an acute and usually mild viral disease, traditionally affects susceptible children and young adults. The public health importance of rubella is primarily due to the teratogenic potential of the virus, which causes harm to an embryo or fetus [4, 9, 10]. The incubation period of rubella is 14 days, with a range of 12–23 days [4]. Apart from the congenital infection, rubella is a mild self-limiting illness that usually occurs during childhood. During the second week after exposure, there may be a prodromal illness consisting of fever < 39°C, malaise and mild conjunctivitis [4, 9, 10].

Adults experience prodromal symptoms more often than children. Characteristic clinical findings include postauricular, occipital and posterior cervical lymphadenopathy typically preceding the rash by 5–10 days [4, 9]. The maculopapular, erythematous and often pruritic rash occurs in 50–80% of rubella-infected persons. The rash, usually lasting one to three days, starts on the face and neck before progressing down the body [4, 9, 10]. Joint symptoms (arthritis, arthralgias), usually of short duration, may occur in up to 70% of adult women with rubella but are less common in men and children [4, 9].

Post-infectious encephalitis occurs in approximately 1/6000 rubella cases, but occasionally incidences have been reported as high as 1/500 and 1/1600 [4, 9, 10]. When rubella infection occurs just before conception and during early pregnancy, it may result in miscarriage, fetal or early infant death, or multiorgan congenital defects known as congenital rubella syndrome (CRS). Also, CRS risk is unrelated to the severity of symptoms in the mother [4, 9].

Rubella vaccines

Rubella vaccine is based on the live attenuated RA 27/3 strain, which is propagated in human diploid cells [9, 10]. There are a few other vaccines based on different strains available in some other regions. Rubella vaccines are available either as monovalent formulations or in combinations with other vaccine viruses, as rubella containing vaccines (RCVs). Commonly used RCVs are combinations with vaccines against measles (MR), measles and mumps (MMR) or measles, mumps and varicella (MMRV). When stored at +4 °C, most RCVs have a shelf-life of 2–3 years [4, 9].

Rubella vaccine induces seroconversion rates of approximately 95% or higher, after a single dose [4, 9]. The recommended schedule of rubella vaccine in UIP in India are two doses as a combined MR vaccine to be given as first dose at 9-12 months age and second dose at 16-24 months.

Rubella elimination

Rubella elimination is defined as the absence of endemic rubella virus transmission in a defined geographical area for >12 months and the absence of CRS cases associated with endemic transmission in the presence of a well-performing surveillance system [7, 8].

1.4 Laboratory diagnosis of measles and rubella cases

Since clinical diagnosis alone is not sufficient to confirm measles and rubella infection, the role of laboratory diagnosis is critical in a measles and rubella elimination programme. Measles or rubella infection can be confirmed by documenting a measles or rubella-specific immune response in the patient and/or by detection of the measles or rubella virus by culture or molecular techniques in a clinical specimen. The most common technique used to confirm the diagnosis of measles and rubella is a test for the presence of measles-specific IgM antibodies in sera collected from suspected measles cases. For MR surveillance, a single blood specimen obtained within 28 days of rash onset may be sufficient to confirm or discard suspected measles cases. All suspected measles cases and outbreaks should be serologically confirmed for differentiation from other causes of fever and rash.

It is also important to conduct genotype characterization of the measles and rubella viruses to understand the transmission chains. This data will be extremely useful for India closer to elimination. Based on genotype data, it will be determined if the country is able to curtail the transmission of all circulating endemic strains. Therefore, appropriate clinical specimens such as throat swab, nasopharyngeal swab or urine for viral genotype characterization through molecular or culture techniques must be collected from sporadic cases and cases from suspected outbreaks.

1.5 Brief overview of the MR surveillance system

India started its outbreak-based MR surveillance in 2005, building upon the existing AFP surveillance system supported by WHO NPSP. Outbreak-based MR surveillance was expanded to all states by 2015. Outbreak-based surveillance involves flagging an outbreak for further investigation if five or more suspected measles cases or a suspected

measles death are reported in a block or in a contiguous area of two or more adjacent blocks in four weeks. India transitioned from outbreak-based to case-based MR surveillance between 2016–19. The MR case-based surveillance system involves investigating all reported sporadic suspected measles cases and switching to outbreak-based surveillance if five or more suspected measles cases or a suspected measles death are detected in a block or contiguous areas of blocks within a four-week period.

Beginning in 2018, fever-rash surveillance was piloted in select states, wherein the suspected case definition was broadened to include all fever with maculopapular rash cases. Beginning in 2015, WHO laboratory supported case-based diphtheria-pertussis-neonatal tetanus (DPT) surveillance was also added to the existing AFP-MR surveillance system.

The components and key activities of the MR surveillance system, which is part of the larger AFP-MR-DPT surveillance system, are briefly described below. Further detailed descriptions are provided in later sections.

1.5.1 Surveillance network

The network of reporting sites (RS) for AFP-MR-DPT surveillance in India consists of reporting units (RU) which send regular weekly reports including nil reports and informer units (IU) who inform cases but do not send any weekly reports. There are approximately 45 000 RS in the country. The key activities to nurture the RS network are:

- Prioritize the RS based on the potential to report cases, and by the history of missed cases, into very high priority (VHP), high priority (HP) and low priority (LP).
- The District Immunization officer (DIO), a trained Nodal Officer and the Surveillance Medical Officer (SMO), should:
  - conduct regular visits, active case searches (ACS) by reviewing the records and searching for unreported cases, capacity building and sensitization of RS staff;
  - track the performance of passive surveillance by RS, such as timely notification of cases, regular weekly reporting and provide feedback;
  - conduct health facility contact analysis (HFCA) of reported cases on a regular basis to identify reporting sites which may have missed reporting a case and for identifying new sites not part of the network;
  - periodically re-prioritize the surveillance network from LP to HP if the RS misses a case or misses sending the weekly report. The priority status may be reverted to LP again, following sensitization of the RS and observing the resolution of the issues for one quarter; and
  - review the network to include new health facilities, based on HFCA, delete the RS which have ceased to exist or are no longer functional.

1.5.2 Case definition of a suspected measles case

The case definition of a suspected measles case is any person with fever and maculopapular (non-vesicular) rash and any one of the 3 C's: cough, coryza (runny nose), conjunctivitis (red eyes) or any person in whom a health worker or a clinician suspects measles infection.[1]

[1]In select states conducting fever rash surveillance, the suspected case definition is: any person with acute fever and maculopapular (non-vesicular) rash or any person in whom a clinician or health worker suspects measles or rubella infection.

1.5.3 Case detection, flagging of outbreaks and investigation

- RS report suspected cases to the DIO or to the Nodal Officer or SMO or Block/PHC MO.
- All reported cases are investigated within 48 hours by DIO/SMO or other trained Nodal Medical Officer by examining the case, collecting relevant information and filling the MR case investigation form MR-CIF.
- Close coordination during district weekly review meetings (DWR) between the DIO and District Surveillance Officer (DSO) of the Integrated Disease Surveillance Programme (IDSP) and Surveillance Medical Officer (SMO WHO-NPSP) at the district level helps cross-check the number of suspected cases reported, including all reported cases in the weekly district report. Any additional cases not reported directly are also taken into account and the investigation of all reported cases duly tracked.
- DIO, SMO and DSO flag outbreaks if there are five or more suspected measles cases in the past four weeks or a suspected measles death in a block or contiguous areas of adjacent blocks.
- In case of a flagged outbreak, a preliminary search is conducted to confirm clinical diagnosis, and confirm clustering of cases in a close geographical area (block/ward/planning unit or an area bordering multiple contiguous blocks/wards/planning units).
- The Epidemic Response Team (ERT) at block/PHC level plan and conduct a detailed investigation of the outbreak by conducting a house-to-house search and collecting information on the outbreak surveillance form VPD-OB003.
- From among the listed cases found during an outbreak investigation, cases are selected for sample collection (5 serum and 2 virology sample) in an outbreak scenario.

1.5.4 Lab confirmation, case and outbreak classification

- For serology, blood samples are collected and serum tested from all sporadic cases and from five cases per outbreak, collected within 28 days from the date rash onset. For virology, throat swab, urine or nasopharyngeal swab collected all sporadic cases and from two cases per outbreak, collected within seven days from the date of rash onset.
- In an outbreak, serum and virology samples must be collected from different subjects, if possible.
- Sporadic cases are classified as lab-confirmed measles, rubella or negative-based on lab results.
- Based on the five samples tested, outbreaks are confirmed as measles positive if two or more samples are positive for measles; as rubella positive if two or more samples are positive for rubella; as mixed measles-rubella positive, if two or more cases are positive for measles and two or more cases positive for rubella; and as negative, if less than two cases are positive for measles or rubella.
- All other cases investigated as part of an outbreak (cases without samples or samples not tested) are epidemiologically linked to measles, rubella, mixed or negative outbreaks.

1.5.5 Case management

- All suspected measles cases are administered two age appropriate doses of vitamin A on two consecutive days.
- Identify any cases with complications and provide referral service.
- Inform families regarding isolation of suspected measles cases in the 0–4 days period from rash onset for preventing the spread of the infection. Important messages include:
  - ensuring infection prevention and control (IPC) measures, including minimal contact with persons not essential for the patient's care;
  - ensuring plenty of rest;
  - taking sponge baths with lukewarm water to reduce discomfort due to fever;
  - drinking plenty of water, fruit juice and herbal tea to replace fluids lost by fever and sweating;
  - seek respiratory relief. Use a humidifier to relieve a cough and sore throat; and
  - resting the eyes.
- Inform the family of common complications of measles and rubella and whom to contact in case complications develop.

1.5.6 Public health response

- During investigation of a sporadic suspected case, scan the neighbourhood for identifying any unreported case with onset in the past four weeks. If any suspect case is found, investigate the case. If five or more cases are found, then flag the outbreak and proceed for an outbreak investigation.
- The outbreak investigation provides additional opportunities to:
  - educate parents to remain alert to any possible complications,
  - strengthen immunization services by identifying gaps,
  - alert schools and Anganwadi centres (AWC) to report cases,
  - alert local general practitioners, and
  - strengthen the surveillance network by identifying, sensitizing and including into the network new health facilities with potential for reporting measles cases, including faith healers.
- Following the detailed outbreak investigation, the frontline workers (FLWs) such as Auxiliary Nurse Midwife (ANM), Accredited Social Health Activist (ASHA) and Anganwadi Worker (AWW) should prepare a list of children in the 9 months to 5 years age group, due for MRCV1 and MRCV2 and mobilize them to the next RI session.
- In case of a confirmed rubella outbreak, all pregnant women in the area should be screened for rubella symptoms anytime during their pregnancy. Lab samples should be collected from a woman with suspected rubella during pregnancy, if the case is ≤ 28 days from rash onset. Pregnant women who test positive for rubella should be followed up by the local health worker until end of pregnancy to note its outcome (live baby, still birth or abortion). All live babies born to a mother with a history of rubella infection during pregnancy should be examined by a MO for birth

defects and to rule out CRS. Infants with CRS need to be isolated and referred to higher centres for further evaluation and management. The Indian Council of Medical Research (ICMR) is conducting CRS surveillance in select locations (cases identified in those locations should be referred to ICMR).

1.5.7 Data management

- Capture data from core variables for all investigated cases using the MR-CIF.
- Collect the outbreak line-list data on the VPD OB-003 form.
- Collect data related to ACS at the RS on the VPD-D003 form.
- Enter the data into a data base surveillance information management system (SIMS) and update at least once on a weekly basis. Lab reports also to be updated to the Measles Laboratory Information system (MLIS) and results merged at national level.
- Using SIMS, analyze data at least once a week and use it at the district weekly review (DWR) meetings.
- Track timeliness of receipt of hospital weekly reports (VPD-H002 form) at district level, using VPD-D001 and VPD-D002 form.
- Track timeliness of receipt of district weekly reports (VPD-D001) at state level, using VPD-S002 form.
- Continuously monitor core indicators of surveillance performance, such as:
  - case investigation within 48 hours,
  - percentage of cases with adequate serology samples collected,
  - percentage of eligible cases[2] with virology sample collected,
  - percentage of samples received in the lab within five days of sample collection,
  - timely receipt of lab results, sharing of feedback,
  - timeliness and completeness of weekly reports,
  - conduct of ACS as per guidelines,
  - re-prioritization of RS as required, and
  - expansion of RS network based on health facility contact analysis.
- Regular data analysis aids in understanding how well the surveillance system is performing and helps in identifying gaps requiring further strengthening. Surveillance data analysis also provides the basis for major actions such as measuring progress towards elimination, and at national and sub-national levels, decisions on introducing new vaccines/tools or modifying programme design.

1.5.8 Precautions to be taken during the COVID-19 pandemic

Health systems around the world are being challenged by increasing demand for care of people with COVID-19, compounded by fear, stigma, misinformation and limitations on movement that disrupt the delivery of health care for all conditions. When health systems are overwhelmed, and people fail to access needed care, both direct mortality from an outbreak and indirect mortality from preventable and treatable conditions increase dramatically.

[2]Cases ≤ 7days since rash onset are eligible for virology sample collection

In the early phases of the COVID-19 outbreak, many health systems were able to maintain routine service delivery in addition to managing a relatively limited COVID-19 case-load. As demands on systems surged, along with indirect consequences of the pandemic, strategic adaptations became urgent to ensure limited public and private sector resources provided maximum benefit for populations. During these challenging times, it is important to maintain VPD (AFP/MR/DPT) surveillance sensitivity as these diseases have high morbidity and mortality.

The guidance provided as Annexure-8 addresses some specific aspects of conducting a disease surveillance programme in the context of COVID-19 and outlines basic principles and practical recommendations that support decision-making to:

- ensure continuity of key surveillance activities that can be delivered safely at various levels; and
- ensure protection through adequate IPC measures.

2. Surveillance network: Structure, prioritization, nurturing and expansion

2.1 Background and structure

An efficient, reliable, geographically representative and widely accepted reporting network is essential for a well-performing MR surveillance system. In 2019, the AFP-MR-DPT surveillance network in India included more than 45 000 reporting sites (RS). In most districts across India, each block/urban area has at least one functional RS, thus ensuring geographical representation.

The surveillance system requires constant nurturing, monitoring of performance, periodic review, and expansion of the RS network, which is a dynamic process. It helps address challenges such as underreporting and late reporting of cases. The RS network includes both reporting units (RU) and informer units (IU).

2.1.1 Reporting units

These often include government or private health facilities. Usually, these facilities have both outpatient and inpatient departments and include medical colleges, district hospitals, infectious disease hospitals (IDH), referral hospitals, community health centres, primary health centres and large private hospitals.

The RUs usually maintain documentation of all patients attending that facility. All RUs are required to immediately report suspected measles cases or suspected measles deaths. In addition, RUs are required to send weekly reports to the DIO with details of cases reported in the past week including “nil” reports on form VPD-H002. The RUs have a designated AFP-MR-DPT surveillance Nodal Officer who supports investigating and reporting of suspected measles cases and sending of weekly reports.

2.1.2 Informer units

These are health facilities such as hospitals and clinics with single practitioners, facilities with traditional healers or faith healers that are likely to see suspected measles cases. The IUs report cases to the DIO/SMO but do not send weekly reports, as they are unlikely to maintain detailed documentation of the patients visiting them or have constraints in sending weekly reports.

2.1.3 Passive and active surveillance at the RS

A well sensitized RS must report whenever s/he sees a case. The RU also adds details of the case in the weekly reports. This represents a functioning passive surveillance. However, it is important for the DIO/SMO to actively nurture the RS through frequent interactions, formal/informal re-sensitization of staff and through ACS for missed cases in the medical records (e.g. out-patient/in-patient registers). The ACS efforts by DIO/Nodal Officer/SMO are recorded in the VPD–D003 form.

2.1.4 Roles and responsibilities of Nodal Officer at the reporting unit

To facilitate and coordinate reporting of suspected measles in health facilities, a Nodal Officer for surveillance should be designated by the hospital or health facility director/superintendent. All physicians and staff in key departments likely to see suspected measles cases (e.g., paediatrics, medicine, skin, ophthalmology, obstetric and emergency) are sensitized regarding the definition of a suspected measles case and the process of reporting the case to the Nodal Officer within the institution and to the DIO/SMO. The Nodal Officer ensures immediate reporting to the DIO/SMO, and tracks case investigation, sample collection, shipment, inclusion of all reported cases in the weekly reports, and receiving and disseminating of lab results from the DIO office. The Nodal Officer makes weekly visits to the relevant departments and checks with them, while preparing a weekly report to ensure all suspected measles cases seen in the institution are reported in the weekly report. S/he is responsible for maintaining all key records related to the MR surveillance (and AFP, DPT surveillance) in the institution.

The Nodal Officer or a trained MO should investigate each suspected case of measles within 48 hours of case notification. The MR case investigation form (MR-CIF) should be used to collect standardized information on each suspected measles case. The NO should also coordinate timely and appropriate sample collection and shipment from reported suspected measles cases.

2.1.5 Community-based surveillance

Frontline workers (ANMs, ASHAs and AWW) have close contact with the local communities in their areas. They are likely to be in touch with local faith healers and traditional practitioners. Hence it is possible that during their routine field visits, they may identify suspected measles cases in the community themselves or through local practitioners, faith healers and priests.

Although it may not be possible to enlist all FLWs and the local practitioners in the list of RS, it is necessary to sensitize them about the importance of measles and rubella elimination, case definition of a suspected measles case and how to report if they see one. The MO and health supervisors at the rural and urban PHCs should make active efforts to sensitize the FLWs using MR info-kits and develop a network with the local practitioners to enhance case reporting in their areas.

2.1.6 Key actions for nurturing the RS network

- Prioritization
- Capacity building (including sensitization)
- Active case searches (ACS)

- Periodic re-prioritization
- Expansion
- Deletion.

2.2 Prioritization of reporting site

Since the DIO/SMO manages a relatively large surveillance network, the visits to RS for conducting ACS and sensitization may be time consuming. In order to facilitate efficient planning of DIO/Nodal Officer/SMO visits, the RS are categorized into very high priority, high priority and low priority (VHP, HP, LP) facilities based on the number of reported MR/AFP and VPD cases and assessed additional potential for reporting more cases or by reviewing history of missed cases.

The categorization into VHP, HP and LP helps to determine the frequency of ACS and in planning capacity building activities at the RS. Based on the performance of the RS, the DIO/Nodal Officer and SMO may periodically reprioritize RS at least once in a quarter based on the progress achieved and further needs, explained in detail below. This helps the surveillance system remain sensitive.

2.2.1 The RS are prioritized into three categories

Very high priority (VHP). Reporting/informer units are highly likely to see a significant number of MR/AFP/DPT cases and may include:

- medical college hospitals;
- district hospitals;
- specialized paediatric hospitals;
- very popular paediatricians/physicians;
- popular measles quack/faith healers/temples – seeing many patients;
- infectious disease hospitals;
- relevant departments in hospitals (skin, ophthalmology etc.).

VHPs should be visited at least twice a month and each visit should be documented in the VPD-D003.

Low priority (LP). Are all other RS that occasionally see MR/AFP/VPD cases. This may include quacks/faith healers/traditional healers for reporting suspected measles cases in particular. Although these RS are “low priority,” they are not “no priority”. In addition to DIO/Nodal Officer/SMO visits, they may be contacted through:

- visits by PHC MO/trained health staff of concerned area;
- telephone/email/SMS or social media (e.g. WhatsApp) by Nodal Officer/DIO/SMO/ Administrative Assistant (AA) at NPSP Unit/IFM and Health staff; and
- newsletter/feedback; and
- maintain documentation contact with LP RS on format VPD-D004.

LP RS should be visited at least once a year but telephonic contact should be conducted at least once every four months.

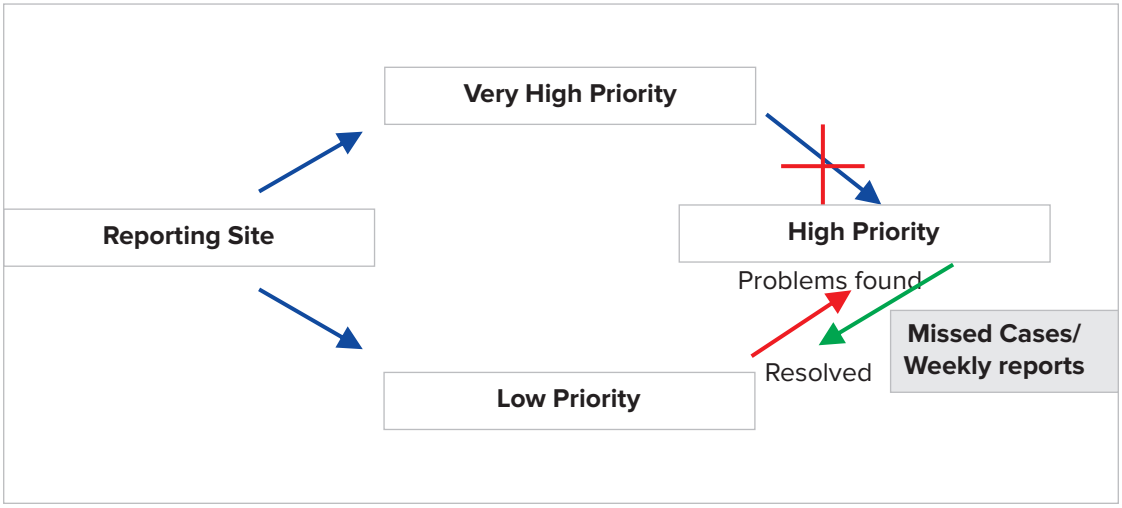
- **High priority (HP) RS.** These are sites where:
- HP is a temporary priority assigned to a LP RS, if the site missed sending weekly reports.
- RS missed reporting a suspected MR/AFP/DPT case:
  - issue of missed reporting identified by health facility contacts analysis (HFCA) of CIFs; and missed cases identified through ACS in the facility.
- Late report of suspected MR/AFP/DPT cases.
- RUs that have stopped sending weekly reports including "nil" reports or timeliness and completeness of reporting unit that is less than 80% in a quarter to be reprioritized as HP.

HPs should be visited at least once a month for three consecutive months before being reprioritized to a LP.

2.3 Periodic re-prioritization of the reporting network

In the past, prioritization of the reporting network has been based on RS likely to see a significant number of AFP cases, as the system was built with a focus on polio. Now, with an added focus on measles and rubella elimination, the prioritization of RS and re-prioritization should be based on the reported suspected measles and the finding of missed suspected measles cases in addition to AFP cases found during ACS at RS (data from VPD-D003) or RS which saw but missed reporting suspected measles found on health facility contact analysis (HFCA) of the investigated cases.

The schematic diagram below provides an overview of the reprioritization process:



The DIO/SMO should reprioritize RS based on:

2.3.1 Reporting of suspected measles cases

The surveillance network should be reprioritized based on RS likely to see a significant number of suspected measles cases (in addition to AFP/DPT). These numbers may be decided by discussion at the DIO and SMO level. A reporting site reporting larger proportion of cases in a district or a large hospital (e.g. medical college) should be designated as a VHP.

2.3.2 Missed cases found in the HFCA (MR-CIF)

Scenario 1. A facility is not part of a reporting network and did not report the case:

- sensitize on AFP-MR-DPT surveillance;
- explore potential for this site to see further cases of suspected measles;
- include in non-coded community-based reporting network health facility list or if it appears to have greater potential, include as an IU or RU.

Scenario 2. A facility is part of the reporting network but did not report the case:

- sensitize and re-orient about potential case missed; and
- re-prioritize this site (eg. low priority reporting site into HP as and when required) and increase active case search visit as per guideline.

Scenario 3. A facility is not part of the reporting network and reported the case:

- check for any further cases reported;
- plan a visit, assess the reporting site with standard inclusion criteria relevant to the surveillance system using VPD-H001 form; and
- assess eligible potential reporting site for MR and AFP/DPT awareness.

2.3.3 Missed/unreported cases found during ACS in health facilities (VPD-D003)

- Assess the number of missed cases and possible reasons for unreported cases at the reporting site.
- Provide feedback to the Nodal Officer or RS about missed cases.
- Conduct sensitisation of health staff including concerned medical doctors through planned small meeting.
- If VHP RS, increase the frequency of visit for initial months apart from other actions enlisted above.
- Reprioritize the LP into an HP.

2.3.4 The RU missed sending weekly reports

- The weekly reports received at the DIO office are compiled at the DIO/NPSP office and recorded as timely/late/not received. The performance of RU in sending reports timely is analysed at the end of each quarter. The DIO/SMO should discuss the issue with the Nodal Officer of the RU to assess the reasons or the constraints in sending the reports in a timely manner.
- The RU should be prioritized for an ACS visit and if necessary, a sensitization workshop should be scheduled at an early date.
- Reprioritize the LP RU into an HP RU.

2.3.5 Reverting HP status of a RS back to LP

- After visits to a HP and resensitization, the performance of RS should be followed up over the next one quarter.
- If the issues of late reporting, non-reporting, and not sending weekly reports are resolved, and if no further missed cases are found, then a DIO and SMO can discuss and decide to change the status of a HP back into LP.
- All such instances of changing the priority of a RS should be reported through SIMS.

2.4 Capacity building of key staff of the reporting network

Capacity building is a continuous process and is accomplished through training of trainers at the state and district levels. Those trained at the state and district levels then train the staff of the RS and sensitize the FLWs.

The state level officers are trained at the national or regional training of trainer's (ToT) workshops. They in turn help the district officials at the State ToT and block-level MOs and Nodal Officers of RS at the district workshops.

Separate training workshops should be planned for orientation and sensitization of the following:

- staff of medical colleges;
- large and multispecialty private hospitals;
- orienting members of professional associations such as the Indian Medical Association (IMA) and the Indian Academy of Paediatrics (IAP) etc; and
- for all doctors and nurses of District/Block-level hospitals and other key health staff.

To strengthen the existing network, all the RS which have not been sensitized or visited in the past year should be physically verified by DIO/Nodal Officer/SMO and prioritized for sensitization on MR, AFP and DPT surveillance.

2.4.1 The sensitization plan for State/ District Officers should be as below

- State level workshops. At the launch of new surveillance, any major changes and at least once a year.
- District/block workshops. At least once a year.

2.4.1.1 Sensitisation plan for reporting sites as well as potential sites

- Medical college workshops. Depends on how frequently residents turnover (suggested once every six months).
- Private hospital staff/private doctors. At least once a year.
- Informers. At least once a year.
- IMA/IAP workshops. At least once a year.
- Other capacity building efforts like ACS.

2.4.2 Sensitize frontline workers (FLW)

To sensitize FLWs, the DIO and Block MOs should:

- assess training load of FLWs – cadre wise sensitization can be done;
- coordinate letters issued from Ministry of Health and Family Welfare and Department for Women and Child Development;
- sensitize FLWs using the info kit and provide one copy to each participant;
- discuss reporting protocol with ASHA/AWW – ANM (IDSP S Form & SMO/DIO) – MOIC (VPD-H002 and IDSP P form) - DIO/SMO;
- enlist quacks/faith healers/traditional healers as a potential site will be oriented and sensitized by ANM/health supervisors; and

- get ANM to compile a list of quack/faith healers/qualified doctors in urban areas and share with MO of PHC. The MOIC should share with DIO/SMO.

2.4.3 Sensitize community informers, faith healers and quacks

To sensitize community informers, faith healers and quacks, the PHC MO or health supervisor should do the following:

- PHC MO to use the list prepared by FLWs based on their assessment, and additional facilities/healers found during the outbreak investigations, for review and inclusion in the list RS or list informal facilities without a code number;
- PHC MO and health supervisor to make efforts to sensitize all such facilities by visits, or phone calls;
- on priority, PHC MO/Block MO/Surveillance Nodal Officer at block level should plan sensitization by meeting them in person in the field or plan meeting of such informal health service providers at the PHC if feasible;
- use handouts/info kits and any training videos during the sensitization; and
- reporting protocol to be that informal facilities report all cases to PHC or block MOIC, who will take needful action (reporting to DIO/Nodal Officer, case investigation, and sample collection).

2.5 Conducting active case searches (ACS) at RS

2.5.1 Planning the ACS visits

- Visits by DIO/Nodal Officer/SMO to RS for conducting ACS and sensitization is an important component of nurturing the surveillance network.
- ACS visits help provide regular updates and feedback to key staff, and to verify records.
- Helps verify that no suspect measles case has been missed in that health facility since the previous search. DIO/Nodal Officer/SMO to conduct ACS and query clinicians regarding any recent suspect measles case (or AFP/DPTs) and record any unreported case in the VPD-D003.
- Provide opportunity to reinforce the suspected case definition and knowledge of the surveillance processes by sensitizing clinicians and other key personnel at the RS.
- DIO/Nodal Officer/SMO plan and conduct ACS in health facilities regularly based on prioritization of reporting site. Data analysis from SIMS helps in planning ACS in advance. The local NPSP unit helps in preparing the VPD-D003 form with the list of the RS pre-filled and providing it to the DIO/Nodal Officer/SMO well in advance.
- Required frequency of ACS visits are as mentioned in the box below:

VHPs should be visited at least twice a month.

HPs should be visited at least once a month for three consecutive months.

LPs should be visited at least once in 12 months, but telephonic contact should be conducted once in four months.

- DIO/Nodal Officer/SMO should combine ACS visits with other activities planned in that block.
- Make a monthly work plan including schedule for ACS visits.
- Keep a record of sites visited and those due for ACS.
- Completed VPD-D003 form for a particular month to be shared with NPSP unit office by 7th of the next month.

2.5.2 Activities at the RU during ACS

Conduct active record searches with support head of the institution, DIO/Nodal Officer/SMO:

- access the records such as registers at IPD, OPD, casualty, and electronic medical records (if available) and look for any missed MR/AFP/DPT cases;
- after scanning the register/s, the DIO/Nodal Officer/SMO, may sign the register mentioning the date of search and number of missed case found, if any. Also, they may add EPID numbers next to the reported cases found on the register as reference;
- enquire from treating physicians and key nursing staff if they have seen any case(s) in the recent past (since last visit) or if any case is currently admitted;
- document missed case(s) in VPD-D003, collect addresses and contact information of the missed case for further investigation;
- check for AFP/MR/DPT poster displayed in ward/clinic/hospital with phone numbers of DIO/SMO and if not, provide them posters;
- if case is admitted, examine the case by filling the CIF and facilitate specimen collection as required;
- provide feedback to the institutional Nodal Officer on missed/late reported cases in a tactful and positive manner. Assess the reasons and discuss the solutions;
- share logistics for laboratory sample collection and updated blank copies CIF (as applicable); and
- emphasize the following key messages:
  - importance of vitamin A in preventing complications;
  - if a complication is suspected, refer to a higher centre;
  - isolation of suspected cases to prevent further spread;
  - role of MR vaccine (as part of RI) in preventing measles and rubella;
  - report any additional suspected cases that they encounter.

Sensitize clinicians on the reporting of suspected measles cases

During the ACS, the DIO/Nodal Officer/SMO should:

- inform the Nodal Officer or head of institution at the reporting site in advance about their upcoming visit and discuss any requirements;
- meet the hospital director and all clinicians likely to see a suspected measles, AFP or DPT case;
- check awareness of case definitions and reinforce the importance of timely reporting;

- share updates on the current status of MR elimination, polio eradication and about occurrence of other VPDs and share copies of resource materials (e.g., copies of newsletters, bulletins, reporting forms VPD-H002, posters with case definition, updated contact information for reporting of cases, etc.);
- share feedback on the cases reported in the past. Appreciate the support provided by the institution for the combined MR-AFP-DPT surveillance and emphasize the importance of their continued participation; and
- discuss the possible areas of technical support and collaboration (e.g. training workshops, immunization services, support for field monitoring, participation in research activities etc).

2.5.3 Activities during ACS/visits to informers

When meeting the informers in person, the DIO/Nodal Officer/ SMO should:

- emphasize the need to continue to report all suspected measles cases (and AFP and DPT cases) under surveillance;
- feedback should be provided to informers regarding reported and missed cases;
- check the informers' records/registers (if available) to scan for any missed or unreported cases since last visit;
- document the visit by signing the registers and records that were verified;
- ensure that surveillance posters are displayed with updated contact information for reporting suspected measles cases;
- emphasize the following key messages:
  - importance of vitamin A in preventing complications,
  - if a complication is suspected, refer to a higher centre,
  - isolation of suspected cases to prevent further spread,
  - role of MR vaccine (as part of RI) in preventing measles and rubella, and
  - report any additional suspected cases that they encounter.

Document the visit in the ACS form VPD-D003.

2.6 Expansion of the reporting network

The DIO and SMO should regularly review the existing list of health facilities in the reporting network and actively make efforts to identify additional health facilities which have reported cases, or have a potential to report cases but are not part of the existing network, and those that have missed reporting cases and are not part of the network. Such information should be available by analysis of the MR-CIFs of the investigated cases, through the health facility contact analysis, and through their local sources such as health workers, professional networks, and from local licensing authorities. In addition, all government facilities should be included in the reporting network for MR surveillance.

To expand the reporting network the SMO/DIO should:

2.6.1 Assess additional health facilities for the potential to report cases and include, if not in the network:

- obtain list of all health facilities in the area;
- compare this list to a list of facilities in the reporting network;
- for those facilities (particularly all government facilities or larger private facilities not included in network) assess for inclusion according to established criteria;
- ensure geographical representation of reporting site. Each block, urban ward should have at least one functional RU/IU, and there must be adequate representation in sparsely populated areas too;
- include facilities as required, assigning prioritization category based on criteria; and
- maintain a record of network expansion in form D-003.

2.6.2 Review the CIF (MR/AFP/DPT) and add those health facilities that have reported cases but are not part of the reporting network.

- Identify health facilities which are under 'Other' category in 'Health Facility Type' for Notified MR/AFP/DPT cases.
- If the health facility already reported two or more suspected measles, AFP, DPT cases in one year, include in the RS network.
- DIO should allot a new code number to the site in consultation with SMO, and send official communication to the reporting site and State Officials (SIO) regarding inclusion.

2.6.3 Use the health facility contact analysis (HFCA) to identify health facilities which have seen but not reported suspect measles cases. If not in the network assess and include.

- A desk review of the MR-CIFs provide data on HFCA, which helps to know how many and which other health facilities were visited by the case before it was reported.
- Sensitize the investigating MO to get the telephone number of health facility – through the parents of the suspect case.
- Contact the health facilities which are not part of the reporting network by making phone call or by conducting a visit.
- If DIO/SMO find that HF has seen the suspected measles (and other AFP or DPT case/s), the health facility needs to be assessed in detail, and should be added to the network.

2.6.4 Assess the health seeking behaviour in the community

Analyse the health seeking behaviour after rash onset and identify if there are any patterns:

- was the suspected measles case/such cases confined at home?
- did the suspected measles case/s contact community workers?

- if the suspected measles case came in contact with community workers[3], did they report the case?
  - Identify training needs of community workers.
- did the suspected case contact a local practitioner/ faith healer/smaller health facility?
  - if yes, check if the health facility is in the reporting network;
  - if the health facility is not in reporting network, utilize the opportunity for sensitization; and
  - if the health facility reports a new case, plan to include in the reporting network.

2.6.5 Steps in adding a new health facility to the reporting network

Introductory meeting and assessment. The DIO/SMO should make a visit to the identified health facility and conduct an introductory meeting with the medical director, clinicians, and other hospital staff including those managing the medical records. The purpose of the introductory meeting is to:

- establish a working relationship with the health facility;
- assess the health facility for its potential to report cases;
- understand the dynamics of internal communication within the health facility; and
- identify a Nodal Officer for future contact.

The DIO/SMO should use the check list VPD-H001 to record the findings of the assessment. The introductory meeting also provides an opportunity to:

- share knowledge about measles and rubella diseases;
- explain the rationale for conducting surveillance;
- provide the case definition for reporting of cases;
- establish the procedures for immediate notification of cases, investigation and sample collection;
- plan a training/sensitization meeting for the hospital staff; and
- collect contact details of all key persons.

Establishing reporting procedures: Following an initial assessment, all government hospitals and those private health facilities with a potential to report suspected measles cases should be included into the surveillance network as RU/IU. If the health facility is large, and willing to send weekly reports, then the facility may be included as a new RU, and smaller clinics not willing to send weekly reports, may be included as IU.

A new RU/IU is allotted a new code number and included in the existing list of RS maintained by DIO/SMO with relevant contact details. At the new RS, procedures of case reporting are explained to the clinician/Nodal Officer. Additionally, at a new RU, procedures for weekly reporting are explained and copies of posters, and key formats such as hospital weekly reporting form VPD-H002 and hospital surveillance forms VPD-

[3]Community workers include health workers (ANM/AWW/ASHA/LHV/MPW/other); religious leaders (priest/temple link person/mazars/maulana/ozha); community influencers (village head/teacher/pradhan/panchayat member)

H003 are shared with the medical director or identified Nodal Officer. The name of the RU with the name of Nodal Officer and contact details are entered in a data base on surveillance information management system (SIMS) maintained by NPSP.

Sensitization at the new RS: DIO/SMO should plan a formal training/sensitization meeting at the new RS at an early date. The training is aimed at enhancing the knowledge and skills of staff at the RS. It helps to ensure that all key staff are aware of the current national goals for measles and rubella elimination, understand the importance of their own role in supporting surveillance, are aware of the case definition, reporting procedures, about case investigation, eligibility of cases for samples, sample collection, storage and shipment processes, documentation, weekly reporting procedures, and about communicating with the patients or parents in case of children.

2.7 Deleting a reporting site

There may be situations where it is appropriate to remove a reporting site from the network. These reasons include:

- site has ceased to exist;
- provider has died, and no one is practicing in his absence;
- provider has moved out of the district permanently, and this has been confirmed by the new location; or
- site has been low performing, but this should be assessed for AFP and measles rubella and DPT.

2.7.1 Steps in deleting a reporting site

- SMO/DIO should provide the reason for the deletion, date of visit to RS and map of the block showing all the RS to SRTL/RTL;
- SMO/DIO should seek appropriate guidance and approval for network deletion from the SRTL/RTL;
- few of the proposed deletion sites may be checked by SRTL/RTL during field visits;
- code of deleted reporting site cannot be assigned again to a new reporting site; and
- if the RS is revived again at some point in future, the same RS code will be continued.

3. Definitions

3.1 Case definition

3.1.1: Suspected measles case[4,5]

Any person with fever and maculopapular (non-vesicular) rash and any one of the 3 C's: cough, coryza (runny nose), conjunctivitis (red eyes) or any person in whom a clinician or health worker suspects measles infection.

3.1.2: Suspected measles related death

A suspect measles death is a death within 30 days of onset of rash without any obvious cause like trauma, snakebite, etc.

3.2 Outbreak definition

A suspected measles outbreak is to be flagged with an outbreak ID when there are:

- Five or more suspected measles cases reported in a block or in an urban ward/ planning unit in the past four consecutive weeks;

OR

- Five or more suspected cases in an area bordering multiple contiguous blocks/urban wards/planning units in the past four consecutive weeks;

OR

- One or more suspected measles-death/s in a block or in an urban ward/planning unit.

[4]A case reported as suspected measles case is investigated for both measles and rubella.

[5]In select states conducting fever rash surveillance the suspected case definition is any person with acute fever and maculopapular (non-vesicular) rash or any person in whom a clinician or health worker suspects measles or rubella infection.

4. Case reporting, case investigation

4.1 Case reporting

Case reporting is the basis of all surveillance actions that follow. Unfortunately, suspected measles remains highly under-reported for many reasons. Many suspected measles cases may not seek care from any doctor/hospital/health facility. There are widespread cultural beliefs across India relating measles to the anger/curse of mother goddess which may impact care-seeking behaviours. It is important to sensitize clinicians at the reporting sites and raise the awareness of health workers to strengthen MR surveillance. The key activities in case reporting are as below:

4.1.1 Key activities in case reporting

- The DIO/MO and SMO should communicate with the RS and health workers about the case definition of a suspected measles case and the importance of reporting all suspected cases.
- All suspected measles cases seen in a district are expected to be reported to the DIO/SMO of the district as soon as the case is seen by a clinician at a RS or a by health worker or others.
- At larger reporting sites (e.g. multispecialty hospitals) with institutional Nodal Officer, clinicians may report suspected measles cases through the Nodal Officer or may chose to report directly.
- Others, such as health facilities not listed as RS, should also report the suspected cases immediately to the MO of nearest PHC to the DIO/SMO.
- Details such as name, age, address, contact information, date of rash onset and any other relevant information should be provided to the Nodal Officer/DIO/SMO.
- Details of all reported cases should be entered into the case notification register maintained at the DIO's/SMO's office. Cases from all other sources, including those reported through newspaper/TV/or other media should also be entered in the notification register. The columns in the register must be updated with information as the case investigation progresses.
- Reported cases should be tracked for completion of the case investigation by DIO/Nodal Officer/SMO, including tracking of sample collection and shipment to the designated laboratory.

- All cases fitting into the case definition are allotted an EPID number by DIO/SMO at the district level.

4.1.2 District weekly review (DWR) of reported cases

The DIO, SMO NPSP and DSO of IDSP should jointly conduct the District Weekly Review (DWR) meetings, preferably on Tuesdays after receiving weekly reports from all reporting units. The team is expected to:

- prepare the weekly district report on VPD-D001 format after reviewing and cross checking weekly reports from:
  - IDSP (P,L and S forms)
  - H002 from all Rus,
  - directly reported cases from Ius
  - other sources (like media and private practitioners, who are not part of the reporting network);
- track all reported cases in the previous week or since the previous meeting for completion of investigation, sample collection, shipment, laboratory results and feedback;
- collate block-wise reports of past four weeks and flag an outbreak if there are five or more suspected cases or a suspected measles death in a block/urban ward/planning unit area or adjacent contiguous areas across blocks;
- once the outbreak is flagged, follow all the steps in the revised outbreak response protocol for investigation and response to an outbreak (see section 11).

4.2 Case investigation

Investigation of reported suspected measles cases, and using the data from case investigations, provide useful epidemiologic information, such as identifying the locations of transmission of measles and rubella viruses, characteristics of persons affected, clinical features, history of travel, health seeking behaviour, health facility contact analysis, immunization status, etc.

Hence all reported cases must be investigated by the DIO/Nodal Officer/SMO using a standard measles rubella case investigation form (MR-CIF). Timely investigation means case investigation within 48 hours of reporting a suspected measles case. The MR-CIF is arranged in different sections collecting important data initially which is updated as more information from laboratory testing becomes available. Some of the key components of case investigation are described below.

4.2.1 Key components of MR case investigation

The MR-CIF has two pages. The following paragraphs describe the purpose of collecting data under various sections of the MR CIF.

Sections 1–3 record data related to type of case, whether sporadic or linked to an outbreak, demographic details such as person identification, with details of age, sex, address, religion, whether a migratory family and contact information;

Sections 4–6 gather information on hospitalization, immunization history with type of MR vaccines and clinical history collecting information on clinical symptoms, signs and any complications. This helps to identify if the case is consistent with the case definition of suspected measles case. Information on type of rash and the date of onset of rash are critical in accepting and rejecting the case. Section 6 also provides space for recording complications if any, and details of vit A doses provided;

Section 7 collects information on travel history prior to onset of rash. This helps identify the location (block and district) where the person may have acquired the infection. The place where the person spent most of his/her time in the 21 days, specifically between 7–14 days prior to rash onset, is the likely place of transmission. The case belongs to that place and if it is in another district (outside the district where it is investigated) then the case should be cross notified at the earliest. The date of cross notification should be recorded;

Section 8 identifies other persons in the family/close neighborhood/work/school with similar symptoms. This helps in identifying other cases. Each such case should be investigated, and samples collected. If five or more cases are found, then an outbreak should be flagged, and further investigation conducted as per outbreak investigation protocol (see section 11: Outbreak response protocol);

Sections 9–11 help in identifying the health seeking behaviour, whether the case contacted any health worker who visited any health facility after onset and sought treatment. Section 10 helps in identifying persons, including the local health worker, faith healers, temple priests and community influencer, whom the case had contacted. These are persons who are not part of the formal surveillance network but have a potential to report cases. This helps in strengthening surveillance in the community. Section 11 provides a chronological record of all the health facilities/hospitals contacted by the case after the rash onset including the facility which reported the case. This data helps in identifying hospitals and health facilities who may have missed reporting the case. If the hospital which missed a case is already in the RS network, then this information can be helpful in sensitization and re-prioritization of the RS from LP to HP. If a hospital/health facility is not in the network but seeing cases and not reporting, then it provides an opportunity to further assess the hospital/health facility for inclusion in the network. The re-prioritization and expansion of network are described in further detail in Section 2 (Surveillance network: Structure, prioritization, nurturing and expansion);

Section 12 records the provisional diagnosis;

Section 13 has details of lab samples collected, sent to the laboratory, received in the laboratory, condition of samples and results with a record of the reasons for late collection. Analysis of the data helps in identifying gaps in sample collection and shipment;

Section 14 is a record of searches in the neighbourhood community, as a public health response to a confirmed case. It should be undertaken by local FLWs under the supervision of MO, PHC. It is suggested that the local ASHA's area (roughly about 200 households) or entire hamlet, if it is smaller, may be searched for any additional cases. If

any cases are found, then each case should be investigated using MR-CIF. If five or more cases are found, then outbreak is flagged and outbreak response such as preliminary search/detailed investigation initiated;

Section 15 outlines details regarding feedback provided to the caregiver and reporting person. Providing feedback to parents/caregivers is an important service to them. It also helps build the community's awareness and trust in surveillance. Providing feedback to the reporting sites in a timely manner is very important, as it leads to improved relationships, which encourage further reporting of cases;

Section 16 records the outcome of a 30-day follow-up of confirmed cases. This should be conducted 30 days after the rash onset. It can be conducted by the MO, HW or over the phone.

Section 17 records pregnancy status of the case, if it is a female of childbearing age. **Section 18** is specifically for pregnant women who tested positive for rubella during pregnancy as there is a possibility of CRS. More details can be found in **Section 6:** Case management and public health response; and

Section 19 records the final classification. Further detailed SOP on how to fill the MR-CIF is provided in **Annexure 2.**

4.2.2 Desk review of MR-CIFs

- all MR-CIFs should be reviewed by DIO and SMO for completeness and correctness of the data entered in it. Also many sections for e.g. laboratory results, outcome of ACS etc need to be filled only after actions are completed. Hence it is important for DIO/SMO to revisit the CIF several times and update it as and when additional information becomes available;
- it is suggested that DIO/SMOs should conduct desk review of the MR-CIFs at least once a week;
- desk review findings should be recorded using the MR-CIF desk review format. The outcome of the desk review should be reported to the State Expanded Programme Immunization Officer (SEPIO) and SRTL/RTL on a monthly basis. It can be undertaken jointly for MR and AFP CIF desk review.

4.2.3 Using surveillance information management system (SIMS)

The data collected on MR-CIF should be entered in the SIMS software available at WHO NPSP field offices. This is usually done by the Administrative Assistant (AA) of the unit. SIMS allows for integration of data at state and national levels. At the national level laboratory results data are merged into the SIMS. Also, the line-list of cases that are generated (which helps in automated classification of cases based on the algorithms) feed into the software.

5. Assigning the unique epidemic identification (EPID) numbers

5.1 Nature and importance of the EPID number

It is critical to assign a unique case identification number to each suspected case and unique outbreak identification to a flagged outbreak.

- The epidemic identification (EPID) of a suspected case is a 15-character alphanumeric figure given as a unique case identifier.
- In case of a flagged outbreak, it is 16–character number assigned as a unique identifier. For each case identified in an outbreak through detailed outbreak investigation, it is a 19-character number (outbreak id with unique serial number).
- It is important to ensure that the same EPID number is mentioned on the CIF, on the laboratory request form (LRF) and specimen labels. This makes it possible to correctly identify and match the lab results with the investigated cases.
- All forms, including electronic data sheets, lab reports, all communication including feedback related to a case must use the same unique case identification number allotted to a case/ outbreak.
- The EPID number for a sporadic case is different than assigning outbreak ID. The differences are explained in the table below.
- The LRF is different for sporadic case and outbreak.

5.2 Understanding the EPID number

- The EPID number identifies disease/outbreak, the country, the state, district, the year and ends with the three-digit numeric case number for a case or an outbreak.
- The first two/three charters signify disease measles rubella/outbreak.
- The next three characters signify country code.
- The next two signify state code – each state in India has a unique code.
- The next three characters signify district code – each district in India has a unique three digit code.
    - o the next two characters signify the year of rash onset in case of investigation of suspected case. In case of an outbreak ID, the two characters signify the year of

reporting of the outbreak. Precautions should be taken at the time of year-end and new year beginning, to give correct year number as per date of onset of rash for sporadic cases. For example, if the date of onset of rash is 25 December 2019 but the case is reported investigated on 7 January 2020; in such cases this will be 2019 case and in the EPID number for MR sporadic case the year "19" should be used.

- The next three numbers are the serial numbers of the individual cases in that year in the same district.
  - in case of outbreak ID, the three characters signify the serial number of the outbreak in the same district in that year. In addition, if the outbreak is selected for detailed investigation, each additional case is allotted a serial number after the outbreak ID (e.g MOB-IND-UP-MRD-18-001-005), this indicates the fifth case of the listed cases in the outbreak. This number is entered on the VPD OB-003 form.

5.3 Process of allotting the EPID number

Only the DIO/SMO should assign this EPID number for an investigated case or a flagged outbreak or additional cases found on detailed investigation of an outbreak.

The DIO/SMO will verify the case/outbreak tracking register at the DIO/SMO office to check the past EPID numbers allotted to cases and outbreaks, decide on the next number.

Any error in the EPID number may misclassify the cases/outbreaks.

5.4 Table showing examples of a unique case identification number allotted to suspected cases or outbreak

Assigning ID	
For MR suspected cases	**For MR flagged outbreak**
MR-IND-UP-MRD-19-001	MOB-IND-MH-RTG-19-001-001
MR indicates disease measles rubella	MOB indicates measles rubella outbreak
IND: Country code	IND: Country code
UP- State code/Province code	MH- State code/Province code
MRD- District code	RTG - District code
19- year of rash onset	19- year of outbreak reporting
001: Serial no of cases in that year in the same district	001: Serial number of outbreak in that year in the same district
	001-XXX serial number allotted to each case identified during the detailed investigation of an outbreak, to be entered in the VPD OB-003 form

6. Case management and public health response

Adequate case management is a critical component of MR surveillance and should address the diagnosis, clinical assessment, severity status, and treatment to reduce morbidity and mortality associated with measles disease. Rubella however is a mild self- limiting disease that rarely requires intervention, unless there is a severe complication or if the case is pregnant. Rubella infection during pregnancy could result in abortion, still birth, or multiple birth defects in the child also known as congenital rubella syndrome (CRS).

Since both measles and rubella are highly infectious, care should be taken for IPC at community level as well as in health care institutions to prevent transmission, including nosocomial transmissions.

6.1 Clinical assessment

Uncomplicated cases can be managed at home but cases with complications may need to be hospitalized. A suspected case must be examined for the signs and symptoms of complications of measles to determine severity of disease. In addition, the family members should be educated on these signs and when to refer if these complications develop. Some of the clinical symptoms/signs pointing to underlying complications are:

- fever persisting beyond seven days;
- general condition worsens or child has persistent toxic look;
- acute respiratory infection/pneumonia, breathing becomes rapid or difficult;
- diarrhoea continues with signs of dehydration;
- convulsions, slurred speech, disorientation with suspected brain infection (encephalitis);
- eyes continue to be red, become painful, corneal clouding or there is a change in vision or eyes are infected with pus at the corner of the eye, signs of vitamin A deficiency (Xeropthalmia, Bitot's spot);
- child unable to eat, drink and is restless;

- rapid pulse, wasting, sore red mouth with ulcer; and
- ear pain and ear discharge not subsiding with home-based care.

6.2 Case management

Any person suspected of having measles should be isolated from others for the first four days following rash onset. As explained above, measles case management depends on the severity of disease.

6.2.1 Uncomplicated measles case

Many children will experience uncomplicated measles and may only require simple supportive measures as follows:

- provide two doses of vit A to all suspected cases, 24 hours apart as mentioned later in this section;
- continue breastfeeding; give plenty of fluids as per the child's requirement;
- provide ORS in cases with diarrhoea to prevent dehydration. In addition, provide Zinc tablets as supportive treatment respiratory infection/pneumonia, breathing becomes rapid or difficult;
- clean eye lesions and treat with 1% tetracycline eye ointment 3 times a day for 7 days (for corneal lesions, cover the eye with a patch) - vitamin A administration is particularly important to minimize the risk of potentially blinding eye lesions. In this situation, a third dose of vitamin A to be given four weeks later using the same dosage;
- clean ear discharge and treat with antibiotics;
- control the child's fever with paracetamol;
- fever will usually decline within one week and the rash will fade within 10-14 days; and
- treat the child at home as long as no complications develop.

6.2.2. Measles cases with suspected complications

- Refer the patient to a higher health facility (secondary care centre) for further management.
- Provide care in hospital settings and use proper infection control practices (e.g. isolation in the first four days) as measles is extremely contagious. Personal protection such as wearing of mask by health care staff, frequent hand washing should be practiced.
- Pneumonia can be treated with antibiotics, and if required with bronchodilators.
- Treat diarrhoea with Zinc-ORS or IV fluids as appropriate.
- Treat malnutrition with sufficient fluids and a high-quality diet.
- If needed, refer patient to a tertiary case health facility for further management.

6.2.3. Administration of vitamin A

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

to all children with suspected measles, irrespective of the timing of the previous doses. Vitamin-A dose should be given as recommended in the table below and it should never be exceeded under any circumstances. Use the spoon provided by the manufacturer. The schedule for treatment of suspected measles:

Age	Immediately on diagnosis	Next day
Infants <6 months	50,000 IU	50,000 IU
Infants 6-11 months	1,00,000 IU	1,00,000 IU
Children 12 months plus	2,00,000 IU	2,00,000 IU

6.2.4. Management of rubella cases

For rubella, care is supportive for non-pregnant persons without complications. The rare complications of rubella are thrombocytopenic purpura and encephalitis. Hence all cases with confirmed rubella should be followed up and referred to higher centre in case of signs of complications. All confirmed rubella cases should be isolated for seven days from the date of rash onset. This should be practiced in case of fresh cases in a confirmed outbreak. Pregnant women should avoid contact with a confirmed or epi-linked rubella cases.

In case of a sporadic case of pregnant women with suspected measles, a detailed case investigation must be conducted by filling the MR-CIF. Samples should be collected for laboratory testing for measles and rubella.

In case of a confirmed rubella outbreak, all pregnant women living in the area and having suffered fever maculopapular rash anytime during their gestation period should be investigated by filling MR-CIF for each case and samples collected for testing measles and rubella.

In case of confirmed rubella with pregnancy, the pregnant women should be followed by the ANM/MO of the area until the completion of her pregnancy to document the outcome (i.e., normal child, CRS child, miscarriage, stillbirth, etc). The newborn should be placed in contact isolation and referred by the MO PHC to higher centres for further evaluation of suspected CRS.

6.3 Public health response to confirmed cases

The confirmation of a measles or rubella case in a district should trigger a public health response by the district and block-level health teams focusing on strengthening surveillance and immunization services in the affected area.

6.3.1 Key activities of public health response

Following the confirmation of a measles or rubella case in a block, DIO/Nodal Officer/SMO must ensure following actions as public health response:

- ACS in the community. This should be conducted at the earliest opportunity by the local FLWs covering the entire village or about 200 households. The purpose is to look for additional cases, identify any child with complications, and provide vitamin A and referral services;
- strengthen passive surveillance within and outside the existing reporting network. All the reporting sites in the area should be alerted about the positive measles/rubella case in the area and they should be encouraged to report suspected cases;
- local FLWs, community influencers, religious leaders and school teachers likely to see cases should be sensitized about the case definition and requested to report any case they may see;
- based on the HFCA, hospitals/health facilities with potential to report or which have reported cases but are not part of the network should be included in an evidence-based expansion of the reporting network;
- strengthen immunization. Left-out and drop-outs for MRCV1 and MRCV2 vaccine doses should be identified by FLWs, preparing the due beneficiary list of the area and mobilizing the beneficiaries to the next routine immunization session in the outbreak area;
- planning need-based additional RI sessions to be conducted in the area;
- plan and implement communication efforts by strengthening IEC with a focus on person-to-person communication with mothers and local influencers;
- review and update RI micro-plans of the block and district with information on addition of sessions and communication plans. Mobilize additional human resources as needed;
- review vaccine supply, cold chain issues of the planning unit and block and address identified gaps;
- in case of a confirmed measles case, the parents should be educated about possible complications such as diarrhoea, pneumonia, eye infections, and otitis media. They should be advised to bring the child to a health centre/hospital if any complications are suspected;
- in case of a confirmed rubella case, identify any pregnant woman in the neighbourhood. If the pregnant women had a history of similar symptoms during the pregnancy then a blood sample should be collected and serum sent to a designated WHO accredited laboratory;

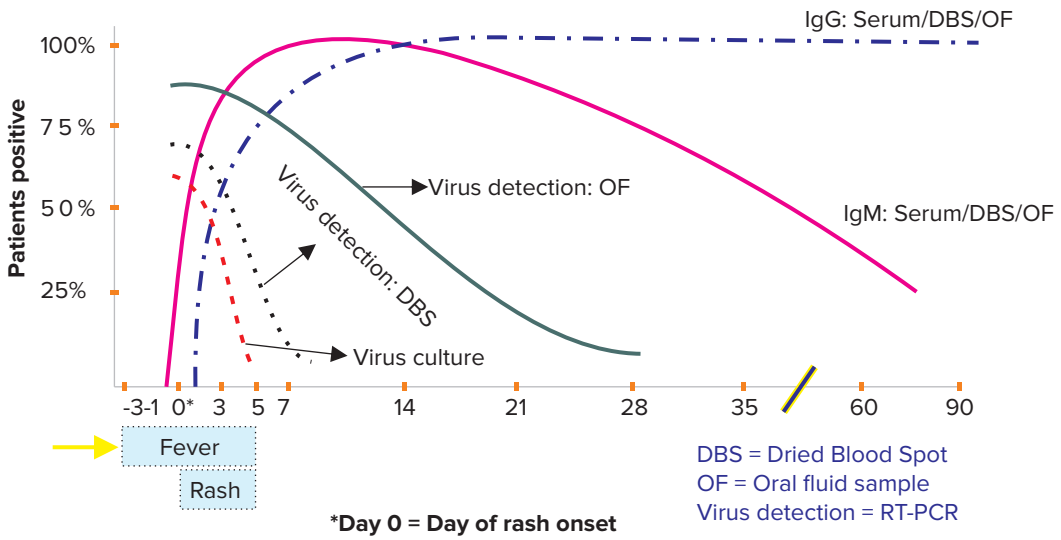
- in case of a pregnant woman with confirmed rubella, local FLWs should follow the woman until delivery. Whenever possible, MO PHC should consider referring her to secondary or tertiary care centres for delivery, evaluate the newborn for CRS and take up further needful management;
- if the newborn has CRS, then contact isolation should be followed and further management of the case continued under expert care.

7. Specimen collection and transportation

For laboratory confirmation of measles and rubella, serological tests are used and usually blood is collected through venipuncture for this purpose. However, for genotype characterization of measles and rubella viruses, collection of throat swab or urine or nasopharyngeal swabs are recommended.

Measles and rubella specific IgM antibodies appear within the first few days of the rash and decline rapidly after one month. Their presence provides strong evidence of recent measles or rubella infection or vaccination. As IgM is also produced on primary vaccination and cannot be distinguished from those produced by wild virus infection, vaccination history is essential for interpretation of serology test results.

Immune response to measles virus infection



Detection of IgM: Single serum, collected ≤ 28 days of rash onset
Virus culture: Throat Swab/Urine, collected ≤ 7 days of rash onset

The IgM ELISA tests are sensitive for samples collected within 28 days after the onset of rash. A single serum sample should be obtained from each measles suspected case at the time of first contact (during case investigation).

7.1 Specimen collection procedures

Under case-based surveillance, serum sample for serology and throat swab/urine sample for genotype characterisation should be collected from the same individual. In an outbreak setting, subjects for serum and throat swab/urine specimen collection could be different. However, if outbreak size is small, both types of samples can be collected from the same subject.

7.1.1 Blood specimen for serology

A blood specimen should be collected from each case within 28 days of rash onset, from any age group with no history of measles vaccination in last 1 month.

Collection-kit

- Lab request form
- Cryovial, 5ml sterile blood collection tubes
- Cryovial, 2ml sterile serum storage vials
- Tourniquet
- Specimen label for cryovials, marker pen
- 5 ml syringe with 23 g needle
- Butterfly/scalp vein with 23 g needle
- Band aid
- Disposable gloves and face mask (one set each)
- Alcohol swab
- Gauge pieces
- Zip lock plastic bags
- Plastic dropper
- Hub cutter
- Vaccine carrier with four ice-packs
- First aid kit (along with address of nearest referral facility in case of blood clotting complications)
- Waste disposal

Blood - Serum Collection Kit

Collection method

- Explain to the subject/parents about blood collection.
- Determine the best collection site (e.g., wrist, cubital area).
- Clean your hands with the hand sanitizer and put on a new pair of disposable gloves.
- Tie a tourniquet proximal to the site of puncture.

- Clean the venipuncture site as follows:
  - wipe with an alcohol swab using a circular motion from the centre to the periphery; and
  - allow the area to dry for at least 30 seconds.
- Collect 2 ml blood by venipuncture using the vacutainer tube assembly or by syringe and needle system.
- Release the tourniquet and press the puncture site with sterile gauze for about 15 seconds until the blood oozing stops. Then apply a band-aid at the site of puncture.
- The collected blood sample should be labelled with patient identification and collection date.
- Soon after collection, the tube containing blood samples should be kept at room temperature undisturbed for at least 30 minutes. During these first 30 minutes at room temperature, clot formation will happen and thus hemolysis caused by shaking of the tube during transportation will be prevented.
- After the clot formation, keep tubes in vaccine carrier with conditioned ice-packs for transportation to local or MR laboratory for serum separation.
- To prevent excessive shaking of sample or freezing of sample by direct contact with ice-packs during transportation, proper packing of the sample should be done in the vaccine carrier with cotton or other packing materials. One may consider using a rack or beaker in a vaccine carrier to keep the tubes in upright position.
- Usually, clot retraction happens in 2–8 hours at 4–8 degree temperatures. Due to clot retraction, the serum will be separated from the whole blood.
- After clot retraction, the whole blood should be centrifuged at 3000 rpm for 10 minutes to facilitate collection of the serum aseptically in a separate sterile tube for further storage or transportation.
- Label the tube with case ID and other details.
- Store the separated serum at 4-8°C until shipment takes place.

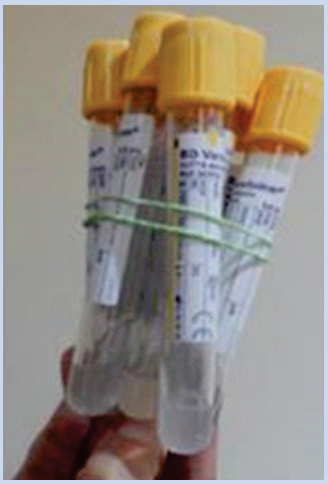
Shipment

- Specimens should be shipped to the designated laboratory as soon as possible within 5 days in cold chain. Do not wait to collect additional specimens before shipping.
- Place specimens in zip lock or plastic bags.
- Place the lab request form inside the plastic bag.

When the arrangements have been finalized, inform the lab of the time and manner of transportation.

Transport of venous specimens during field work

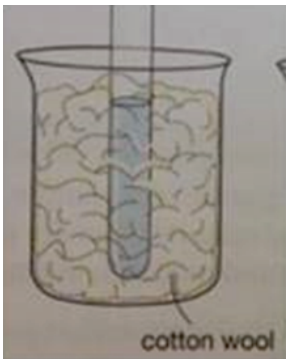
- Recommend wrapping the tubes together with a rubber band
- Place set of tubes in a beaker filled with cotton then place beaker in vaccine carrier at 2- 8^{0}C with conditioned ice packs after clotted (at least 30 mins at RT)



*For household specimen collection, recommend keeping tubes in a rack in a set location for first 30 minutes at RT

Packing venous blood specimens in vaccine carrier

Carefully transfer vacutainer from tube racks to beaker inside vaccine carrier.



Secure vacutainer tubes in beaker and cotton wool in vaccine carrier

Secure vacutainer tubes in beaker and cotton wool in vaccine carrier

Remember

- Label the vial with the patient's name, EPID number, specimen number for outbreak (match to the case-code in the VPD-OB003 format).
- Fill in the MLRF completely. The different MLRFs for sporadic cases and cases from outbreaks should be used while capturing the information in a different setting.
- Three important dates for filling the MLRF:
  - date of onset of rash,
  - date of last measles and rubella vaccination,
  - date of collection of sample.
- The sterile serum should be shipped in a vaccine carrier with a conditioned ice-pack to a WHO accredited laboratory and should reach the lab within 5 days of sample collection.
- In a rare scenario, the sterile serum can be stored at 4–8°C for a maximum period of 7 days. In case a delay of more than 7 days is anticipated, sera must be frozen at -20°C and should be transported to the WHO accredited laboratory on ice-packs. Repeated freezing and thawing can have detrimental effects on the stability of IgM antibodies.

7.1.2 Viral detection/isolation

The detection or isolation of measles or rubella virus in clinical specimens is done mainly for genotype characterization of the viruses to identify transmission chains. This provides very important information concerning the likely geographic origin of measles or rubella virus, importations which complement the information obtained from the standard epidemiologic investigation.

Therefore, appropriate clinical specimens for viral detection/isolation must be obtained in all outbreak settings and sporadic cases. Throat swab, urine or nasopharyngeal samples are the preferred samples for viral isolation/detection for both measles and rubella viruses. Preference should be given to collecting throat swabs over other methods (over nasopharyngeal swab or urine). If it is not possible to obtain a throat swab, an attempt should be made to collect a urine sample or nasopharyngeal swab. Blood sample and throat swab may be collected from the same case for all sporadic cases and in an outbreak only if the size of the outbreak is small.

The throat swab and nasopharyngeal swab should be collected and transported in viral transport media (VTM) tubes in the cold chain.

Throat/nasopharyngeal swab or urine samples for virology

Any one, either throat swab, nasopharyngeal swab or urine, should be collected from each suspected measles case within 7 days of onset of rash. During outbreaks, virology samples are collected from only two cases.

Equipment required

- VTM (viral transport media)
- sterile swab
- tongue depressor
- sticker labels
- culture tube for urine sample
- mask and gloves.

Collection method

The throat swab and nasopharyngeal swab should be collected and transported in viral transport media (VTM) tubes in the cold chain. The specific steps are as described below.

Throat-swab

For throat-swab ask patient to open mouth and use tongue depressor then:

- hold tongue away with tongue depressor;
- locate areas of inflammation and exudate in posterior pharynx, tonsillar region of throat behind uvula;
- avoid swabbing soft palate, do not touch the tongue;
- rub area back and forth with cotton or Dacron swab;
- immediately place the swab inside the VTM vial;
- break the remaining portion of the stick that extends outside the vial and cap the vial securely; and
- ship at 2-8°C.

Figure showing throat swab collection method and the collection kit:

Nasopharyngeal swab

Nasopharyngeal swabs are obtained by rubbing the nasopharyngeal passage through inserting the sterile swabs to dislodge epithelial cells

- Have the patient sit with his/her head against a wall or support.
    - patients have a tendency to pull away during this procedure.

- Explain the procedure to the parents or patient.
- Measure the distance between anterior nares to the lower lobe of the ear of one side.
- Mark the swab with half of the above measured distance.
- Ask the patient to blow the nose forcefully to remove any mucous plug.
- Position the head slightly upwards and insert the swab along the floor of the nose up to the distance marked
  - avoid insertion of swab in upward direction.
- Do not force swab if obstruction is encountered before reaching the nasopharynx
  - remove the swab and try the other side.
- Try to leave the swab in place for 5–10 seconds to increase sensitivity
- Immediately place the swab in transport media and tighten the cap
  - it is best to wrap the tape around the cap to prevent any leakage.
- Ship at 2–8°C

Figure Showing nasopharyngeal swab

Urine collection

Urine samples should be collected in the sterile container which should have a screw that is tightened properly. The container should be packed in the zip lock bag to avoid contamination of vaccine carrier from any spillage.

Specimens collected should be transported to the designated MR laboratory network after proper labelling of VTM/culture tubes with EPID No. and completed MR-LRF at the earliest as possible.

Storage and transportation conditions

- Soon after collection the urine/nasopharyngeal/throat swab sample should be stored at 4 to 8°C inside a vaccine carrier in the field.
- Urine sample should be properly packed to ensure leak proof transportation to the designated MR laboratory.
- Efforts should be made to deliver the sample within 24 hours of collection. Both samples are rich culture medias for bacterial growth and any delay in storage/transportation will reduce chances of virus isolation.

Figure Showing sterile container for urine sample

7.1.3: Summary of types of samples to be collected for laboratory diagnosis of measles and rubella

Type of specimen	Test type	Volume to collect	Timing for specimen collection	Storage conditions
Serum (venipuncture)	IgM antibody detection	5 ml of blood in an older age group; 1 ml for infants and younger children; 0.5 ml from small infants	Within 28 days after rash onset	4–8 °C
Throat, nasal, or nasopharyngeal (NP) swabs or nasopharyngeal aspirates**	Viral isolation and detection of viral RNA	Swab or NP aspirate	Within 7 days after rash onset for viral isolation (cell culture)	4–8 °C
Urine	Viral isolation by cell culture Detection of viral RNA by RT-PCR	Minimum 50 ml (preference first morning void).	Within 7 days after rash onset	Storage and transport at 4–8 °C

Urine and serology samples need to be sent in separate vaccine carriers to avoid cross-contamination wherever feasible.

8. Case and outbreak classification

All reported suspected measles or rubella cases should be classified into one of the following mutually exclusive categories (see figure). Case classification must be done in close coordination with the DIO, SMO, national team, and the laboratory staff. It is the responsibility of the DIO, SMO and national data team to review the case classification of each suspected case, and to follow the subsequent steps to ensure case classification and investigations are completed for each case. Case classification of each suspected case is based on clinical presentation, laboratory results and the epidemiological information elicited during case investigation and collected from the MR-CIF.

8.1 Definitions

8.1.1 Adequate samples

- **Adequate serological sample.** A blood sample collected within 28 days of rash onset by venipuncture, with minimum quantity of 2 ml whole blood drawn to obtain at least 0.5 ml of serum after separation, with no signs of hemolysis in serum sample and received in the laboratory under proper cold chain conditions with appropriate documentation.
- **Adequate urine sample.** An adequate specimen for virology is a urine sample collected within 7 days of rash onset with 50 mL of urine collected in a sterile, leak-proof container and received under proper cold chain conditions in the laboratory with appropriate documentation.
- **Adequate throat/nasopharyngeal sample.** An adequate specimen for virology is a throat/nasopharyngeal sample collected within 7 days of rash onset in viral transport media and received under proper cold chain conditions in the laboratory with adequate documentation.

8.1.2. Discarded non-measles non-rubella case. A suspected case that has been investigated and discarded as non-measles and non-rubella by:

- laboratory result negative for measles and rubella, through serum sample testing in a proficient laboratory; and

- no epidemiological linkage to another confirmed measles or rubella case.
  - there may be an epidemiological linkage to a disease other than measles or rubella

8.1.3 Laboratory-confirmed measles. A case that meets the suspected measles case definition and is laboratory (serologically or virologically) confirmed as measles.

8.1.4 Laboratory-confirmed rubella. A case that meets the suspected measles case definition and is laboratory (serologically or virologically) confirmed as rubella.

8.1.5 Epidemiologically-linked cases. As a part of an outbreak investigation, additional suspected cases captured on line listing forms but without specimens collected are epi-linked if they are part of a lab-confirmed outbreak (see Figure 8.3).

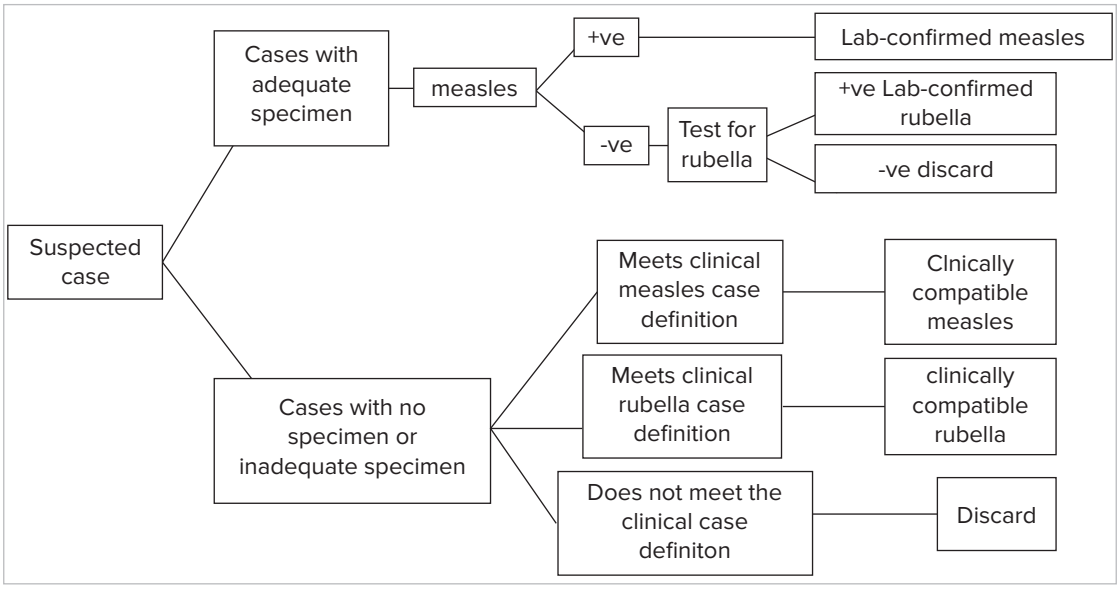
8.1.6 Clinically compatible measles case. A suspect case with fever, maculopapular (non-vesicular) rash and one of the 3 C's (cough, coryza or conjunctivitis) for which no adequate laboratory specimen could be collected and is:

- not epidemiologically linked to a laboratory-confirmed case of measles or rubella; and
- not epidemiologically linked to another laboratory-confirmed communicable disease.

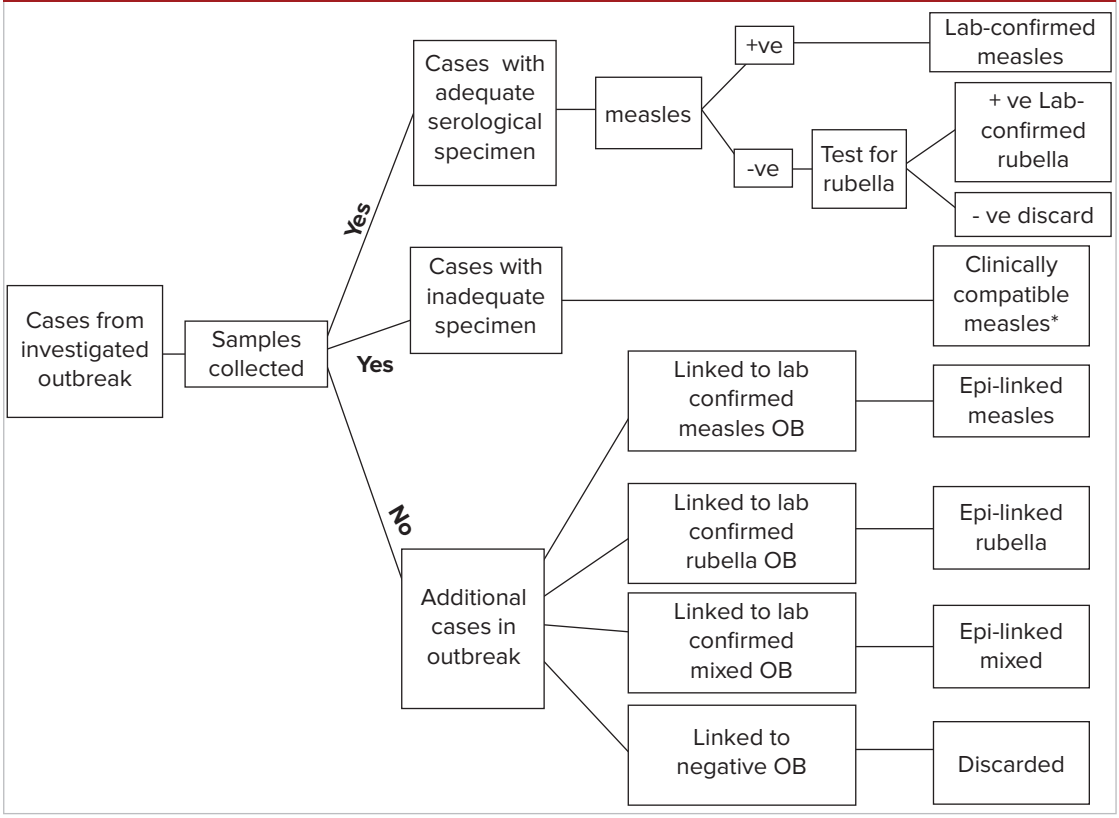
8.1.7 Clinically compatible rubella case. A suspect case with fever, maculopapular (non-vesicular) rash and one of arthritis/arthralgia or lymphadenopathy, for which no adequate laboratory specimen could be collected and is:

- not epidemiologically linked to a laboratory-confirmed case of measles or rubella; and
- not epidemiologically linked to another laboratory-confirmed communicable disease.

8.2: Scheme of classification of sporadic MR cases



8.3: Scheme of classification of cases in MR outbreaks



*if not able to epi-link; for fever and rash states also clinically compatible rubella.

8.4: Classification of MR outbreaks[6]

Outbreak classification	
≥ 2 measles & ≥ 2 rubella positive	Mixed outbreak
≥ 2 measles positive	Measles outbreak
≥ 2 rubella positive	Rubella outbreak
< 2 measles & < 2 rubella positive	Negative

8.5: Other definitions

Preventable vs. non-preventable cases

Every measles and/or rubella case in an outbreak should be categorized as:

8.6.1. Programmatically preventable. Failure to receive age appropriate two doses.

8.6.2 Programmatically non-preventable. Either vaccine failure (received two doses) or as not having received the required two doses because the child was too young at the time of infection (e.g. a case < 9-month-old child) or the programme had only one dose in the schedule when the person was eligible. This classification will be done at the national level.

[6]Classification of outbreaks is described in detail in Section 11: Outbreak response

9. Data management and analysis

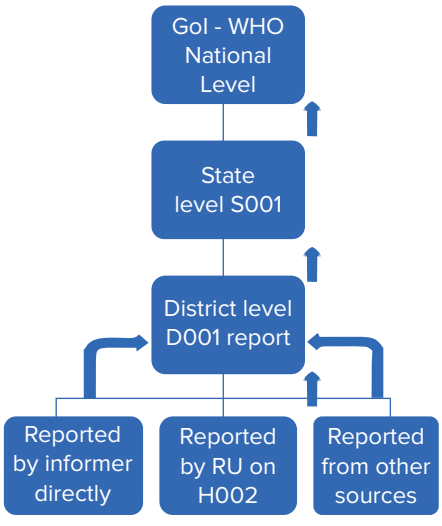
Disease surveillance generates specific and actionable data on the current epidemiology of diseases in the country to guide appropriate and timely measures to achieve elimination objectives. Hence it is important to collect relevant data from MR surveillance for:

- assessing the surveillance sensitivity;
- analyzing data to generate information;
- interpreting and generating feedback to guide evidence-based actions at the national, state, district and sub-district levels.

Regular data analysis helps in understanding how well the surveillance and the immunization programmes are performing in a given area. It also helps in identifying gaps requiring further strengthening. Surveillance data analysis provides the basis for major actions such as measuring the progress towards elimination, and at national and sub-national levels, decisions on introducing new vaccines/tools or modifying of programme design.

9.1 Data sources and collection

The MR surveillance data is generated from multiple activities. The data related to suspected measles cases flows from the RS to the DIO/SMO at the district level. Reporting units send weekly reports on the VPD-H002 format including "nil" reports. Every reported case, from any source, is added to the district weekly report in the VPD-D001 format and sent to the state level. At the state level, the reports from all districts are compiled into the state weekly surveillance report on the VPD-S001 format. Data related to individual cases is captured using the MR-CIF and entered into SIMS. The data related to the cases found during an outbreak investigation is captured using the VPD OB-003 form and is also entered into SIMS. Other surveillance data, including the list of RS in a district, and ACS at RS are also entered SIMS.



There are data generated by activities such as ACS at reporting sites, re-prioritization, reporting network maintenance through adding new health facilities and by deleting non-functional RS, and by periodic reprioritization. There is huge amount data generated from these activities which should be collected in a systematic manner. The data collection formats of MR surveillance have been standardized to help facilitate smooth collation and analysis for further actions. The key formats used for data collection in MR surveillance include:

VPD – H series forms related to hospital or reporting site:

- H 001-hosptial assessment for adding into RS network;
- H002 hospital/RS weekly report;
- H003 doctor-wise number of cases in a week maintained by the institutional Nodal Officer; and
- H003A department-wise number of cases in a week maintained by institutional Nodal Officer in large institutions with multiple departments.

VPD – D series forms at the district level:

- D001 – district weekly report;
- D 002 – tracking timeliness of reporting unit wise reports;
- D003 – ACS in RS by DIO/Nodal Officer/SMO; and
- D-004 record of contact with RS by telephone/ letter/health supervisor visit.

VPD – S series forms at the state level:

- S001 – weekly state report; and
- S002 – tracking timeliness of district wise weekly reports.

Data from cases investigated using the MR CIF generates information related to:

- unique identification number
- source of reporting
- demographic data
- immunization history
- basic clinical data
- travel history
- health seeking behaviour
- health facility contact history
- sample collection
- sample results
- follow-up
- case classification.

During an outbreak investigation, details of cases found are entered in the VPD OB-003 form and the details collected are similar to the one on MR-CIF but fewer in number.

9.2 Data analysis

The data collected on standard forms is entered into the data management and analysis software named Surveillance Information Management System (SIMS) at the NPSP unit office. SIMS helps in collation of data from field units and from the laboratories and merging the data as needed. The SIMS generates a line-list of cases and outbreaks with unique column headings for core variables, which can be used for further analysis to generate valuable information. SIMS also provides automated data analysis which helps the programme managers at national, state and district levels to track the performance of the surveillance system and to generate appropriate feedback.

Data from the line-listings should be analysed to monitor classification of laboratory confirmed, clinically compatible, and epidemiologically linked cases (in outbreaks), cases by age, sex, location and vaccination status, whether standards for case reporting and investigation are being met and to identify facilities which are seeing cases but not in the network. The line-list produced by SIMS should be used for such analysis. SRTLs/State SMO and SEPIO should share the results with DIOs and MOs on a weekly or monthly basis.

Data on cases are analyzed to describe person, time, place distribution of reported cases and to monitor the performance of the MR surveillance system by district and state.

Analysis by time

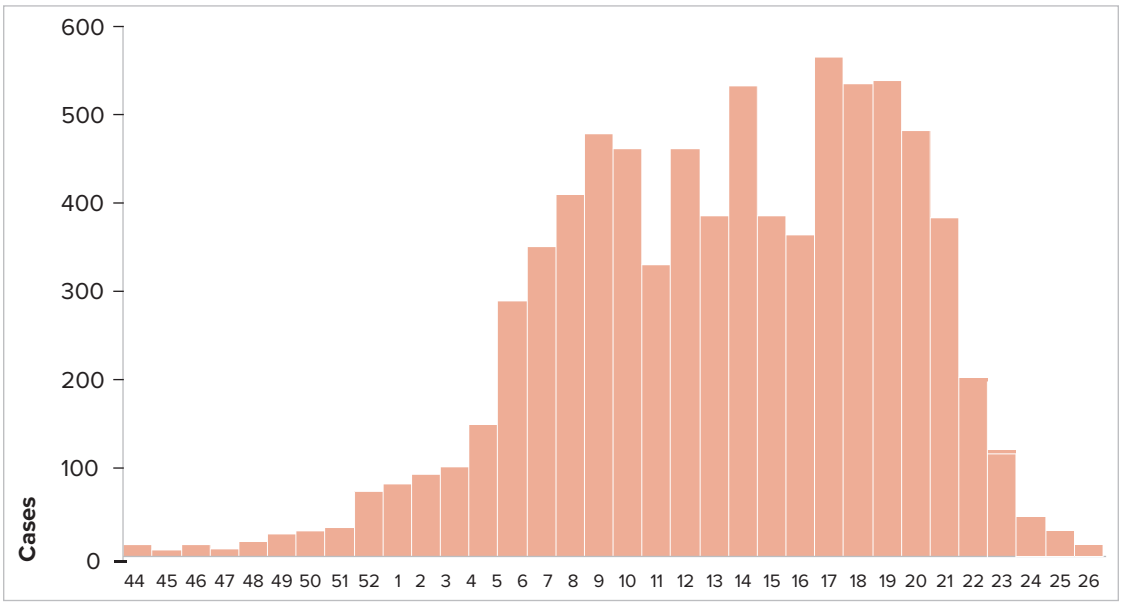
Date of onset of rash of investigated suspected cases is the most critical information for time analysis. Time analysis detects changes in disease occurrence:

- month-wise occurrence of cases by states/districts in the past 12 months. This helps identify if there is any seasonality and if any district is silent (not reporting a single suspected case in a 12-month period); and
- analysis of suspected cases by case classification over the years in a district/state shows if the surveillance system is functioning well. Analysis of confirmed cases by district/state by year helps in tracking progress towards elimination.

Epidemic curve

An epidemic curve is used to describe the occurrence of cases over time, usually plotting the number of cases with rash onset by week or reported by week. It helps in visualizing the trend of cases over time. In an outbreak analysis, it can help determine the magnitude and if the peak of the outbreak is over, regarding primary-case, index-case, last-case, and whether control efforts are having an impact.

Figure: Measles cases (lab-confirmed, epi-linked and clinically compatible) by epidemiologic week (example of an epi-curve)



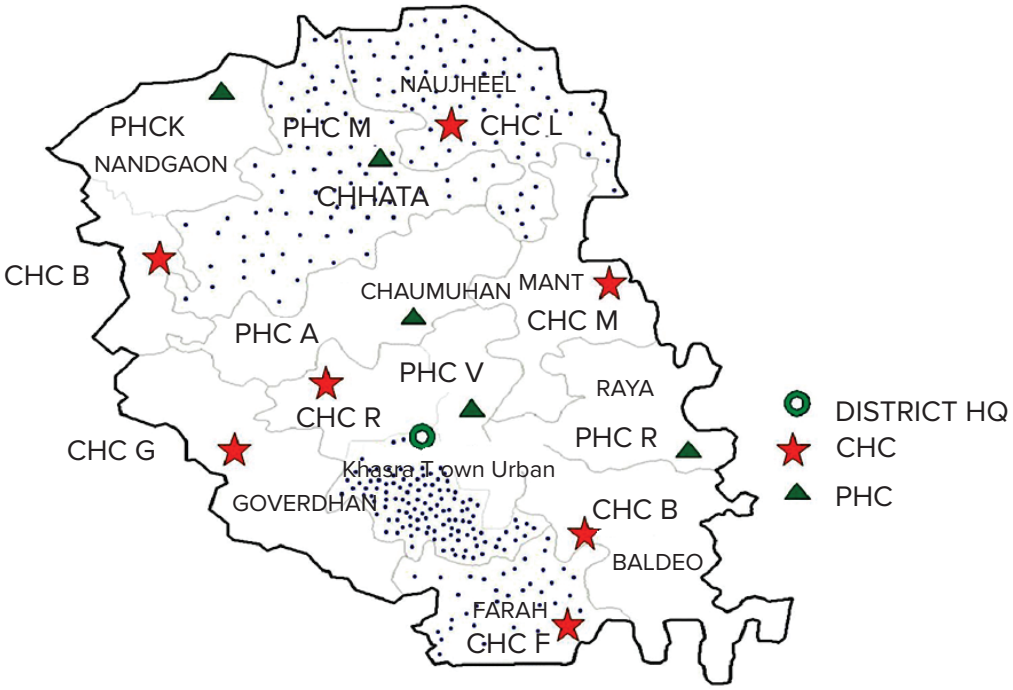
Surveillance week numbers for 2018- 2019

Analysis by place

Place of residence, i.e. the place where case was residing during the incubation period, is important information. Spot mapping of reported cases should be done at the block, district and state levels. This helps to visualize the cases by block, identify if there is any clustering of cases, if any blocks are silent etc. The limitation of the map is it does not consider the density of the population in an area. In case of an outbreak, the mapping may be required at the village level.

As shown below, spot mapping the cases (in this case a district) can help identify the most affected areas and identify clustering of cases.

Figure: Number of cases in blocks, District A



The place where the case was residing at the time of onset of symptoms must be determined for all reported cases. The location of cases is then plotted on a map either manually or with the help of computerized mapping programmes.

Maps with confirmed cases and outbreaks can point to areas requiring strengthening of immunization. This provides an opportunity to review the immunization services and plan interventions including increasing routine immunization sessions or taking up of special campaigns to augment routine immunization such as Mission Indradhanush.

Analysis by person

The characteristics of cases such as age, sex, religion, vaccination status, hospitalization, and others such as risk factors including travel, exposure in school/work can be analyzed from the line-list. Some examples of analysis of age and vaccination can be seen in the tables below.

Age distribution. Age distribution of cases permits programme managers to detect any changes in the epidemiology of the disease and to establish which age groups to target for vaccination. The figure below provides an example of the age distribution of measles and rubella cases. Comparison of such graphs indicate whether the disease pattern of measles or rubella has changed over time and which of the age groups are most affected.

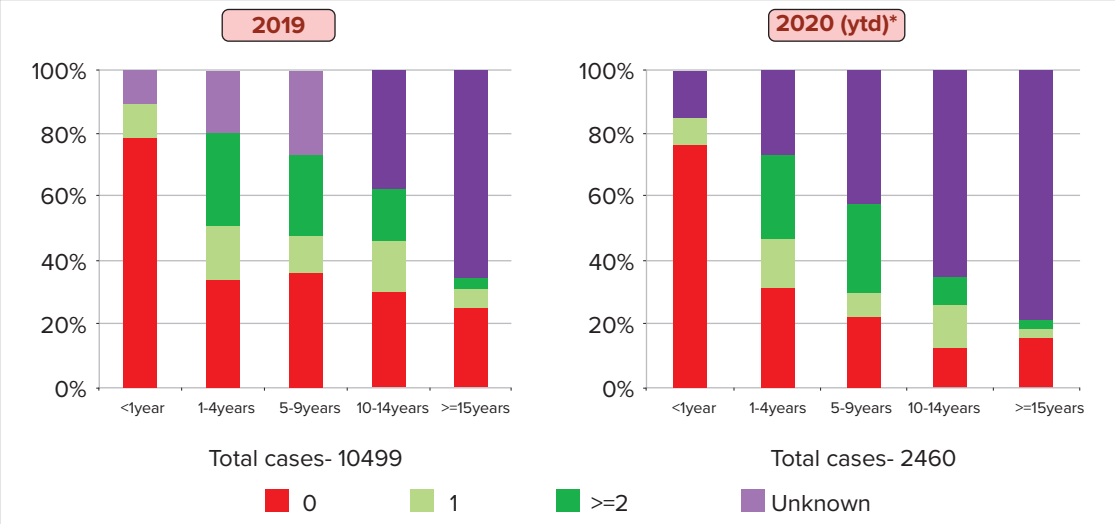
Age distribution of measles and rubella cases, 2018 - 2019

*data as on November 2019

#Measles cases include lab confirmed cases, epi-linked cases and clinically compatible cases
##Rubella cases include lab confirmed cases, epi-linked cases

Vaccination status. Accurate information on the vaccination history of confirmed cases is essential for evaluating vaccine coverage, vaccine effectiveness and detecting potential problems with the cold chain. The figure below provides an example of vaccination status by age group.

Vaccination status of measles cases by age-group, 2019-2020 (ytd)*



#Measles cases include lab confirmed cases, epi-linked cases and clinically compatible cases
*data as on 09 April 2020

Incidence per million population per 12-month period by geographic area (country, state, district) may be calculated. Because of seasonality, it is not appropriate to calculate the incidence for shorter periods of time:

Incidence of measles. The number of measles cases per million population

$$\frac{\text{Number of measles cases (confirmed + epi-linked + clinically compatible) for 12-month period}}{\text{Population in which cases found}} \times 1\,00\,0000$$

Incidence of rubella. The number of rubella cases per million population

$$\frac{\text{Number of rubella cases (confirmed + epi-linked) for 12-month period}}{\text{Population in which cases found}} \times 100\,0000$$

9.3 Surveillance performance indicators

The following surveillance performance indicators should be calculated and closely monitored at the district, state, and national levels:

Non-measles and non-rubella discard rate. As a proxy for the sensitivity of surveillance (target: ≥2 per 100 000 total population)

$$\frac{\text{Total number of lab-discarded non-measles non-rubella cases}}{\text{Total population}} \times 100\,000$$

Representativeness of reporting. Proportion of second administrative level units reporting at least two non-measles non-rubella cases per 100 000 population (target: ≥ 80% of second-level administrative units)

$$\frac{\text{Total number of sub-national (state/district) units reporting at least two non-measles non-rubella cases per 100 000 population}}{\text{Total number of sub national (state/district respectively) units}} \times 100$$

Target is ≥ 80% of states/districts reporting NMNR discard rate ≥ 2 per 100 000.

Timeliness of weekly reporting. Proportion of surveillance units sending measles and rubella reports, 'zero-case reporting' to the national level on time (target: ≥80%).

Weekly reports are considered timely if:

- RU report (VPD-H002) received in the district from RUs by Tuesday noon;
- District report (VPD-D001) received at the state HQ by Wednesday noon; and
- State reports (S001) received at the national level by Thursday noon.

$$\frac{\text{Surveillance units reporting measles and rubella data to the district/state/national level on time.}}{\text{Total number of surveillance units in the district/ state/national level.}} \times 100$$

Timeliness of case investigation. Proportion of suspected cases investigated within 48 hours of notification (target: ≥80% of suspected cases).

$$\frac{\text{Total number of cases investigated within 48 hours of notification}}{\text{Total number of suspected cases*}} \times 100$$

* cases reported from MR-CIF

Completeness of case investigation: Completeness of investigation includes filling of all key elements of MR-CIF or VPD OB-003 for all the following key variables from each suspected case of measles or rubella:

From MR-CIF/VPD-OB 003:

- date of case notification (CIF)/ date of notification of index case (VPD-OB003)
- date of case investigation(CIF)/date of outbreak investigation (VPD-OB 003)

- name and address
- age and sex
- MR vaccination status
- date of last dose of MR vaccination
- date of onset of rash
- travel history
- health seeking behaviour after rash onset
- contact with community workers/health facility
- date of specimen collection
- death

$$\frac{\text{Total number of cases investigated/line-listed with collection of key data elements}}{\text{Total number of suspected cases}} \times 100$$

Adequacy of serum sample collection. Proportion of suspected cases with adequate serum specimen collection (target: ≥80% of suspected cases, excluding epidemiologically linked cases)

$$\frac{\text{Total number of cases in which adequate serum sample is collected}}{\text{Total number of suspected cases*}} \times 100$$

Adequate specimens for serology are those collected within 28 days after rash onset that consist of ≥ 0.5 mL serum (at least 2 ml of blood drawn, serum separated with no haemolysis), shipped to the MR laboratory in proper cold chain at 2-8 deg C. Epidemiologically linked cases should be excluded from the denominator. *Denominator is total number from MR-CIF.

Adequate virology sample collection. Proportion of eligible suspected cases with adequate virology specimen collection.

$$\frac{\text{Total number of cases in which adequate virology sample is collected}}{\text{Total number of suspected cases eligible for virology collection*}} \times 100$$

Adequate specimens for virology are the samples (throat swab/urine/nasopharyngeal) collected within 7 days of rash onset that arrive to the laboratory in good condition. Epidemiologically linked cases should be excluded from the denominator.

*The denominator should be cases with date of notification ≤ 7 days from date of rash onset from the MR-CIF.

Timeliness of specimen transport. Proportion of specimens received in the lab within 5 days of collection (target ≥80% of the total number of specimens collected).

$$\frac{\text{Total number of specimens received in the MR laboratory within 5 days of collection}}{\text{Total number of specimens collected}} \times 100$$

Timeliness of laboratory reporting. Proportion of serology results reported by the laboratory within 4 days of specimen receipt (target: >80%).

$$\frac{\text{Total number of results reported by laboratory within 4 days of specimen receipt}}{\text{Total number of serology specimens received}} \times 100$$

Proportion of virology results reported by the laboratory within 2 months of specimen receipt (target: >80%).

$$\frac{\text{Total number of results reported by laboratory within 2 months of specimen receipt}}{\text{Total number of virology specimens received}} \times 100$$

Outbreak investigation (target: 100%).

$$\frac{\text{Total number of outbreaks with preliminary investigations}}{\text{Total number of flagged outbreaks}} \times 100$$

10. Roles and responsibilities

A well-functioning MR surveillance system is key to measuring progress towards achieving MR elimination. The smooth functioning of the system depends on the dedicated efforts of multiple teams involving political and administrative leadership, key government officials, development partners, academic institutions, health facilities, and community leaders. The awareness, ownership of the programme and continued availability of sufficient human, logistics and financial resources lead to the success of the surveillance system. Even though it may not be possible to list the roles and responsibilities of all personnel, some select roles and responsibilities are described below.

10.1 Roles and responsibilities

10.1.1 Responsibilities of PHC/UPHC teams, including MO and designated NOs and FLWs in surveillance

The PHC teams are the functional units at the field level carrying out surveillance activities such as supporting the surveillance network, supporting community-based surveillance, case investigation, sample collection, sample shipment and public health response.

- the MO is the programme manager at the peripheral level. PHC MO's ownership and efforts help strengthen the surveillance network, reporting of cases and timely case investigations;
- FLWs should network with local practitioners, influencers and teachers in their areas to strengthen passive reporting of cases;
- following confirmation of a measles or rubella case, under guidance of MO PHC, the FLWs in the area should conduct an ACS in the neighborhood, including schools, kindergartens and temples, to check for any unreported cases;
- if an outbreak is flagged, the ERT team, mainly MO PHC and FLWs must undertake preliminary search in the community to check for additional cases; and
- this helps the District managers to determine if there is clustering and if a further detailed investigation needs to be conducted. For the detailed role of field teams in outbreak investigation, refer to section 11: Outbreak response protocol.

10.1.2 Responsibilities of Block level teams, including BMO

- the BMO is the programme manager at the Block level. The BMO's ownership and efforts help strengthen the surveillance network, reporting of cases and timely case investigations;
- the BMO and/or Nodal Officer should visit the reporting sites of his block;
- organize and conduct Block level workshops of FLWs & private practitioners for sensitization on MR surveillance;
- the BMO and/or Nodal Officer should network with local practitioners, influencers and teachers in their areas to strengthen passive reporting of suspected cases;
- the BMO and/or Nodal Officer should verify MR-CIFs and cases and supervise sample collection done by PHCs; and
- following the confirmation of a measles or rubella case, the BMO should supervise an ACS in the neighborhood, including the schools, kindergartens and temples by PHC staff.

10.1.3 Responsibilities of DIO and SMO at the district level

The DIO, with technical support of the SMO at the district level, is the key programme manager for basic field operations. Much of the basic activities in surveillance related to nurturing surveillance network, case reporting, case investigation, sample collection, sample shipment, and public health response to confirmed cases are managed at the district level. More specifically the DIO and SMO:

- ensure capacity building of all RS staff, MOs of PHCs, sensitization of FLWs and other sources of case information in the district;
- participate in District Weekly Review (DWR) meeting with District Surveillance Officer (DSO), monitor passive reporting of cases and weekly reports from RS, track case investigations, flag and manage outbreak investigations, track sample collection, shipment, results, feedback and ensure completion of documentation at every level of activity;
- flag outbreaks, review results of preliminary investigation and manage detailed outbreak investigations;
- plan and monitor public health response to confirmed cases and outbreaks, including case management and referral, strengthening of surveillance and immunization in the affected area;
- use MR surveillance as a tool for strengthening routine immunization by adding affected areas to the list of high risk areas in the district and intensifying efforts in reaching the unreached in the HRAs;
- DIO/SMO to monitor data entry and overall data management through SIMS;
- DIO to plan mobilization of resources, including additional resources to support field teams especially during outbreaks;
- DIO to hold periodic review (monthly/quarterly) of the immunization programme in which progress and issues in surveillance are discussed with MOs and block level programme managers;
- DIO to make efforts to engage key partners in surveillance such as IMA and IAP at district level to ensure their support; and

- as Member secretary to the District Task Force on Immunization, DIO to present progress and challenges including feedback on recent cases/outbreaks and public health response to the District Magistrate and other key senior administrative leaders at district level.

10.1.4 Programme management at the state level

The State Expanded Programme Immunization Officer (SEPIO), with technical support from the State SMO/Sub Regional Team Leader (SRTL), manage the MR surveillance as part of the larger AFP-MR-DPT surveillance system.

- ownership at the state level translates into actions at the district level;
- SEPIO's ownership, guidance, and provision of resources, including human and financial resources, motivate district teams on strengthening surveillance;
- SEPIO's office manages the data, identifies gaps, and sends out key state letters to the districts;
- SEPIO organizes state level capacity building workshops, development of guidelines and training material in local languages;
- SEPIO engages state IDSP cell and other key partners such as IAP and IMA
- SEPIO organizes quarterly review meetings in which surveillance progress and issues are discussed with the district officers; and
- as Member secretary to the State Task Force on Immunization, the SEPIO should present the surveillance data to State Mission Director/Secretary to the Government and discuss the gaps requiring support/ approval.

10.1.5 Role of partners

WHO NPSP have been working closely with the Government at the national, state and district levels, providing technical support for MR surveillance and for the overall goal of MR elimination. The key areas of support from NPSP are:

- advocacy at state and district levels and participation at key meetings;
- technical advice;
- capacity building and development of training material, organizing workshops;
- case investigation;
- outbreak investigation; and
- data management.

IAP and IMA are the other key partners supporting MR surveillance

11. Outbreak response protocol

11.1 Rationale for investigating measles and rubella outbreaks

Measles is one of the world's most contagious diseases, and complications occur in approximately 30% of reported cases. The risk for severe complications or death from measles increases for children less than five years of age, malnourished children, immune compromised children, and those living in crowded conditions [2]. Rubella is an acute, mild, self-limiting viral illness. While the majority of rubella cases occur in children less than 15 years of age, rubella infection occurring during early pregnancy or immediately before conception may result in congenital rubella syndrome (CRS), miscarriage or foetal death [9]. Measles and rubella can, however, be prevented with a safe and effective measles and rubella containing vaccine (MRCV) that gives long term immunity [2,9].

India is committed to the elimination of measles and rubella. In addition to achieving and maintaining high population immunity with 95% vaccination coverage with two doses of MRCV, a key strategy for elimination of measles and rubella in India is ensuring a sensitive surveillance system that can respond rapidly to measles and rubella outbreaks. The primary reasons for an outbreak investigation are to facilitate rapid implementation of control measures to control the outbreak, reduce the extent of disease spread, and ensure that virus transmission is interrupted as soon as possible.

Despite recent improvements in coverage with MRCV1 and MRCV2 in India, pockets of low immunity still exist. When there is low population coverage with MRCV1 and MRCV2 in a community, there is an increased risk for measles and rubella outbreaks. As areas with low population coverage for MRCV may also have low routine immunization (RI) coverage, an outbreak of measles or rubella highlights an opportunity to strengthen RI in the outbreak area.

11.2 Objectives of outbreak investigations

- Facilitate early detection and rapid response.
- Facilitate rapid implementation of control measures to reduce the extent of disease spread.
- Implement control measures to control and prevent the further outbreaks.

- Ensure that virus transmission is interrupted as soon as possible.
- Reduce morbidity and mortality due to measles and rubella.
- Study the epidemiology of measles and rubella and define the population at risk.
- Use outbreak data to identify areas of low population immunity.
- Review the dynamics of disease and impact of vaccination.
- Provide guidance for strategic actions to improve vaccination strategies.

11.3 Outbreak response

11.3.1 Steps in identification of an outbreak

Definition of a suspected measles outbreak

A suspected measles outbreak will be flagged with an outbreak ID when there are:

- ≥ 5 suspected measles cases reported in block/ward/planning unit in the past four consecutive weeks;

  OR
- ≥ 5 suspected cases in an area bordering multiple contiguous blocks/wards/planning units in the past four consecutive weeks;

  OR
- ≥ 1 suspected measles-death in a block/ward/planning unit.

Identifying the outbreak

- In the weekly district review meeting (DWR), the district team comprising the DIO, DSO/epidemiologist IDSP and SMO (as per availability) will collate different sources of information and prepare the weekly district report form (VPD-D001) to identify a suspected outbreak in a block/ward/planning unit in the past four consecutive weeks.
- The VPD-D001 should include:
  - suspected cases reported through weekly VPD-H002
  - suspected cases reported directly from informers
  - suspected cases from IDSP (S, P and L forms).
- The district team should cross-check that all suspected cases are investigated.
- If the team finds five or more suspected cases in a block/ward/planning unit in the past four consecutive weeks, the team should flag an outbreak and assign an outbreak identification number which is unique for each outbreak.
- The outbreak ID is assigned serially to the outbreaks flagged in the district in a calendar year. The outbreak ID is an alpha numeric figure given as a unique identifier for each outbreak. The first two characters signify a suspected measles outbreak, the next three characters signify the country code, the next two signify the state code, the next three signify the district code, the next two signify the year of rash onset and the final three numbers are the serial numbers of the outbreaks in that year, in the same district.
- The box below gives an example for assigning an outbreak ID for a suspected measles outbreak in Uttar Pradesh, Moradabad district in the year 2019:

Assigning an outbreak ID for a suspected outbreak
MOB-IND-UP-MRD-19-001
MOB: suspected measles outbreak
IND: country code
UP: state code/province code
MRD: district code
19: year of rash onset
001: serial no of an outbreak in that year in the same district

- Once the outbreak ID is assigned, the following actions are undertaken:
  - the DIO will immediately inform the respective MOIC through a telephone call/email about the flagged outbreak and provide guidance on conducting preliminary search; and
  - the MOIC will guide the field teams (ANM/ASHA/AWW) on how to conduct the preliminary search from the area where the suspected cases have been reported.

Preliminary search

The preliminary search is a process to ascertain:

- if the cases fit into the suspected measles case definition (particularly non-vesicular rash);
- if there is clustering of suspected cases (its geographical spread) in the past four weeks in the affected area;
- if there is any measles related death.

A preliminary search must be initiated within 72 hours of flagging an outbreak. All flagged outbreaks should undergo a preliminary search. The preliminary search will be carried out by the field team (led by the ANM and assisted by the ASHA/AWW) under the supervision of the health supervisor/MO. The suspected cases will be listed in her diary with a standard set of information (name, age, address, mobile no., fever and date of onset of rash).

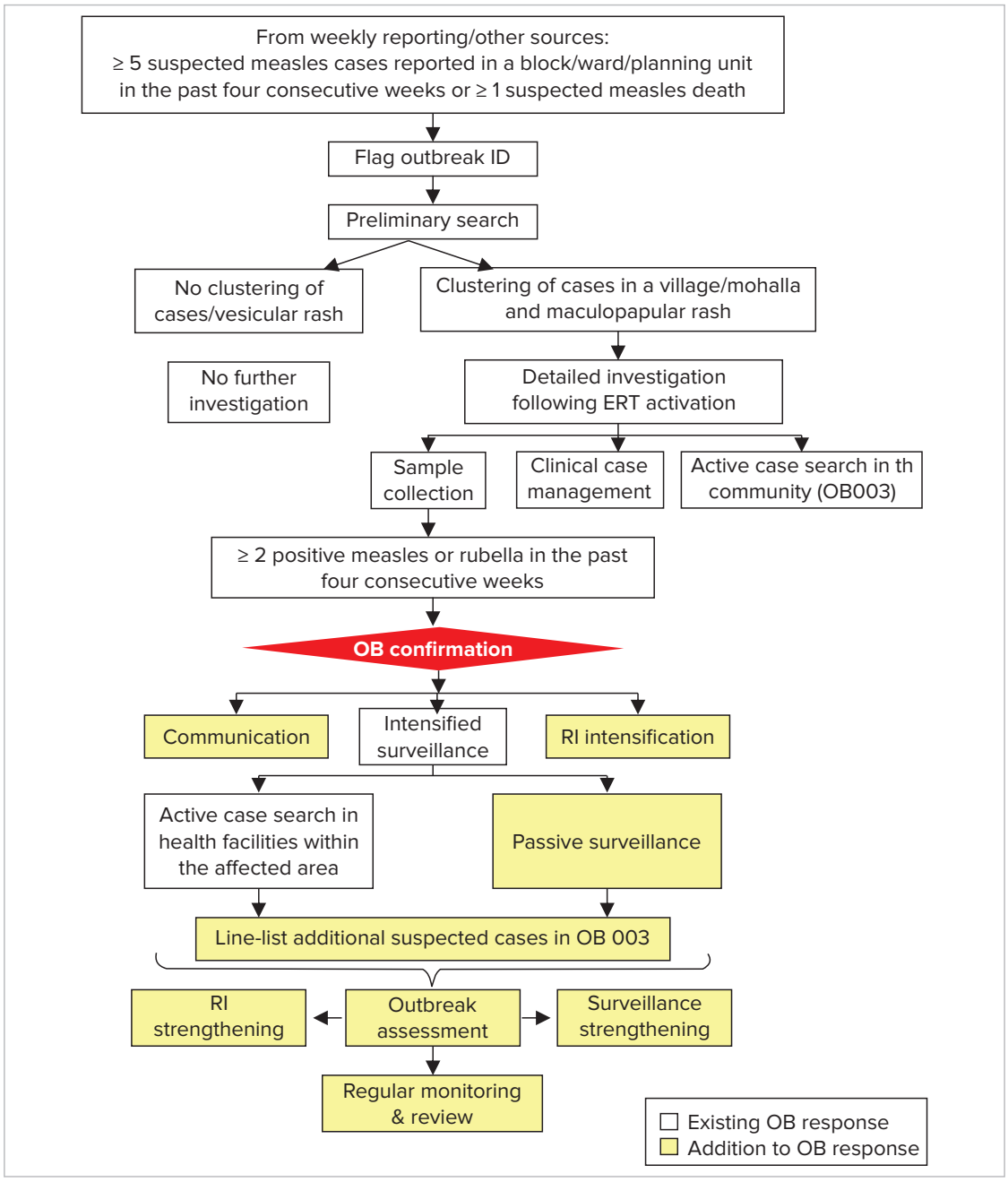
The following are the steps in conducting a preliminary search:

- visit 5-10 suspected cases and verify them for presence/history of fever, maculopapular rash and any of 3C's (cough/coryza/conjunctivitis) which will help in excluding the cases not consistent with the case definition (e.g. cases with vesicular rash);
- scan nearby areas by visiting a few households and looking for similar cases by talking to a few members of the local community, religious leaders, faith healers, informers, school teachers and Anganwadi workers for identifying more cases; and
- check if there is a clustering of suspected measles cases within a close geographical unit (a village/small mohalla/urban pocket) with onset of rash in the past four consecutive weeks.

The field team will share the enlisted details with the MOIC who will assess the following:

- details of suspected cases to be reviewed and MOIC to assess for clustering in each village/mohalla;
- if there is no clustering of suspected cases or the cases have vesicular rash (not maculopapular rash) no further outbreak investigation is required; and
  - if an individual suspect measles cases are identified, initiate the case investigation process for a sporadic case as per case-based surveillance guidelines.
- the MOIC will share the information (suspected outbreak or no outbreak) from preliminary searches with the district official, who will provide further guidance on activation of the ERT and conduct detailed investigation.

OUTBREAK RESPONSE PROTOCOL



11.4 Actions prior to starting the detailed outbreak investigation

11.4.1 Epidemic response team (ERT) activation

The ERT should be constituted and periodically revised according to the needs in the district, before the occurrence of an outbreak. The DIO, SMO and DSO will provide direct oversight to the ERT. The epidemic response team should include the following individuals:

- BMO;
- MOIC of the planning unit;
- hospital clinician/physician/pediatrician;
- pharmacist;
- Health supervisor;
- Public health nurse;
- Laboratory representative/personnel/microbiologist;
- NGO representative/community leader; and
- any others, as appropriate for outbreak investigation and response.

The DIO in coordination with the MOIC will activate the ERT. The ERT's role will be critical in defining activities in the outbreak area. The specific responsibilities of the epidemic response team are to:

- analyze epidemiological information related to the outbreak to guide the public health response;
- based on epidemiological and other data, plan control and response strategies to prevent further spread;
- identify adequate human resources needed for outbreak response;
- ensure available staff have received appropriate training;
- conduct a pre-investigation orientation meeting with field staff before the field visit;
- reorient field teams on questions and key messages to be delivered during HTH activities;
- establish clear lines of responsibility for planned actions like case management, sample collection, ACS, passive surveillance, RI intensification and data analysis following outbreak confirmation; and
- meet regularly to review data and evaluate response.

11.4.2 Pre-investigation orientation meeting

An orientation meeting for conducting a detailed investigation should take place within 24-48 hours of detection of clustering of suspected cases in a village/mohalla. The field team (ANM/ASHA/AWW) and health supervisor/lab technician and others should participate in the orientation meeting. They will be trained by ERT members.

11.4.3 The team will be oriented on following topics

- establishing communication with the village head/sarpanch/ward member;
- suspected measles case definition;
- date of notification of index case and time period for house-to-house search;

- steps in ACS in the community for detecting additional suspected measles cases and deaths;
- age appropriate vitamin A supplementation as per guidelines;
- patient care and case management for suspected cases and timely referral for cases with post measles complications;
- communication (interpersonal communication and delivery of key messages);
- sample (serology and virology specimen) collection and shipment;
- lab specimen collection kits and shipment;
- lab support and logistics;
- procedures for collection forms after fieldwork, compilation and transmission of documents;
- ACS in health facilities;
- passive surveillance;
- assessing health seeking behaviour; and
- sharing of feedback with patients/parents/health facilities/faith healers.

11.5 Steps in conducting a detailed investigation

11.5.1 Establishing communication with the village head/sarpanch/ward member

Before a detailed investigation is initiated, the MOIC, health supervisor, lab technician and field team should visit the affected village and establish communication with the village head/sarpanch/ward member. They should communicate the following:

- information about the ongoing outbreak;
- explain control measures such as isolation for the initial four days after rash onset;
- seek support in sensitizing the community;
- seek his/her assistance to avail the list of medical practitioners and faith healers within the village;
- seek support in sample collection; and
- emphasize the importance of routine immunization for disease prevention.

11.5.2 Suspected measles case definition

Any person having fever with maculopapular rash with any one of 3Cs (cough or coryza or conjunctivitis) OR any person in whom a health worker or clinician suspects measles.

11.5.3 Conducting ACS in the community

ACS should be initiated by the field team (ANM/ASHA/AWW) under the supervision of the health supervisor/MOIC.

Where will the ACS be conducted?

- The ACS will be conducted in the affected village/mohalla including its hamlets/tola/purwa/field huts and polio high-risk areas (HRAs).
- All affected areas should be included in the active case search.
- The plan for case search should include day wise allocation of a defined area to each field team.

Who will undertake the ACS in the community?

- The field teams, identified by the MOIC in consultation with DIO, should conduct the detailed investigation which includes ACS through house-to-house searches and communication with the families.
- The ANM will lead the team and will be assisted by the ASHA/AWW and link workers/Mahila Arogya Samiti (MAS) members in urban areas for house-to-house searches.
- The house-to-house searches are to be conducted under the supervision of the health supervisor/MOIC.

What is the workload for a team?

- The suggested workload for a team is 50 – 60 houses per day in an affected area.
- The distribution of work to each team should be done carefully to ensure that the case searches can be performed efficiently.
- Each supervisor's area should be clearly defined.

What are the tools used to conduct the ACS?

- Polio micro plans can be used by the teams for area demarcation.
- A spot-map of the district/block showing the location of the reported measles cases will be prepared to help identify the affected area and to demarcate the day-wise team areas for planning the case searches.
- Suspected measles cases should be line-listed on the VPD-OB003. A practical demonstration of filling of all the forms (VPD-OB003) and formats should be arranged if feasible in the local language. Various issues related to correctly completing the formats should be discussed.

11.5.3.1 House-to-house searches

How should case searches and house marking be conducted?

Every house in the affected village/mohalla must be visited by the field team. During HTH visits, mark each house with chalk/geru. The objective of house marking is to ensure all the houses are visited as per plan in the identified area. The house marking will include the following components:

- the letter "M" which indicates a measles outbreak;
- the number following the "M", which indicates the house number visited by the team;
- the date of house-to-house visit in day/month/year format;
- an arrow, which represents the direction in which team has carried out the house-to-house searches.

An example of house marking:

M – 25
→
30/4/19

Following the identification of a suspected measles case in a house, the team will encircle the house marking which will allow the health supervisor to identify houses with suspected cases for following up and administering the second dose of vitamin A (see section on clinical case management in surveillance field guide).

The team will record the details of the identified cases in the VP-OB003 form and will then move to the next house and repeat the process.

At the end of the day, VPD-OB003 forms should be handed over to the supervisor for collation and assignment of a case ID to each case in the line-list at the block/district level.

Role of the field team during ACS in the community

During the house-to-house searches, the field team will:

- greet the family members;
- explain the purpose of the visit to the head of the family/adult family member;
- explain about signs and symptoms of the disease;
- enquire about any suspected measles case in the past 90 days in the house:
  - if yes, information about all suspected measles cases in the household should be line-listed in the VPD-OB003 form using separate row for each suspect case; and
  - further enquire regarding travel history, health seeking behaviour, and other relevant information and record this information in the VPD-OB003.
- tactfully explore about any suspected measles death in the family in the past 90 days (a suspect measles death is a death within 30 days of onset of rash without any obvious cause like trauma, snakebite, etc.);
- enquire about complications such as pneumonia, diarrhea, eye and ear infections, and provide referral service as required;
- refer suspected cases with complications to seek medical advice as soon as possible;
- provide information to families about the possible complications of measles, ask them to keep a close watch for the next three months and report immediately to the field team (ANM/ASHA/AWW/local health worker) if they notice any complications;
- share contact information for the nearby health centre and referral hospitals;
- The ANM should carry the following during HTH case search:

  - VPD-OB003 form;
  - pen/pencil;
  - white chalk for house marking;
  - vitamin A solution with the spoon;
  - map of area for area demarcation;
  - information about date of index case notification and period of HTH search; and
  - ANM/ASHA diary for any additional information to note.

- all detected/suspected measles cases are line-listed in the VPD-OB003 form;
- during house-to-house searches, if the ANM identifies suspected cases in households with children under five years of age, the parents should be sensitized on the importance of RI for the prevention of vaccine preventable disease including measles and rubella;
- cross-check the MCP card (if available) of suspected cases and children living in their households to assess immunization status for MRCV1, MRCV2 and other age appropriate vaccines.
    - if a child below the age of five years has missed measles, rubella or any other vaccination, inform the parents regarding where and when the child can receive the vaccination.

Role of the health supervisor in conducting house-to-house search

Supervisors have an important role in ensuring the high quality of house-to-house case searches. They should ensure that:

- houses are randomly checked for the quality of work;
- all areas are searched as per the micro-plan and no house is missed by community health workers;
- adequate supplies/logistics are available to all the teams in the field;
- if the field team faces any difficulties, the supervisor should provide hands-on help and support;
- cases with serious complications are referred, and appropriate care is provided;
- VPD-OB003 forms are collected at the end of the day from all the teams;
- data fields for outbreak ID and case IDs are checked on each form including suspected measles case totals in each row/column;
- all detected/suspected measles cases are line-listed in VPD-OB003 form with unique identifiers (case-ID);
- vitamin A is given to all cases of suspected measles as per the recommended schedule (two age appropriate doses administered 24 hours apart); and
- progress and completion of the investigation is monitored.

11.5.3.2 Conducting screenings at schools/Anganwadi centre(s)

The health supervisor/MOIC along with the field team will visit all the schools/Anganwadi centre(s) in the outbreak area.

- The health supervisor/MOIC will:
    - sensitize the school principal/nodal teacher about the ongoing suspected measles outbreak in the area;
    - sensitize teachers/Nodal Officers to report absentees with suspected measles; and
    - provide teachers with contact details of the MOIC for reporting suspected cases.
- The field team will:
    - screen for any suspected measles cases from each class;
    - seek more information from class teachers on children who have been absent for a week or more due to illness to check if they are potential suspected measles cases; and
    - enlist all suspected cases in the VPD-OB003.

11.5.3.3 Conducting screening and sensitization of potential faith healers/health facilities

- The field team will:
  - screen and enlist the names of potential health facilities, including faith healers and temple sites within the affected village/mohalla; and
  - the list will be maintained in a register at the planning unit (CHC/PHC) as non-coded informers.
- The health supervisor/MOIC will:
  - visit these enlisted potential sites, sensitize the potential faith healers about the ongoing suspected measles outbreak and motivate them to report the suspected measles cases through the telephonic call/SMS;
  - emphasize the following key messages:
    - importance of vitamin A in preventing complications;
    - if a complication is suspected, refer to a higher centre;
    - isolation of suspected cases to prevent further spread;
    - role of MR vaccine (as part of RI) in preventing measles and rubella; and
    - report any additional suspected cases that they encounter.
  - when a suspected case is identified, the potential faith healer should note the patients' name, age, sex, detail address, contact number, date of onset of rash and share them with the health supervisor/MOIC through telephone call/SMS.

The DIO and SMO will review and include potential sites for inclusion as informers. They may also plan to conduct an orientation workshop for the newly recruited informer unit personnel.

11.5.3.4 Clinical case management

Appropriate clinical case management of measles and rubella cases is critical to reduce morbidity and mortality and prevent further transmission.

Vitamin A oral dosage should be given immediately on diagnosis by the field team and repeated the next day (24 hours apart) by a health supervisor as follows:

Age	Immediately on diagnosis	Next day (24 hours apart)
<6 months	50,000 IU	50,000 IU
6-11 months	1,00,000 IU	1,00,000 IU
Children 12 months plus	2,00,000 IU	2,00,000 IU

Vitamin A should be administered to all suspected cases of measles irrespective of the timing of the previous doses of vitamin A. If the MO finds a child with clinical ophthalmic signs of vitamin A deficiency such as Bitot's spots, a third dose of vitamin A should be administered four to six weeks later.

The most common complications observed in measles are pneumonia, diarrhea, ear discharge and eye complications.

- Suspected cases without complications should immediately be given vitamin A as per the schedule.

- Suspected case should be examined for the signs and symptoms of measles complications. Based on the severity of the disease the suspected case should be treated with antipyretics, ORS-zinc and/or antibiotics under the supervision of a MO (refer to case management section of Surveillance guidelines).

The field team will:

- immediately refer children with severe complications who need admission to a higher centre;
- inform the health supervisor/MOIC about referred cases;
- deliver key messages on IPC to health care workers in health facilities;
- deliver key messages regarding isolation of suspected cases for at least four days from the rash onset; and
- ask the family to immediately report any new suspect measles cases to the ANM/ASHA/AWW or MOIC.

The health supervisor/MOIC will:

- provide the second dose of vitamin A to all suspected cases as per the recommended schedule; and
- ensure that suspected cases with serious complications are immediately referred to a higher centre.

11.5.3.5 Specimen collection and shipment to WHO accredited MR laboratory

From the VPD-OB003 line list, the MOIC will select suspected cases for collecting following samples:[7]

- Five serum samples for diagnosis.
- Two throat swab or urine samples or nasopharyngeal for genotype characterization.

In an outbreak setting, subjects for serum and throat swab/urine specimen/ nasopharyngeal collection could be different. However, if outbreak size is small, both types of samples can be collected from the same subject.

Guidelines for blood collection. A blood sample should be collected from those suspected measles cases which have rash onset within the past 28 days. Complete the following steps:

- blood should be collected by venepuncture using the vacutainer tube assembly or by syringe and needle system;
- soon after collection, the tube containing blood samples should be kept at room temperature undisturbed for at least 30 minutes. During these first 30 minutes at room temperature, the clot formation will happen and thus haemolysis will be prevented by shaking of tube during transportation;
- after the clot formation, keep tubes in vaccine carrier with conditioned ice packs for transportation to local or MR laboratory for serum separation;

[7]If any cases identified as part of the detailed investigation were previously identified under case-based surveillance, these should not be line-listed on the VPD-OB003 form, but considered as part of the outbreak. For classification of the outbreak, at least five samples should be collected, including any samples already collected.

- to prevent excessive shaking of sample or freezing of sample by direct contact with ice packs during transportation, proper packing of the sample should be done in the vaccine carrier with cotton or other packing materials. One may consider using a rack or a beaker in vaccine carrier to keep the tubes in upright position;
- usually, clot retraction happens in 2-8 hours at 4-8 degree temperatures. Due to clot retraction, the serum will be separated from the whole blood;
- after clot retraction the whole blood should be centrifuged at 3000 rpm for 10 minutes to facilitate collection of the serum aseptically in a separate sterile tube for further storage or transportation;
- label the tube with case ID and other details; and
- store the separated serum at 4-8°C until shipment takes place.

Guidelines for collecting virology samples (throat swab/urine sample/nasopharyngeal sample): These samples will be collected from two different suspected cases that have rash onset within the past seven days. Preference should be given to collecting throat swabs. If it is not possible to obtain a throat swab, an attempt should be made to collect a urine sample or nasopharyngeal swab. Blood sample and throat swab may be collected from the same case if the size of the outbreak is small.

- The throat swab and nasopharyngeal swab should be collected and transported in viral transport media (VTM) tubes in the cold chain.
- Urine collection. Urine samples should be collected in the sterile container which should be screw tightened properly. The container should be packed in the zip lock bag to avoid contamination of vaccine carrier from any spillage.

An adequate serological sample is the sample meeting the following criteria:

- minimum 5 or more serum samples from suspected outbreak;
- all sample collected within 28 days of rash onset;
- serum volume should be at least 0.5 ml in quantity;
- with no signs of hemolysis or gross contamination;
- with proper labelling and documentation; and
- received in the laboratory without any leakage under proper cold chain conditions.

An adequate urine sample is the sample meeting the following criteria:

- urine sample collected within 7 days of rash onset;
- with –10-50 ml of urine collected in a sterile, leak-proof container; and
- received under proper cold chain conditions in the laboratory with adequate documentation.

An adequate throat/nasopharyngeal sample is the sample meeting the following criteria:

- throat/nasopharyngeal sample collected within 7 days of rash onset;
- collected in viral transport media (VTM); and
- received under proper cold chain conditions in the laboratory with adequate documentation.

Measles lab request form (MLRF) outbreak Complete the MLRF (Outbreak). All samples collected should come under one outbreak ID, but the sample collection case number will differ based on the VPD-OB003 line-list. The EPID number (Outbreak ID plus case serial number as per VPD-OB003) will be followed by 'S' for serum specimen, 'U' for urine specimen and 'T' for throat swab specimen and 'N' for nasopharyngeal swab as pre-requisite, before sending the samples to appropriate laboratory (Ex: MOB-IND-ST-DIS-YR-XXX-YYY-S/T/U/N).

During filling of the MLRF (Outbreak), three dates are very important:

- date of last measles vaccination;
- date of onset of rash; and
- date of collection of sample.

Please ensure that these dates are correctly captured in the MLRF (Outbreak).

11.6 Classification of the outbreak

The DIO, DSO and SMO should review the laboratory results for final classification. The outbreak will be classified based on the definition of a confirmed outbreak.

- If specimens (serum or virology) from two or more cases are positive for measles **the outbreak is a measles outbreak.**
  - all additional cases captured on line listing forms during the outbreak but without specimens collected will be epi-linked measles.
- If specimens (serum or virology) from two or more cases are positive for rubella **the outbreak is a rubella outbreak.**
  - all additional cases captured on line listing forms during the outbreak but without specimens collected will be epi-linked rubella.
- If specimens (serum or virology) from two cases are positive for measles and specimens (serum or virology) from two cases are positive for rubella, **the outbreak is a mixed outbreak.**
  - all additional cases captured on line listing forms during the outbreak but without specimens collected will be epi-linked mixed.
- If specimens (serum or virology) from less than two cases are positive for measles or rubella, **the outbreak is negative or discarded.**
  - all additional cases captured on line listing forms during the outbreak but without specimens collected will be epi-linked negative.

11.7 Steps following confirmation of the outbreak (measles, rubella, or mixed)

11.7.1 ACS in health facilities

The MOIC/BMO/DIO will initiate ACS in health facilities within the affected area. All health facilities in the outbreak area will be visited, sensitized and encouraged to report suspected cases of measles coming to the health facility through call or SMS.

- ACS conducted in health facilities already included in the reporting network will be recorded in the existing VPD-D003 format and other non-coded facilities or special sites will be recorded in the VPD-D004 format.

- Records should be checked for missed case.
- Determine whether the missed or reported case is part of the existing outbreak or it represents a new case in a new area.
- The treating physicians should be sensitized to educate family members to:
  - isolate suspected measles cases for at least four days following rash onset;
  - in order to prevent further transmission, any susceptible close contact of a confirmed or epi-linked case should be encouraged to limit contact with others at the first sign of possible fever and maculopapular rashes.

The ERT will determine the frequency of ACS in health care facilities based on the progress of the outbreak.

11.7.2 Passive surveillance

During ACS conducted as part of the outbreak response, health facilities, temple sites/faith healers and teachers in schools will be sensitized for the reporting of suspected cases. This sensitization should lead to increased reporting of suspected cases through passive surveillance. At the end of each day, the MOIC will review cases (from any source) reported through passive surveillance and undertake the following actions:

- if the suspected case belongs to an existing OB area, the MOIC will assign an ANM to visit the case within the next 48 hours and complete the case information in the VPD-OB003 form; and
- if the suspected case belongs to a different area, the MOIC will cross notify the case to the respective area MOIC who will investigate the case using the MR-CIF, following the protocols for investigating sporadic cases in case-based surveillance.

Suspected cases reported through passive surveillance should be line-listed on the VPD-OB003 form until the end of the outbreak. After the outbreak is over, suspected cases should be investigated as sporadic cases (using MR-CIF) as per case base surveillance guidelines.

11.7.3 Intensification of routine immunization

During an outbreak, routine immunization services should be intensified in the affected and surrounding PHC catchment areas. Use this opportunity to strengthen routine immunization in the outbreak area.

During a house-to-house search, if the ANM identifies a suspected case in households with children under five years of age, the parents should be sensitized on the importance of RI for the prevention of other vaccine preventable diseases. After the ACS in the community has been completed (gap of four weeks after onset of rash for the last case can be considered as closure of outbreak), and before the next scheduled RI session, the following steps should be conducted:

- the ANM will review her RCH registers and MCP counter foil of children below 5 years (0-59 months) and identify age appropriate dropout and left-out children; these children need to be due-listed for vaccination;
- plan additional RI session(s) in the local area if required;
- mobilize due-listed beneficiaries to the session site on the planned date of a regular or additional RI session, whichever is earlier;

- the field team should inform village leaders and parents to bring any child less than five years of age, who has missed MRCV1/MRCV2 or any other age appropriate vaccine/s, to a scheduled regular/additional RI session; and
- emphasize the importance of four key messages.

11.7.4 Data analysis

During an outbreak, the MOIC, using data from the VPD-OB003, should conduct the following epidemiologic analyses on a regular basis:

- epidemic curve of the outbreak;
- analysis of measles or rubella cases by age, sex and vaccination status;
- analysis of vaccination status by age;
- spot maps (by block);
- attack rate (AR) and age-specific attack rate; and
- case-fatality rate (CFR).

Attack rate (AR): the proportion of the population that developed measles

$$AR = \frac{\text{Number of cases of measles}}{\text{Total population}} \times 100$$

Age-specific AR

$$\text{Age-specific AR} = \frac{\text{Number of measles cases in age group}}{\text{Total population of the age group}} \times 100$$

Case fatality rate (CFR)

The CFR can be calculated as follows:

$$CFR = \frac{\text{Number of deaths due to measles}}{\text{Total number of measles cases}} \times 100$$

CFR indicates severity of outbreak and depends on multiple demographic and epidemiological factors.

11.7.5 Social mobilization and communication in an outbreak

At the district level, the DIO in coordination with the District Communication Officer should prepare a communication plan, which will include the following components:

- informing and sensitizing all stakeholders;
- addressing rumours and misinformation;
- enhancing detection and reporting of suspected measles cases by developing IEC material (banner/poster/FAQs) for community and health workers in the local language;
- identifying NGOs/civil society organizations working in affected areas and seeking their support;
- interpersonal communication training of health workers; and
- media handling by identifying media spokesperson.

11.8 Steps to be taken at the end of the outbreak response

11.8.1 Outbreak assessment

All the suspected cases identified through ACS in the community, ACS in health facilities and suspected cases reported from passive surveillance will be captured in the VPD-OB003 form during an outbreak. This process of enlisting cases in the VPD-OB003 form will continue until the outbreak response is concluded – when there have been no further epidemiologically linked cases for one month from the date of onset of rash of the last case. The MOIC should complete the outbreak summary, VPD-OB004 at the block level. The summary form includes standardized reporting of the following:

- location of the outbreak
- notification of the outbreak
- preliminary investigation
- the duration of outbreak
- the size of outbreak
- case management
- number of ACS in community
- number of ACS in health facilities
- epidemic curve of the outbreak
- spot maps by block
- age-specific vaccination
- attack rate (AR) and age-specific attack rate
- case-fatality rate (CFR).

11.8.2 Assessment of surveillance and immunization performance

The DIO and SMO should assess surveillance and immunization performance. An outbreak of measles or rubella is an indicator of immunity gaps and/or potential surveillance gaps. For this reason, it is important to assess for potential immunity gaps and surveillance sensitivity in the district in which the outbreak occurred. This data should be used to take action to prevent further outbreaks in the district.

11.8.2.1 Review surveillance performance and highlight gaps for past three years, if any

- Non-measles non-rubella discard rate;
- Silent block(s); and
- % suspected cases with specimens collected, timeliness of notification, investigation, specimen collection, and lab results.

11.8.2.2. Routine immunization, SIA performance indicators for past three years:

- Prior SIA coverage – admin and survey
  - review SIA monitoring data to look for reasons why children were not vaccinated; and
  - RCM data (if available).
- RI coverage
  - % of MRCV1 and MRCV2 coverage;

- assess MRCV1 – MRCV2 dropout rate;
- review RI coverage – administrative and NPSP monitoring data (if available);
- review RI monitoring data for reasons why children were not vaccinated;
- review RI monitoring data for # and % of left out children; and
- review RI monitoring data for # and % of drop out children.

Following an assessment of surveillance and immunization performance indicators, any identified gaps should be noted (i.e. silent block, NMNR < 2.0, any issues with specimen collection, etc.). The DIO and SMO should summarize key findings and recommendations for action and share feedback with the district officials.

11.9 Follow-up action based on outbreak assessment

11.9.1 RI strengthening

The following key activities should be undertaken for RI strengthening:

- reprioritize HRA
- focus on urban areas
- review RI micro plan
- review RI activities in the past year in that area
- plan additional outreach sessions
- mobilize additional resources like health workers, vaccines and logistics for planned sessions
- strengthen mobilization of beneficiaries
- respond to vaccine hesitancy tactfully
- advocate during task force meetings
- training status of FLWs.

11.9.2 Surveillance strengthening

11.9.2.1 ACS in health facilities. Ensure ACS in health facilities are being conducted as per guidelines.

11.9.2.2 Expansion and reprioritization of the reporting network based on:

- RS likely to see a significant number of suspect measles cases;
- health facility contacts analysis (HFCA);
- missed cases/unreported cases found during ACS (VPD-D003); and
- late reporting of cases (VPD-D002) should also be considered.

11.9.3 Health seeking behaviour in the community (VPD-OB003 form & MR-CIF)

During the outbreak, the MOIC will analyze the information captured on the VPD-OB003 form and MR-CIF. S/he will analyze the health seeking behaviour after rash onset and utilize the data for sensitization of community workers and for expansion of the reporting network. The following indicators should be calculated:

- Number and % of cases:
  - confined at home
  - contacted community workers
  - contacted health facility.

11.9.4 Sensitization through workshops and trainings on reporting and investigating for officers and frontline health workers. Sensitize traditional faith healers through health workers/MO for reporting of suspected cases.

11.9.5 Regular review and monitoring

11.9.5.1 Prioritize RI monitoring in the outbreak and high-risk areas. Use this data to identify reasons for immunization gaps in the outbreak area. Using the existing RI monitoring formats describe and quantify any issues with:

- vaccine confidence;
- convenience;
- complacency;
- knowledge and awareness; and
- any other obstacles.

11.9.5.2 Monitor the following:

- monitor MRCV1 and MRCV2 coverage for > 95 % at every level;
- monitor sessions planned vs held;
- monitor cold chain;
- monitor vaccine availability; and
- conduct regular district review meetings.

11.9.5.3 Share feedback

Feedback should be shared with the following:

- local level (PHC/planning unit in the ward) including community leaders
- district health authority (District Magistrate/CMO and others)
- state health authority
- government of India, Immunization Division MoH&FW
- NPSP WHO-India (SRTL/RTL & Country office).

Annexures

Annexure 1: Case investigation form for suspected measles/ rubella (MR-CIF)

Case Investigation Form (CIF) for Suspected Measles / Rubella

MR EPID Number: MR-IND-_____- _____- _____- _____ (Matches with Laboratory Request Form)

1. Type of Case: Sporadic / Outbreak, [If case belongs to an outbreak then please provide a linked MOB-ID (MOB- IND-_____- _____- _____- _____)

2. Notification / Investigation Information:

Date Case Notified: _____ /_____ / _____ Notified by: _____ Designation: _____

Date Case Investigated: ____ / ____ / ___ Investigated by:_____ Designation: DIO/DSO/Medical Officer/ Nodal Officer/ SMO/ Other

Date case verified: _____ /_____ / _____ Verified by:_____ Designation: DIO/DSO/Medical Officer/ Nodal Officer/ SMO/ Other

Notifying Health Facility Type: RU/ Informer/ Other **Category**: VHP/ HP/ LP/ Other **Setup**: Govt. Allopathic/ Pvt Allopathic/ ISM Pract./ Quack/ HW / HSC /HLW/ Others

3. Case Identification: Patient's Name: _____ other given names: _____

Sex: M / F Date of birth: _____/ _____ / _____ Age: years_____ months_____

Father's Name:_____ Mother's Name:_____

Father's Occupation:_____ Grand father's Name:_____

Address: _____ Religion: Hindu / Muslim / Other

Landmark: _____ Village / Mohalla: _____ HRA: Y / N

Block /Urban area: _____ District: _____ Setting: Urban / Rural

State: _____ Mobile _____ mail ID :_____)

Patient belongs to migratory family/ community : Yes/ No If yes, specify: Slum with migration / Nomad / Brick Kiln / Construction site / Others : _____

4. Hospitalization: Yes / No Treated at OPD/ IP Date of Hospitalization:____/____/____ IP No. _____

Name of Hospital:_____ Diagnosis as per hospital records, if any: _____

5. Immunization History: Measles vaccine received: Yes/No/Unknown/NA

Measles containing vaccine(MCV) received through RI :

a. MCV 1: Y / N / Unknown / NA ; **Type**: M/MR/MMR/MMRV/Unknown If card available, date ____/____/_____

b. MCV 2: Y / N / Unknown / NA **Type**: M/MR/MMR/MMRV/Unknown If card available, date ____/____/_____

If MCV is missed in RI ,specify reason: Awareness gap / AEFI apprehension / Child travelling / Operational gap / refusal / others _____

c. No. of MCV doses received through campaign (SIA): _____ Total MCV doses (RI+SIA): 0 / 1 / 2 / 3 / 4 / more

If campaign dose is missed, encircle reason - Awareness gap / AEFI apprehension / Child travelling / Operational gap / refusal /campaign not held/ others _____

Date of last dose of MCV (before rash onset): _____/ _____/_____ (to be filled in line list)

Date of last dose of MCV (before blood collection): _____/ _____/_____ (to be filled in LRF)

6. Clinical History: Generalised Maculopapular Rash : Yes / No / Unknown **Date of Rash Onset:**____/____/____

Fever : Yes / No / Unknown Date of fever onset : ____/____/_____

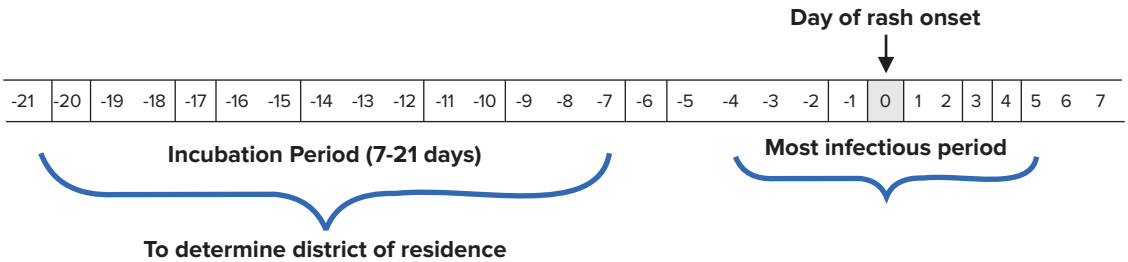
Cough : Yes / No Coryza (Running Nose) : Yes / No Conjunctivitis (Red eyes) :Yes / No Clinician suspects Measles: Yes / No

Enlarged lymph nodes : Yes / No Joint pain : Yes / No Clinician suspects Rubella : Yes / No

Complications : Yes / No If yes: Diarrhea / Malnutrition / Encephalitis / ARI / Pneumonia / Ear problems (otitis media), Eye problems (corneal clouding / xerosis) / others (Please specify)

No. of Vitamin-A doses received: 0/1/2 Date of Vit A dose1: ____/____/_____ Date of Vit A dose2: ____/____/_____

7. Travel History: Yes / No Travel of case within 21 days prior to onset of rash (indicate dates and place of travel with arrows on date line)



District of residence: _____

(Based on maximum stay during incubation period, if multiple districts are involved)

Block/ Urban area of residence: _____

Requires cross notification? Yes / No

If yes, date of cross notification: ____/____/_____

8. History of similar symptoms among close contacts:

Similar symptoms in other household contact(s): Yes / No If yes, No. affected: _____ Name/s: _____

Similar symptoms in other neighbourhood / work / school contact(s): Yes / No If yes, No. affected: _____ Name/s: _____

If any of the above contact is already lab confirmed, mention EPID No : _____

CIF contains two pages, both pages must be filled for all suspected MR cases

MR CIF (Page 2) **MR EPID No.:** MR-IND-_____- _____- _____- _____

9. Health seeking behaviour after rash onset (encircle): confined at home / contacted community workers / contacted health facility

10. If history of contact with community workers / influencers after the date of rash onset , mention details:

Contacted community workers / influencers	Specify categories of community contacts	Date of contact	Did they refer / report the case to any facility	Action by DIO / SMO
1	Health workers / Religious leader /Community influencer	_____/_____/_____	Yes / No	
2	Health workers / Religious leader /Community influencer	_____/_____/_____	Yes / No	

Categories of Community workers / influencers : Health Workers - ANM /AWW/ASHA/LHV/MPW , **Religious leaders :** Priest / Temple link person/ Mazars/Maulana / Ozha
Community influencers : Village head / Teacher/ Pradhan/ Panchayat member

11. If history of contact with healthcare providers after the date of rash onset (including the notifying health facility), mention details:

Name & address of Health Facility (Hospital/ doctor/ quack/other):	1	2	3	4
Date case visited:				
Already RU/informer?	Yes / No	Yes / No	Yes / No	Yes / No
Did the HF report this case?	Yes / No	Yes / No	Yes / No	Yes / No
Action taken by SMO / DIO				
Date feedback given to health facility				

12. Provisional diagnosis:

Suspected Measles / Suspected Rubella / Dengue / Chickungunya / Scrub typhus / Others if Others Specify _____

13. Specimen Collection: Yes / No (Blood from suspected case within 28 days of rash onset; Any one of throat swab / nasopharyngeal swab / urine sample within 7 days of rash onset)

For Serology	Date Collected	Date Sent	Date of Result	Condition	Laboratory Result* (circle)
Blood	___/___	___/___/___	___/___/___	Good / Poor	**IgM Positive (M / R) / IgM Negative (M / R)**

If sample is not collected **within 28 days of rash onset** then encircle reason. Late Notification/ Late investigation/ Delay in sample collection / Parent denial / Death / Lost/ Other

For Virology (any one)	Date Collected	Date Sent	Date of Result	Condition	Laboratory results
1.Throat Swab	___ / ___ / ___	___ / ___ / ___	___ / ___ / ___	Good / Poor	**Measles virus (_____) / Rubella virus (_____) / Negative**
2. Nasopharyngeal swab	___ / ___ / ___	___ / ___ / ___	___ / ___ / ___	Good / Poor	**Measles virus (_____) / Rubella virus (_____) / Negative**
3. Urine sample	___ / ___ / ___	___ / ___ / ___	___ / ___ / ___	Good / Poor	**Measles virus (_____) / Rubella virus (_____) / Negative**

If sample is not collected **within 7 days of rash onset** then encircle reason. Late Notification / Late investigation / Delay in sample collection / Parent denial / Death / Lost / Other

14. Active Case Search in community:

Active case search in community done: Yes / No If yes, Date of search: _____/_____/_____ Number of suspected cases found: _____

15. Feedback:

Patient / Caregiver: Mobile:_____ Email Id:_____ Date Given: ____/ ___/ _____
Reporting Person / Institution: Mobile:_____ Email Id:_____ Date Given: ____/ ___/ _____

16. 30 Day Follow-up: Date of follow-up: _____/_____/_____ if not done give reason:_____ Outcome: alive / death / lost
If died, date of death: ___/___/___ cause of death: _____ Complications present: Yes/No
Type of complications:Diarrhea / Pneumonia / Encephalitis/ Ear infection / Eye complications / Skin complications / Co-morbid conditions / Others _____

17. If the suspected case is Pregnant: Yes / No, if pregnant please record observation during 30-day followup, for future CRS outcomes once again at EDD

18. At the time of EDD, follow up if CRS is suspected, then specify observation after delivery / end of pregnancy: Spontaneous abortion / MTP / Still birth
Date visit made to newborn from infected mother:_____/_____/_____ Newborn Status: Normal / Birth defect
If New born has birth defects then please encircle : Congenital heart defect / Eye defect / Hearing defect / Neurological deficit / Endocrine deficit / Other deficits

19. Final Classification:	**Measles / Rubella / Discard**
	Lab-confirmed / Epi-linked / Clinically-Compatible

RU-Reporting unit, **VHP**-Very high priority, **HP-**High priority, **LP-**Low priority, **HW**-Health worker (ANM/MPW/LHV/Health Inspector/Supervisor etc.), **HSC**-Health sub center, **HLW**-Health link worker (ASHA/AWW), **EDD**-Expected date of delivery,**CRS**-Congenital rubella syndrome,**MTP**-Medical termination of pregnancy

* Equivocal to be considered as positve

Annexure 2: Standard operating procedures (SOP) for investigation of a suspected measles-rubella case using MR case investigation form (MR-CIF)

Case investigation is crucial for the disease confirmation and to plan the public health response. All suspected measles cases notified as per the case definition should be investigated by a trained MO. This includes the DIO, SMO, DSO, other trained MO, or a trained Nodal Officer of the health facility. The investigation should be done within 48 hours of case notification. The process of case investigation involves examining the patient and filling the case details using the standardized measles-rubella case investigation form (MR-CIF), as described below.

Steps in filling the MR-CIF

The MR-CIF has many sections spread over two pages and collects key epidemiological information (see Annexure 01: MR-CIF). The DIO/Nodal Officer/SMO should fill both pages with the information collected. Sections 1-12 and 17 must be filled at the time of initial case investigation. The remaining sections should be progressively filled as and when the required actions related to the respective section/s are completed.

- The DIO/SMO should allot an MR-EPID number at the beginning as a unique identifier for every suspected case that is investigated. The Investigating Officer must use the same allotted number on the MR-CIF and the MLRF.
- As any error in the EPID number may misclassify the case, the number should be allotted only at the district level by the DIO/SMO.

The section-wise description of filling the CIF in brief is described below:

Section 1. Type of case

- Record type of suspected case (sporadic/outbreak):
  - sporadic cases are the individual cases that are reported through case-based surveillance. They are isolated cases, scattered across the block/district without any clustering in place and time and do not fit into the prescribed outbreak definition; and
  - if this sporadic case becomes part of an outbreak at a later time, then mention the outbreak ID to which the case is linked (e.g. MOB-IND-ST-DIS-YR-001). Note that the year for the outbreak will be year when outbreak ID is allotted.

Section 2. Record details regarding notification and investigation by filling the dates of notification, investigation, name/s of the persons investigating and of the person verifying a previously investigated case. Encircle facility type (RU/informer/other), category (VHP/HP/LP) and setup (Govt. allopathic/pvt. allopathic/ISMpract/ quack/HW/HSC/ HLW/others of notifying health facility).

Section 3. Record the case identification details including patient's name, age, sex, father's and mother's name, address, block and contact information and regarding setting (rural/urban). Capture the status as a migrant or not and if the area is part of the identified HRA. If the child is from a migrant or a settled HRA, then encircle the relevant category of migrant family/community then encircle the HRA category whether from slum with migration/nomad/brick kiln/construction site/others.

Section 4. Record details of hospitalisation if any, including hospital diagnosis.

Section 5. Complete the immunization history for measles containing vaccine (MCV). The investigating officer should review the immunization card if available, and if the card is not available carefully elicit the history of vaccination regarding measles containing vaccine and encircle and enter the dates:

- measles containing vaccine (M/MR/MMR/MMRV) received through routine immunisation;
- measles containing vaccine (MCV/MRCV) received through SIA campaigns;
- total MCV (M/MR/MMR/MMRV) doses (a+b+c) received;
- date of last dose of MCV (before rash onset) for case line listing;
- date of last dose of MCV (before blood collection) for LRF;
- assess reason for missed doses in RI and SIA if any and encircle appropriately.

  In case of missed campaign dose, encircle the reason.

Section 6. Assess clinical history including symptoms and examine the suspected measles case for signs of measles or rubella:

- date of rash onset is the most important date and must be assessed with care and validated;
- history of fever with maculopapular (non-vesicular) rash along with cough/coryza/conjunctivitis/joint pain/lymph node enlargement and if clinician suspects;
- encircle complications, if any (multiple choice is applicable); and
- to reduce morbidity and mortality from measles, every suspected measles case investigated must be administered two doses of vitamin-A (age appropriate) with an interval of 24 hours, this should be recorded on the MR-CIF.

Section 7. Travel history

- record the travel history of suspected case in the three weeks preceding the onset of rash to identify the area/district from where the suspected case may have picked up infection (place with longest duration of stay in the 7-21 days before rash onset to be considered) which will help to determine the district of residence based on the incubation period;
- record cross notification. A suspected case that has been investigated in a district but belongs to a different district/state/country, needs to be immediately cross-notified to the concerned/resident district health team (CMO/DIO/DSO/SMO) for validation/verification on the ground as evidence for any ongoing MR outbreak/transmission, that may require detailed epidemiological field investigation.

Section 8. History of similar symptoms among close contacts and neighbourhood:

- if similar symptoms are observed among other household members, neighbourhood, school, workplace contacts in the past 90 days, mention number of such contacts and enlist the names of the contacts. Investigate each of the contacts by filling an MR-CIF. If any of the contacts are already investigated and lab confirmed as either measles or rubella record the relevant EPID number;the

investigating officer and health team should make an effort to identify the persons whom the case has come into to contact during the most infective period (4 days prior to 4 days rash onset in case of confirmed measles and 7 days prior to 7 days after the rash onset in case of confirmed rubella) and enlist them separately. Alert them/or the family to report if any of them develop similar symptoms to the health staff. Also, in the case of rubella, the pregnancy status of the contacts is also to be reported.

Section 9. Mention health seeking behaviour of the patient after the onset of rash. If the patient is confined at home without seeking any consultation or help from health workers/religious leaders/ community worker or did not visit any health facility, then skip sections 10 and 11. If the patient gives history of contact with any of them then complete sections 10 and 11 of the MR-CIF accordingly. The data of health facility seeking behaviour will help in understanding cultural practices which can be addressed during community awareness and engagement.

Section 10. Complete the history of contact with health workers/religious leader/ community influencers locally after the rash onset, and provide the name of the community workers/influencer, the category of community contact, the date the case contacted them and if they reported or referred the case to any facility. DIO/SMO should ensure that PHC MO or local health supervisors make effort to raise the awareness of all such health workers/religious leaders/community influencers who are seeing suspected measles cases to report the cases immediately.

Section 11. Complete the history of contact with healthcare providers/health facilities the patient visited after the date of rash onset in a chronological order. These are the persons or places the suspected case consulted and was treated before being reported to the MO/health staff.

The data of health facility contact will help in identification of all the health facilities which a case may have visited but did not report the case.

This information helps in

- prioritization of reporting units;
- enhancing surveillance sensitivity by increasing ACS and sensitization efforts; and
- expanding the surveillance network.

Section 12. Mention provisional diagnosis as per any available record or clinician's opinion.

Section 13. Specimen collection:

- arrange for specimen collection and collect serum and throat swab or urine sample, for both serology and virology;
- collect serum sample from all suspected cases in the 0-28 days from rash onset for testing IgM;
- collect urine or throat swab or nasopharyngeal swab samples for virus isolation from all suspected cases in the 0-7 days of from rash onset;
- the following table helps in making appropriate decision making regarding collection of samples:

S.no	Period from rash onset	Serum sample collection (for serology)	Any one of the sample to be collected for virology throat swab/nasopharyngeal swab /urine
1	<=7 days	Yes	Yes
2	>7 <= 28 days	Yes	No
3	>28 days	No	No

- adequate specimens for serology are those collected in 0-28 days after rash onset and has ≥ 0.5 mL serum;
- ensure proper collection of adequate specimens and shipment to the WHO MR laboratory-network along with properly filled MR laboratory request form (MR–LRF);
- more details regarding specimen collection and transport can be found in the section laboratory samples at section 9 of these guidelines; and
- update the lab result after lab reports are available.

Section 14. If the case is positive for measles or rubella as a public health response, the local field level workers carry out active case search in the neighbourhood around the suspected case by talking to mothers, local influencers, school teachers and local practitioners. Enter the date of search and the number of additional suspected cases found.

Section 15. Enter the details regarding feedback shared with patient, and reporting persons/health facility (institution).

Section 16. The local health worker should follow-up every case after 30 days from rash onset by visiting the case either in person or by contacting over the phone. This should be documented in the CIF following 30 day follow up. This will provide information about post measles complications/death/potential CRS cases. Record observations during the 30-day follow up if this suspected case is pregnant. This will have bearing on future CRS outcome.

When to do 30 day follow-up examination

- lab confirmed case;
- epidemiologically linked case;
- clinically compatible case;
- case results showing equivocal.

Section 17. If a laboratory confirmed rubella case is detected in a pregnant woman, she needs to be followed up until the outcome of pregnancy for observation and record of the foetal outcome of the pregnancy.

Section 18. At the time of expected date of delivery, all health events such as abortion, stillbirth, or live birth with congenital anomalies, if any in the new born, which might be due to CRS, including congenital cataract, congenital deafness and congenital heart disease or any other anomalies suspected in a CRS case, should be recorded.

Section 19. Record final classification of each case based on laboratory result as:

- measles. Sample positive for measles, or case epi linked to measles positive outbreak or clinically compatible because sample is inadequate/no sample collected as beyond window period.
- rubella. Sample positive for rubella or epi linked to a rubella positive outbreak.
- discarded. Sample negative for both measles and rubella.

Keep the MR-CIF progressively updated with all information including health facilities visited, laboratory results and final classification.

Recording case rejection. During case investigation, if a case is found not matching with the given case definition (for e.g. case with vesicular rash), then the investigator may decide to reject the case. For recording purposes, the CIF must be filled and "rejected" mentioned at the top of the CIF. Such CIFs must be preserved in the district rejection file.

Rejection can happen at two different levels:

- field level;
- national level.

Annexure 3: Lab request form for sporadic suspected measles

Form VPD-MR-LRF

MEASLES LABORATORY REQUEST FORM
(for sporadic cases)

EPID Number: MR-IND-

PART I : Case Information

Patient name:

DOB/ Age: **Years:** **Months:**

Sex: M /F **Date of rash onset:**

Measles dose received: Y/N **If yes,date of last measles dose:**

State: **District:** **Block:**

Address:

Specimen collection :	Type of specimen	Date specimen collected	Date specimen sent
Please collect any one	Serum	_____	_____
	Throat swab	_____	_____
	Urine	_____	_____
	Nasopharyngeal swab	_____	_____

Name and designation of person sending the specimens:_____

Address:_____

PART II :Receiving at Laboratory

Type of specimen	**Lab ID Number**	**Date specimen received**	**Condition of specimen**	**Result**		**Remarks (if any)**
				Measles	Rubella	
Serum			Good / Poor			
Throat swab			Good / Poor			
Urine			Good / Poor			
Nasopharyngeal swab			Good / Poor			

Receiving laboratory name:_____ Signature:_____

Note: 1. Serum specimen should be collected within 28 days of rash onset;
2. Any one among (Throat Swab / Urine/ Nasopharyngeal swab) should be collected within 7 days of rash onset
3. Label on each specimen must include: (1) MR Epid Number (2) Specimen type
*** Case number should exactly match with case number in "MSLCIF" linelist format and specimen label.**

Annexure 4: Lab request form for cases from outbreaks

Form VPD-MR-LRF

MEASLES LABORATORY REQUEST FORM (for outbreaks)

Address: _____ Outbreak ID ## : _____

State:_____ District:_____ Block:_____

Case information									To be filled out by receiving laboratory			
Patient name	Case number* (if outbreak)	Specimen Type (encircle one)**	DOB/ Age		Sex	Date of rash onset	Date of last measles dose	Specimen collection date	Condition of specimen	Result		Remarks (if any)
			Years	Months	M / F					Measles	Rubella	
	_ _ _	S / T / U / N							Good / Poor			
	_ _ _	S / T / U / N							Good / Poor			
	_ _ _	S / T / U / N							Good / Poor			
	_ _ _	S / T / U / N							Good / Poor			
	_ _ _	S / T / U / N							Good / Poor			
	_ _ _	S / T / U / N							Good / Poor			
	_ _ _	S / T / U / N							Good / Poor			

Date specimens sent:_____

Name and designation of person sending the specimens:_____

Address:_____

Date specimens received:_____

Receiving laboratory name:_____

Signature: _____

Note: 1. Serum specimen should be collected within 28 days of rash onset

2. Any one among (Throat Swab / Urine/ Nasopharyngeal swab) should be collected within 7 days of rash onset

3. Each specimen label must include: (1) Outbreak ID / MR Epidnumber; (2) Case Number; (3) Specimen type;

*** Case number should exactly match with case number in "VPDOB003" linelist format and specimen label.**

** Specimen type: S= serum; T=Throat Swab; U=Urine;N=Nasopharyngeal swab
EPID number to be created based on Outbreak ID and Case number

Annexure 5: VPD OB 003 outbreak survey form

Block/Ward:	District:	State:
Setting(encircle) : Urban / Rural	HRA(encircle) : Yes / No If yes: #Type of HRA : Put code :1 / 2 / 3 / 4 / 5 / 6	
Name of ANM & Mobile No:	Report sent by:	Date Sent: ____/____/_____
Outbreak ID: MOB-IND -	Date of Notification of INDEX CASE ____/___/_____	Date of Outbreak Investigation: From : ____/____/_____ To ___/____/_____
Source of notification of suspected cases (encircle) : Active Case Searches : Community / Health Facility / Passive Surveillance		

EPID Number* (Not to be filled by team)	**Patient's name, father's name and address**	**Sex**	**Religion / Caste**	**DOB / Age##**		**Immunization History (Encircle & write date with last vaccination)**	**Clinical History (Encircle where eve applicable)**	**Travel History** (Outside district)**	**Any pregnant women in the house : Y / N If yes note down the details of the women**	**Health seeking behaviour after rash onset (encircle)**	**If history of contact with community workers / influencers after the date of rash onset, mention details:**				**Sample collected**	**Death (circle)**
				Years	**Months**						**Specify categories of community contacts *** **	**Date of contact**	**Did they refer / report the case to any facility (Y / N) If Yes Name & address**	**Case Notified by the health facility Y/N**		
_ _ _	Name :	M / F	H / M / O			MCP Card Availability: Y / N	Fever: Y es / No / Unknown	Any history of travel : Y / N		Confined at home / Contacted Health Facility / Contacted Community Worker	Health workers / Religious leader /Community influencer		Y / N (If Yes, please mention address)	Y / N	Yes / No	Y / N / U
	Fathers/ Husband Name :					Measles containing Vaccine Received: Yes / No / Unknown / NA , If yes , answer below ;	If Yes : date of onset									
							Rash: Y es / No / Unknown						Name & Address:		If Yes (encircle) : Serum / Throat / Urine	If yes , mention date:
							If Yes , date of onset									
	Address :		Caste			First dose: M / MR / MMR /MMRV	Cough : Y es/ No	If Yes, name of the district :								
						2nd dose: M / MR / MMR /MMRV	Coryza : Y es / No									
						2+ dose: M/MR/ MMR /MMRV	Conjunctivitis : Yes / No									
	Telephone:					Date of last MSL Vaccine before onset of rash (dd/mm/yyyy):	Joint pain : Y es / No						Type of health facility ### G / P / I / Q / O			
							Enlarged Lymphnode**** : Yes / No									
							Vit A phophylaxis after onset of rash : Yes / No									
_ _ _	Name :	M / F	H / M / O			MCP Card Availability: Y / N	Fever: Y es / No / Unknown	Any history of travel : Y / N		Confined at home / Contacted Health Facility / Contacted Community Worker	Health workers / Religious leader /Community influencer		Y / N (If Yes, please mention address)	Y / N	Yes / No	Y / N / U
	Fathers/ Husband Name :					Measles containing Vaccine Received: Yes / No / Unknown / NA , If yes , answer below ;	If Yes : date of onset									
							Rash: Y es / No / Unknown						Name & Address:		If Yes (encircle) : Serum / Throat / Urine	If yes , mention date:
							If Yes , date of onset									
	Address :		Caste			First dose: M / MR / MMR /MMRV	Cough : Y es/ No	If Yes, name of the district :								
						2nd dose: M / MR / MMR /MMRV	Coryza : Y es / No									
						2+ dose: M/MR/ MMR /MMRV	Conjunctivitis : Yes / No									
	Telephone:					Date of last MSL Vaccine before onset of rash (dd/mm/yyyy):	Joint pain : Y es / No						Type of health facility ### G / P / I / Q / O			
							Enlarged Lymphnode**** : Yes / No									
							Vit A phophylaxis after onset of rash : Yes / No									

_ _ _	Name :	M / F	H / M / O			MCP Card Availability: Y / N	Fever: Y es / No / Unknown	Any history of travel : Y / N		Confined at home / Contacted Health Facility / Contacted Community Worker	Health workers / Religious leader /Community influencer		Y / N (If Yes, please mention address)	Y / N	Yes / No	Y / N / U
	Fathers/ Husband Name :						If Yes : date of onset									
						Measles containing Vaccine Received: Yes / No / Unknown / NA , If yes , answer below ;	Rash: Y es / No / Unknown						Name & Address:			
							If Yes , date of onset									
						First dose: M / MR / MMR /MMRV	Cough : Y es/ No	If Yes, name of the district :								
	Address :		Caste			2nd dose: M / MR / MMR /MMRV	Coryza : Y es / No								If Yes (encircle) : Serum / Throat / Urine	If yes , mention date:
						2+ dose: M/MR/ MMR /MMRV	Conjunctivitis : Yes / No									
						Date of last MSL Vaccine before onset of rash (dd/mm/yyyy):	Joint pain : Y es / No						Type of health facility ### G / P / I / Q / O			
	Telephone:						Enlarged Lymphnode**** : Yes / No									
							Vit A phophylaxis after onset of rash : Yes / No									

Use separate sheet for suspected cases from active case seaches in community / ACS in health facility and passive surveillance

Note: - Outbreak ID should consist of State code / District code / Year / Outbreak Number; (Year is the year of notification of index case)

*** Not to be filled by investigating team. Unique Case Number to be allotted at district level while colating all the sheets of outbreak investigation.**
Combination of Outbreak ID and Case Number will be the EPID Number for the case.

Abbrevations : Y =Yes ; N=No; U=Unknown ; M= Measles containing vaccine ; MR= Measles & Rubella containing vaccine; MMR = Measles, Mumps & Rubella containg vaccine; MMRV = Measles, Mumps, Rubella & Varicella vaccine

 # Type of HRA code : 1 = Slums with migration; 2 = Nomads; 3 - Brick kiln; 4 - Construction site; 5 - Other migratory high risk areas; 6: non-migratory (settled population) high risk areas

Write date of birth if available. Age is calculated from date of birth to date of Rash onset

Health Facility : G- Government allopathic / P- Private allopathic / I - ISM practioner / Q - Quack / O- Other

**** Travel history : Mark Yes and district of travel if any outside the district within 21 days before the onset of rash**

*****Health worker: ANM /AWW/ASHA/LHV/MPW ; Religious leader: Priest / Temple link person/ Mazars/ Maulana / Ozha ; Community Influencer: Village head / Teacher/ Pradhan/ Panchayat member**

******Enlarged lymphnode: This particularly refers to post auricular, sub occipital and posterior cervical lymph node enlargement**

Annexure 6: Standard operating procedures (SOP) for completing the VPD OB-003

The VPD OB-003 is a single page document designed to capture the essential epidemiological variables of suspected measles cases identified during an outbreak investigation. The VPD OB-003 form is to be completed by the ANM who is conducting active case search (ACS) in the community (i.e. the detailed investigation which follows the preliminary search).

During the pre-investigation orientation meeting, the District Immunization Officer (DIO)/Medical Officer In-Charge (MOIC) should share the following details with team members before they initiate the house-to-house detailed search:

1. **MOB-EPID number** at the beginning as a unique identifier for a suspected outbreak.
2. **Date of notification of index case**. This is an important date, as it determines the time period for searching for suspected measles cases. During ACS, the team should look for suspected cases in the **90 days before** the date of notification of the index case.
3. **EPID Number*** (to be filled by team under the direct oversight of the supervisor/MO). This will be assigned by MOIC/Supervisor at the end of the day after end of the daily house-to-house activity.

Before beginning the house-to-house search, the ANM should record the following information on the VPD OB-003:

- Source of notification of suspected cases (encircle), ACSs (the ANM should use a new OB003 sheet for each type of source of notification):
  - in community (house-to-house search)
  - in health facility
  - through passive surveillance.
- Record the date the outbreak investigation began in dd/mm/yyyy format. After the detailed outbreak investigation is complete, the ANM can add this date to the record in dd/mm/yyyy format.
- The ANM will record additional information in the VPD OB-003 including:
  - village/area, subcentre/health post, PHC/UHC, block/ward, district;
  - HRA type (if applicable). Capture the status as a migrant or not and if the area is part of the identified HRA
  - settings - urban or rural
  - name of BMO/ANM with their mobile numbers
  - name of person and date of conducting ACS.

Once all the details mentioned above are recorded in the VPD OB-003, the team should conduct house-to-house searches in the community in an assigned area and start documenting the details in the VPD OB-003 for each identified suspected case of measles.

Patient's details

Record the name, father's/husband's name, address, age, sex, religion (whether

Hindu/Muslim/other) and caste details of the suspected case.

Record date of birth from immunization card/birth certificate or any other reliable source. In addition, calculate age in years and months based on date of birth and date of rash onset.

Immunization history (encircle)

Ask to see the MCP card.

- if the MCP card is available, the ANM should encircle "yes" on the VPD OB-003 and complete the data on immunization history from the MCP card
- if MCP card is not available, the ANM should encircle "no" on the VPD OB-003 and elicit information from recall method from parents or care givers.

The ANM should enquire whether the suspect has received measles containing vaccine, and if yes:

- encircle type of vaccine for first dose and second dose (M/MR/MMR/MMRV)
- record date of last MCV/MR dose before the rash onset.

Capturing date with last MCV/MR vaccination before the onset of rash is important, as it will help to rule out vaccine induced rash.

Clinical history (encircle)

Elicit information regarding clinical history of the suspected case and record the following:

- fever (yes/no) - if yes date of onset of fever
- rash (yes/no) - if yes date of rash onset
- any symptoms like cough (yes/no), coryza (yes/no) and conjunctivitis (yes/no), joint pains (yes/no), enlarged lymph nodes (yes/no)
- record whether suspected case has received vit A prophylaxis after onset of rash (yes/no).

Travel history

Record the travel history of the suspected case in the three weeks (21 days) before the onset of rash. This is to identify any area/district from where the suspected case may have picked up the infection. Record the name of the district(s) where the suspected case traveled. The Medical Officer will take a call on whether cross notification is required for action in another district.

Complications

Measles may cause complications including pneumonia, diarrhea, ear infection, eye complication or other complications. Record the complication by encircling the options provided. Complications are usually observed 2-3 weeks after the date of rash onset.

If any suspect is female and is of child-bearing age (15-45 years), elicit from her history whether she is currently pregnant. If yes, record her expected date of delivery (EDD). This information is important, especially in rubella outbreaks, where pregnancy outcome and newborn status should be followed to rule out congenital rubella syndrome (CRS) in the infant.

Health seeking behaviour

Record whether the suspected case (after onset of rash) visited a health facility, was

confined at home, or contacted any community worker to seek treatment for the suspected measles.

If the suspected case had contact with a community worker/influencer after the date of rash onset, encircle the category of community contact (health worker/religious worker/community influencer). Each of these categories is described below:

- health worker. ANM/AWW/ASHA/LHV/MPW/other
- religious leader. Priest/temple link person/mazars/maulana/ozha
- community influencer. Village head/teacher/pradhan/panchayat member.

Record the date of contact with any of the above community workers/influencers. Elicit and record the history whether these community workers referred or reported the suspected case to any of the health facility. If yes, document the name, address and type of the health facility. The types of health facilities include:

- government allopathic;
- private allopathic;
- ISM practitioner;
- quack; and
- other.

The MOIC/Supervisor will further verify from records VPD-H002, IDSP (S or P form) whether each health facility notified this case. This information can be utilized for enlisting potential informers and for expansion of reporting sites if required.

Sample collection

From the enlisted suspected cases on VPD OB-003, select five cases from whom serum can be collected and (if possible) two different suspected cases from whom virology sample (throat/nasopharyngeal swab or urine) can be collected based on the recommended window period for sample collection.

- Serum sample (to be collected within 28 days of rash onset)
- Throat/urine/nasopharyngeal swab (to be collected within 7 days of rash onset).

Record on the VPD OB-003 whether a sample was collected from each case (yes/no), and if yes, type of sample was collected (serum/throat/urine/nasopharyngeal).

Death

Record the date of death in case death occurs in the community due to suspected measles.

Completion of the VPD OB-003

Information regarding three suspected cases can be recorded on each single page of the VPD OB-003. After completion of the house-to-house detailed search, submit all the hard copies of the VPD OB-003 to the supervisor or MOIC. After review by the MOIC, these hard copies will be shared with NPSP field offices to generate the line-list by updating information in SIMS.

Annexure 7: MR-OB004 outbreak summary report

The outbreak will be considered over after there have been no further epidemiologically linked cases for one month from the date of onset of rash of the last case documented on the VPD OB-003.		
Notification		
Source of notification of Index case (encircle): weekly report (NPSP/IDSP)/active case search/media/other		
If other, please specify:		Date of notification of index case:
Index case reported by:		Designation:
Name of DIO:		Name of SMO:
Location of the outbreak		
Name of village/ward affected:		Total population of village/Mohalla:
Name of subcenter:	Name of PHC/UHC:	Name of block:
District:		State:
Cross notification needed (encircle): yes/no		Outbreak ID:
Preliminary search including desk review		
Date of desk review:		Date/s of preliminary search:
Total number of suspected measles cases in preliminary search:		
Number of areas searched:		Number of sub-centers/urban wards searched:
Whether considered as an outbreak requiring detailed investigation (encircle): yes/no		
If no, encircle reason:	1. No clustering of cases	2. Vesicular rash
	3. Others (please specify):	
If yes, provide following details of outbreak investigation as mentioned below		
Date of epidemic response team activation:		
Date of pre-investigation orientation meeting*: (Date of orientation of field teams regarding how to conduct HTH search)		

Detailed investigation	
Date of pre-outbreak investigation orientation:	No. of health workers trained: ANM: ASHA: AWW:
Date of outbreak investigation: from _____ to _____	Number of teams conducting HTH searches:
Number of sub-centers/urban wards involved:	Number of villages/mohalla involved:
Date of rash onset of index case:	Date of rash onset of primary case from OB003:
Active case searches	
Total number of suspected measles cases identified through ACS:	
Total number of suspected deaths due to measles identified through ACS:	Vit A supplementation given as per guidelines: yes/no
Number of schools and Anganwadi screened during ACS searches:	
Number of temple sites/faith healers identified within OB area:	
Number of temple sites/faith healers sensitized within OB area:	
Number of health facilities sensitized within OB area:	
Number of ACS conducted in health facilities within OB area:	
Laboratory investigation details	
Details serum specimens collected	

Case number	Age	Sex	Date of last MRCV dose	Date of collection of specimens	Date sent to lab	Date received in lab	Result IgM positive (M/R) IgM negative (M/R) Mixed (for M+R)	Date of result
__ __ __								
__ __ __								
__ __ __								
__ __ __								
__ __ __								

Check Box: Outbreak classification		
	☐ Measles OB (≥2 confirmed measles)	☐ Rubella OB (≥ 2 confirmed rubella)
	☐ Mixed OB (≥2 confirmed measles + ≥ 2 confirmed rubella)	☐ Discarded (< 2 confirmed cases)
	☐ Unclassified OB (< 2 confirmed measles or rubella cases in outbreaks with < 5 cases having serum/virology samples collected)	

Details of virology specimens: *T=Throat swab U=Urine N= Nasopharyngeal swab									
Case Number	Specimen type* (T/U/N)	Age	Sex	Date of last MRCV dose	Date of collection of specimens	Date sent to lab	Date received in lab	Measles virus type (_____) / Rubella virus type (_____) / Negative	Date of Result
__ __ __									
__ __ __									

Passive surveillance	
Number of health facilities reporting suspected cases through passive surveillance:	
Number of faith healers/temple sites reporting suspected cases through passive surveillance:	
RI intensification	
Additional session conducted: yes/no	If yes, date session conducted:
If no, please specify the reason:	
No. of unimmunized/under-immunized children <5 years of age identified and due-listed for age-appropriate vaccination:	
No. of unimmunized/under-immunized children <5 years of age vaccinated in additional session:	
Epidemiological characteristics (from OB003 and OB004)	
Duration of the outbreak:	Size of the outbreak (lab confirmed + epi-linked):
Number of lab confirmed cases:	Number of epi-linked cases:
Is the affected area high risk area (encircle): yes/no	If yes, type of HRA:
Sex proportion (lab confirmed + epi-linked) % male _____% female_____	Religion proportion (lab confirmed + epi-linked) % Hindu_____, % Muslim_____, % Others_____

Age group	Vaccination status (lab confirmed + epi-linked)				Total	Any remark/ observation:
	Zero dose	One MRCV dose	Two or more MRCV doses	Unknown dose		
< 9 months						
9 months < 1 yr.						
1 year ≤ 4 yrs.						
5 years ≤ 9 yrs.						
10 ≤ 14 yrs.						
≥15 yrs.						
Total						

Data analysis	
Spot map of cases in an outbreak area prepared	yes / no
Epi curve of cases in an outbreak area plotted	yes / no
Attack rate = $\frac{\text{Number of cases of measles/rubella}}{\text{Total population}} * 100$	
Age specific attack rate = $\frac{\text{Number of measles/rubella cases in age group}}{\text{Total population of the age group}} * 100$	
Case fatality rate (CFR) = $\frac{\text{Total number of deaths due to measles/rubella}}{\text{Total number of measles/rubella cases}} *100$	

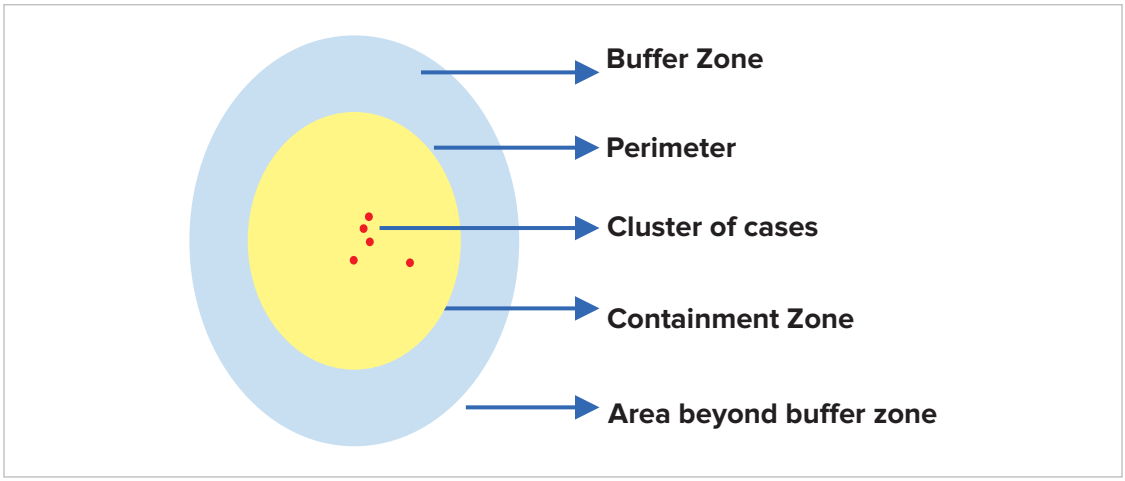
District Immunization Officer **Medical Officer-in Charge**

Annexure 8: Vaccine preventable disease (VPD) surveillance activities including outbreak investigation during the COVID-19 pandemic

The COVID-19 pandemic is challenging health systems across the world. Rapidly increasing demand for care of people with COVID-19 is compounded by fear, misinformation and restrictions on movement of people and supplies that may disrupt the health care delivery. When health systems are overwhelmed, and people fail to access needed services, both direct and indirect mortality from vaccine preventable diseases are likely to increase. Hence, VPD surveillance should be reinforced to enable early detection, outbreak response and management of VPD cases.

Health services including immunization are deemed as essential and need to be functional across the country, as per Ministry of Home Affairs (MHA) order dated 15th April 2020. Depending upon the COVID-19 situation, areas are categorized as:

- Containment Zone: Areas where COVID-19 cases are reported
- Buffer Zone: Areas surrounding containment Zone
- Area beyond Buffer Zone: Outside the buffer zone



The categorization of 'Containment Zone' and 'Buffer Zone' is a dynamic process based on active COVID-19 cases and is updated regularly.

Basic principles for delivery of services in the context of COVID-19 outbreak:

1. Guidelines from MHA and MoHFW pertaining to COVID-19 and related updates will be the primary reference points and no state should violate any COVID-19 guidance.
2. Practices of social distancing, hand washing, and respiratory hygiene need to be followed at all levels.

This guidance addresses specific aspects of conducting VPD surveillance activities, while also ensuring safety of health personnel in the context of COVID-19 and outlines basic principles and practical recommendations for the same.

- Desk review of surveillance data: is an important tool to monitor the ongoing activities and should be regularly carried out to provide feedback to the authorities during district weekly review meetings. Data reviews should drive actions such as increase in telephonic active case searches (ACS), feedback and directives to Medical Officer In-charges (MOIC). Key indicators for the review should include tracking of case investigation, flagging of outbreak and

investigation, sample collection including adequacy, discard rate, weekly comparison of number of suspected cases and health facility contact analysis. Feedback from activities undertaken for quality assurance of case investigation form (CIF) and sample collection should be included. Monthly surveillance indicators and feedback on identified issues should be shared with district officials through WhatsApp/email.

- Directive from District administration to blocks: Relevant district authorities should send written communication (letter/email/WhatsApp) to blocks/health facilities to maintain surveillance and response to AFP, measles, rubella, diphtheria, pertussis and neonatal tetanus (NNT) cases while ensuring appropriate infection prevention and control measures as per MOHFW guidelines.

Table 1. Continuity of key surveillance activities in COVID-19 defined zones

	Activity	Containment & Buffer Zone	Areas beyond buffer zone
1.	Sensitization of reporting sites	telephonic contact and other virtual platforms	active surveillance visits in all priority reporting sites
2.	Surveillance workshops	Utilize virtual platform or small batches	Utilize virtual platform or small batches
3.	Case notification & tracking	✓	✓
4.	Case investigation by MOs	PPE Kits and other measures	✓
5.	Sample collection	PPE kits and other measures	✓
6.	Sample shipment	✓	✓
7.	House to house searches	Limited with PPE kits and other measures	✓

Following standard guidelines of COVID-19 like social distancing, mask, PPE use in containment zone

1.1 Sensitization of reporting sites by Surveillance Medical Officer/District Immunization Officer/Nodal Officer

- Active Case Searches (ACS)
  - In areas beyond Buffer zone: ACS as per existing guidelines
  - In Containment and Buffer Zones: telephonic ACS and other virtual platforms (temporary plan for COVID-19 situation). Frequency of telephonic ACS will be as per routine norms
- Block wise reporting sites (RS) may be allocated to different staff for ACS to avoid duplication.
- DIO office/ Administrative Assistant (AA) from WHO NPSP unit may conduct telephonic ACS in the low priority reporting sites while Health staff/ Field Monitor /Immunization Field Volunteer (IFV), where applicable will conduct the ACS by visiting the low priority reporting sites (LPs), unqualified practitioners and potential informers. In areas with travel restrictions, Health staff/AAs/FMs/IFVs will ensure

sensitization through telephonic ACS. The telephonic ACS thus conducted should be documented in the in D-004 and at the same time they should also track sample collection and shipment.

1.2 Surveillance workshops:

Workshops should be done using online video conferencing applications available at block level through personal computers/smart phones. Avoid physical gathering of large number of participants within a confined room. If unavoidable, then, plan in small batches, ensuring physical distancing measures. Thermal screening of participants should be carried out before they enter the training venue, and any febrile person or having covid like symptoms should not attend the training.

1.3 Case notification/tracking register:

The register should be maintained at health facility for regular tracking of cases and thus identify reasons for delay in case investigation, sample collection, sample shipment from field to District Immunization Officer (DIO) / Surveillance Medical Officer (SMO) office and shipment from office to laboratory.

1.4 Case investigation by medical officers:

Standard IPC measures (wearing of triple layer mask/N-95 mask* and gloves) should be followed as per the available guidelines. Any case suspected to have the COVID–19 disease should be encouraged to wear a mask.

o NOTE: any medical staff having symptoms consistent with COVID-19 should not participate in case investigation, sample collection and transportation.

1.5 Sample collection and transportation:

Standard IPC measures should be followed as per the available guidelines. If transport is not available for shipment to district, it can be stored at the block level health facility either in sample carrier (daily change icepack should be done) or in a freezer if available. Serum can be stored at 4-8°C for a maximum period of 7 days, beyond which it must be frozen at -20°C and subsequently should be transported to the designated laboratory. Repeated freezing and thawing should be avoided as it has detrimental effect on the stability of IgM antibodies. Use standard IPC measures including wearing triple layer medical mask and gloves along with hand hygiene measures.

1.6 Conducting house to house case searches in area beyond Buffer Zone & in Green Zone:

House to house case searches, including during outbreak investigations should be conducted with IPC measures, including physical distancing and hand and respiratory hygiene. Interview should be conducted outdoors or in a well-ventilated space.

1.7 Protecting self through infection prevention and control (IPC) measures:

Physical distancing, hand and respiratory hygiene and the use of appropriate personal protective equipment (PPE) according to a risk assessment.

- Avoid touching any surface (e.g. door handle, handrails, etc.) in the hospital. If any surface is touched, immediately sanitize hands using alcohol-based hand rub.
- Wear gloves when touching blood, body fluids, secretions, excretions, mucous membrane or skin. Immediately perform hand hygiene in case of any such contact.

- Preferably do not sit anywhere within the hospital – standing is a much better option.
- Follow the Guidelines on rational use of Personal Protective Equipment issued by Directorate General of Health Services [Emergency Medical Relief], Govt. of India

Table 2. PPEs to be used during Public health investigations

S. No.	Setting	Recommended PPE	Remarks
1.	Telephonic interview of suspected/confirmed cases	No PPE required	
2.	In-person interview of suspect/ confirmed cases	Triple layer mask White coat (full-sleeved)	Physical distancing; hand hygiene Interview to be done outdoors Patient to wear triple layer mask
3.	Non-COVID field activities, like case investigations, concurrent monitoring etc.	Triple layer mask	Physical distancing; hand hygiene; Respiratory hygiene/Cough etiquette Interview/examination to be done outdoors (if possible)
4.	Handling of clinical samples – stool, blood, serum	Triple layer mask Gloves	Hand hygiene after handling of specimen

References:

1. World Health Organization. Regional Office for South-East Asia. (2019). Measles and rubella elimination by 2023. World Health Organization. Regional Office for South-East Asia. https://apps.who.int/iris/handle/10665/327923
2. World Health Organization. Measles vaccines. WHO Position Paper. Weekly Epidemiological Record, 2017, 92(35):205-227.
3. Strebel PM, Papania MJ, Fiebelkorn, & Halsey, N.A. Measles vaccines. In: Plotkin SA, Orenstein WA, Offit PA, eds. Vaccines, 6th ed. Philadelphia, PA: Elsevier Saunders; 2013;352–387.
4. World Health Organization. "Surveillance standards for vaccine-preventable diseases." 2018.
5. World Health Organization Regional Office for South-East Asia. Surveillance Guide for Vaccine Preventable Diseases in WHO South East Asia Region—2017. New Delhi, India: World Health Organization, Regional Office for South East Asia; 2017. https://apps.who.int/iris/handle/10665/277459
6. Review of the effect of measles vaccination on the epidemiology of SSPE | International Journal of Epidemiology | Oxford Academic. https://academic.oup.com/ije/article/36/6/1334/821076. Accessed February 6, 2020.
7. World Health Organization. Guidance for evaluating progress towards elimination of measles and rubella. Wkly Epidemiol Rec 2018; 41:541-552.
8. World Health Organization. Framework for verifying elimination of measles and rubella. Wkly Epidemiol Rec 2013; 9:89-98.
9. World Health Organization. Rubella vaccines. WHO Position Paper. Weekly Epidemiological Record, 2011, 86:301–316.
10. Reef SE, et al. Rubella vaccines. In: Plotkin SA, Orenstein WA, Offit PA, eds., Vaccines, 6th ed. Philadelphia, PA: Elsevier Saunders; 2013;689–717.

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