

Field Guide

Measles Surveillance & Outbreak Investigation

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सत्यमेव जयते

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Department of Family Welfare
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FOREWORD

Measles is a leading cause of childhood morbidity and mortality accounting for nearly half the global burden of vaccine preventable deaths. In India measles is the biggest cause of vaccine-preventable mortality and morbidity, predominantly affecting children under 5 years of age. The case fatality due to measles can be as high as 24%. Measles cases in India are thought to be significantly under-reported, substantiated by the fact that States with low immunization coverage report the lowest number of cases.

Consistent with the WHO's Global Strategy for sustainable measles mortality reduction, the Government of India will endeavor to reduce measles mortality by ensuring strong routine immunization of at least 90% of target population, establishing an excellent measles surveillance system to provide data for action, and improve measles case management by providing vitamin A and antibiotics to affected children.

The objective of this field guide on Measles Surveillance and Outbreak investigation is to provide step-by-step guidance for establishing and carrying out surveillance activities and outbreak investigations aimed at reducing measles mortality. These guidelines should be particularly useful for public health personnel, epidemiologists, clinicians, medical officers and other health personnel involved in the implementation of Government of India's Multi Year Strategic Plan (MYP) 2005-2010 of the Universal Immunization Programme to reduce measles mortality by two-thirds by 2010 (as compared to 2000 estimates).

I believe this field guide will be instrumental for the establishment of measles surveillance and case management, and will establish a better understanding of the epidemiology of measles in India, allowing for targeting of strategies to ensure rapid reduction in measles morbidity and mortality in India.

(Prasanna Hota)
Secretary to the Government of India

ACRONYMS

AEFI	Adverse Events Following Immunization
AFP	Acute Flaccid Paralysis
ARU	Attack Rate among Unvaccinated
ARV	Attack Rate among Vaccinated
BMO	Block Medical Officer
CDC	Centers for Disease Control and Prevention (USA)
CFR	Case Fatality Rate
DDHS	Deputy Director Health Services
DIO	District Immunization Officer
ELISA	Enzyme Linked Immunosorbent Assay
EPI	Expanded Program of Immunization
ERT	Epidemic Response Team
GAVI	Global Alliance for Vaccines and Immunization
GoI	Government of India
HIV	Human Immunodeficiency Virus
HW	Health Worker
IAP	Indian Academy of Pediatrics
ICMR	Indian Council of Medical Research
ID Number	Identification Number (Measles outbreak)
IDSP	Integrated Disease Surveillance Project
IgG	Immunoglobulin G
IgM	Immunoglobulin M
MMR	Measles Mumps & Rubella Vaccine
MO	Medical Officer
MoHFW	Ministry of Health & Family Welfare
MR	Measles & Rubella Vaccine
NGO	Non Governmental Organization
NICD	National Institute of Communicable Diseases
NPSP	National Polio Surveillance Project
NPSU	National Polio Surveillance Unit
NTAGI	National Technical Advisory Group on Immunization
ORS	Oral Rehydration Solution
ORT	Oral Re-hydration Therapy
PHN	Public Health Nurse
PVPC	Proportion of Vaccine Preventable Cases
RCH	Reproductive and Child Health

RU	Reporting Unit
SEARO	South-East Asia Regional Office (World Health Organization)
SEPIO	State EPI Officer
SMO	Surveillance Medical Officer
SSPE	Subacute Sclerosing Panencephalitis
TCID	Tissue Culture Infective Dose
UNICEF	United Nations Children's Fund
VE	Vaccine Efficacy
VPD	Vaccine Preventable Disease
WHO	World Health Organization

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INTRODUCTION

In May 2003, the 56th World Health Assembly had unanimously adopted a resolution to reduce measles deaths by 50% by the end of 2005 compared to 1999 levels. This goal was established a year earlier by the United Nations General Assembly Special Session on Children "World Fit for Children". Based on these in 2005, Regional Technical Consultative Group for Vaccine Preventable Diseases in WHO South East Asia Region endorsed a goal of achieving 90% reduction of measles mortality by 2009 in comparison to 2000 estimates. Measles mortality reduction initiatives will contribute in achieving United Nations Millennium Development Goal of reducing the under-five child mortality rate by two-thirds by the year 2015 compared with 1990 levels.

In 2005, the Government of India developed a multi-year strategic plan which includes following goals and objectives

- i) Reducing the measles mortality by two-thirds by 2010, compared to 2000 estimates.
- ii) Achieving at least 90% coverage with Measles vaccine in 80% of the districts of the country by 2009.
- iii) Collection of good quality epidemiological data through active surveillance and outbreak investigation and use them to guide further action.

In India more than 50% of measles cases are currently reported in children less than five years of age, indicating insufficient routine measles immunization. Most of the outbreaks in the country go unreported; some get highlighted in the media. Currently since there is limited capacity at the state and district level to carry out the outbreak investigation, teams from the government of India are usually deputed to carry out the investigations.

The purpose of this document is to provide guidelines for

states to implement measles surveillance with the objective of reducing morbidity and mortality due to measles. This is in keeping with the concepts outlined in the Government of India's 5 year strategic plan 2005-2010 for measles mortality reduction.

The AFP surveillance system, with its strong field network and technical collaboration, seems to be a reliable medium to implement measles surveillance throughout the country and to fulfill the measles related goals of Government of India.

1. MEASLES DISEASE

1.1 Historical perspective

Measles is an acute viral infectious disease. There are references to measles as far back as the 7th century A.D. The disease was described by Rhazes in the 10th century A.D as “more dreaded than smallpox”. In 1846, Peter Panum described the incubation period of measles and lifelong immunity. Enders and Peebles isolated the virus in human and monkey kidney tissue cultures in 1954. The first live attenuated vaccine was licensed for use in the U.S in 1963 (Edmonston B strain).

1.2 The organism

The measles virus is a paramyxovirus, of genus Morbillivirus. It is 100 to 200 nm in diameter, with a core of single-stranded RNA and is closely related to the rinderpest and canine distemper viruses. There is only one antigenic type of measles virus. Measles virus is rapidly inactivated by heat, light, acidic pH, ether and trypsin. It has a short survival time (<2 hours) in air or on objects and surfaces.

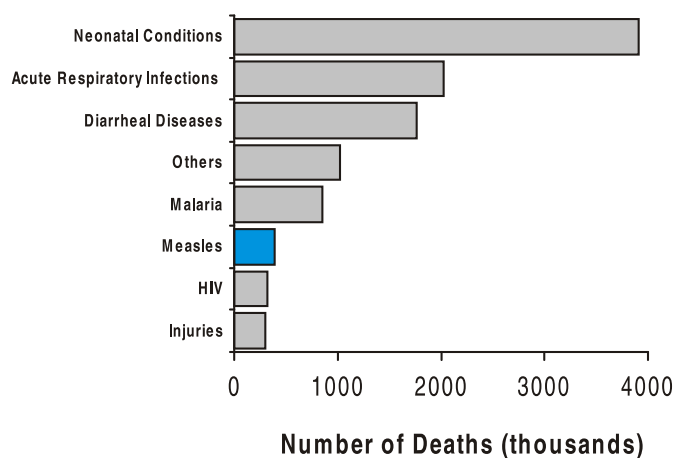
1.3 Pathogenesis

Measles is a systemic infection. The primary site of infection is the respiratory epithelium of the nasopharynx. 2 to 3 days after invasion and replication in the respiratory epithelium and regional lymph nodes, a primary viremia occurs with subsequent infection of the reticuloendothelial system. Following further viral replication in regional and distal reticuloendothelial sites, there is a second viremia, which occurs 5 to 7 days after initial infection. During this viremia, there may be infection of the respiratory tract and other organs. Measles virus is shed from the nasopharynx beginning with the prodrome until 3 to 4 days after rash onset.

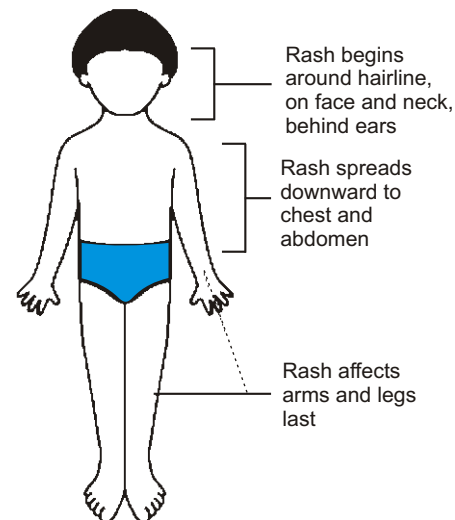
1.4 The clinical picture

The incubation period of measles from exposure to prodrome averages 10 to 12 days. From exposure to rash onset it averages 14 days (range 7 to 18 days).

Top causes of death in children aged <5 years, worldwide, 2000-2003



Source: World Health Organization, The World Health Report 2005



1.4.1 Clinical features

The prodrome lasts 2 to 4 days (range 1 to 7 days). It is characterized by fever, which increases in stepwise fashion, often peaking as high as 103° to 105°F. This is followed by the onset of cough, coryza (runny nose), and/or conjunctivitis. Koplik's spot, an exanthem present on mucous membranes, is considered to be pathognomonic for measles. It occurs 1 to 2 days before the rash to 1 to 2 days after the rash and appears as punctate blue-white spots on the bright red background of the buccal mucosa.

The measles rash is a maculopapular eruption that usually lasts 5 to 6 days. It begins at the hairline and then involves the face and upper neck. Over the next 3 days, the rash gradually proceeds downward and outward, reaching the hands and feet. The maculopapular lesions are generally discrete, but may become confluent, particularly on the upper body. Initially, lesions blanch with fingertip pressure. By 3 to 4 days, most do not blanch with pressure. Fine desquamation occurs over more severely involved areas. The rash fades in the same order that it appears, from head to extremities.

Other symptoms of measles include anorexia, diarrhoea especially in infants, and generalized lymphadenopathy.

1.4.2. Protective immune response

Following infection with measles virus, the initial cell mediated immune response is followed by an antibody mediated response at the time of the rash. Whereas, antibody titres wane over the course of several years, measles virus-specific cellular immunity appears to persist. Some persons with very low or undetectable antibody titres may be susceptible to measles. The role of antibodies in the immune response is further demonstrated by the temporary prevention of measles in exposed individuals following timely administration of immunoglobulin.

Depending upon the titre of passively acquired maternal antibodies, young infants are usually protected against measles for several months. This protection decays by 6 to 9 months of age, leaving infants increasingly susceptible to measles.

1.4.3 Laboratory confirmation

Following primary infection with measles virus, measles specific antibodies appear in the blood. IgM antibodies appear first and can be detected 3 to 4 days after rash onset. They attain peak levels approximately one week later and then gradually decline and are rarely detectable at six weeks after rash onset. The detection of measles IgM antibodies in the blood of a clinical measles case can be considered confirmation of measles virus infection

1.4.4 Complications

Approximately 30% of reported measles cases have one or more complications. Complications of measles are more common among children less than 5 years and adults over 20 years of age.

Most persons recover from measles without sequelae. However, severe forms of the disease, including bleeding from skin and mucosa, may occur. Persons with malnutrition, especially vitamin A deficiency, or with severe immunological disorders such as advanced HIV infection are at increased risk of developing severe or even fatal measles. Relatively common complications of measles include otitis media, laryngo-tracheobronchitis and pneumonia. Among children less than 5 years of age, frequent measles complications include otitis media (5 to 15%) and pneumonia (5 to 10%).

In developing countries, persistent diarrhoea with protein-losing enteropathy may ensue, particularly in young infants. Measles encephalitis, which is considered an autoimmune disorder, occurs once in about 1000 cases. Subacute sclerosing panencephalitis (SSPE), a slowly progressive infection of the central nervous system, occurs once in about 100,000 measles cases. Some complications associated with measles may be facilitated by the transient suppression of cellular immunity, which is a characteristic feature of the disease.

Investigations have generally found case fatality rates to be in the range 1 to 15% in developing countries, however, in developed countries, measles deaths are rare, with case-fatality ratios in the range of 0.01 to 0.1%. Although there is no specific treatment for measles, limited studies have demonstrated some clinical benefit of the antiviral drug ribavirin. Vitamin A supplementation has been shown to markedly reduce measles-associated mortality in developing countries and should always be given to measles patients in areas where vitamin A deficiency is prevalent. Appropriate treatment of secondary bacterial infections with antibiotics is essential.

1.5 Epidemiology

The World Health Organization estimates that over 40 million cases still occur worldwide each year, contributing to approximately 530,000 deaths including 182,000 in the South East Asian region as reported in 2003. Epidemics often occur every 2 to 3 years and usually last between 2 to 3 months, although their duration varies according to population size, crowding and immune status of affected population.

The disease is seasonal. In temperate climates, outbreaks generally occur in late winter and early spring. In tropical climates, transmission appears to increase after the rainy season. In India, the epidemics of measles are more common in winter and early spring (January to April). Outbreaks last

Measles Disease

longer where family size and hence the number of household contacts is large. In the absence of measles vaccination, virtually all children will have been infected with measles by the time they are 10 years old.

Man is the only natural host of measles virus. Although monkeys may become infected, transmission among them in the wild does not appear to be an important mechanism by which the virus persists in nature.

Since the introduction of effective measles vaccines, the epidemiology of measles has changed in both developed and developing countries. As vaccine coverage has increased, there has been a marked reduction in measles incidence, and with decreased measles virus circulation, the average age at which infection occurs has increased.

Outbreaks may still occur even in areas where immunization coverage is high. Periods of low incidence (the "honeymoon" effect) may be followed by a pattern of periodic measles outbreaks, with an increase in the number of years between epidemics. Outbreaks are generally due to the accumulation of measles-susceptible persons, including both unvaccinated children and those who were vaccinated but failed to seroconvert. Approximately 15% of children vaccinated at 9 months and 5%-10% of those vaccinated at 12 months of age are not protected after vaccination.



Corneal ulcer following measles



Encephalitis following measles

2. MEASLES VACCINE

Measles is an extremely contagious viral disease that affected almost every child in the world before the widespread use of measles vaccine. An excellent live, attenuated measles vaccine has been available since the 1960s and currently reaches about 70% of the world's children through national childhood immunization programmes. The live, attenuated measles vaccines that are now internationally available are safe, effective and are used in national immunization programmes.

Immunity

Serologic studies have demonstrated that measles vaccines induce seroconversion of 85% at 9 months and above 95% above 12 months of age.

Both the development and the persistence of serum antibodies following measles vaccination are lower than, but parallel to, the response following natural measles infection.

The peak antibody response occurs 6 to 8 weeks after infection or vaccination. Immunity conferred by vaccination against measles has been shown to persist for at least 20 years and is generally thought to be life long for most individuals.

2.1 Measles vaccines

A number of live, attenuated measles vaccines are available, either as single-antigen vaccines or in combination with either rubella or mumps and rubella vaccines. When the MR or MMR vaccines are used, the protective immune response to each of the components remains unchanged.

Most of the live, attenuated measles vaccines used now originate from the Edmonston strain of measles virus isolated by Enders and Peebles in 1954. Subsequently, this strain underwent numerous passages in various cell cultures to become the attenuated Edmonston B-vaccine, which was licensed in the United States in 1963 and widely used until 1975.

Well known vaccine strains derived from the original Edmonston isolate include the Schwarz, the Edmonston Zagreb and the Moraten strains, all in widespread use since the 1960s.

2.2 Vaccine characteristics

- Measles vaccine, like measles virus, is very stable when stored between minus 70°C and minus 20°C.

- Reconstituted measles vaccine loses about 50% of its potency after one hour at 20°C and almost all potency after one hour at 37°C. Following reconstitution, the vaccine must be stored at 28°C and used within 4 hours.
- The vaccine induces both humoral and cellular immune responses comparable to those following natural infection, although the serological titres are usually lower. Declining antibody titres may be boosted by revaccination or by exposure to circulating measles virus.

2.3 Storage and supply

- Vaccine should never be left at room temperature, especially in tropical climates. When used in the field, it should be transported on dry or wet ice in isothermic containers.
- When stored at 0 to 8°C, a minimum infective dose can be maintained in non reconstituted vaccine for two or more years. Storage at temperatures over 8°C will reduce potency.
- The vaccine is also very sensitive to sunlight hence the need to keep it in coloured glass vials
- Measles vaccine is relatively heat stable before reconstitution. However, breaks in the cold chain that result in temperatures higher than 37°C may render the vaccine completely ineffective. Measles vaccine can be safely frozen without loss of potency.
- Reconstituted vaccine should be stored at 2 to 8°C and disposed off after 4 hours. There would be loss of potency and complications such as toxic shock syndrome if used beyond 4 hours of reconstitution.

2.4 Indications and contraindications

Indications:

- Measles vaccine should be given to infants and young children. It should also be given to teenagers and adults likely to be susceptible to measles including health workers who are at relatively higher risk for being exposed to measles.
- In most developing countries, high attack rates and serious disease among infants necessitate early vaccination, usually at 9 months of age, despite the

relatively low (80-85%) seroconversion rates following vaccination in this age group.

- Asymptomatic HIV infection is an indication, not a contraindication, for measles vaccination. Ideally, the vaccine should be offered as early as possible in the course of HIV infection.
- HIV-infected infants should receive measles vaccine at 6 months of age, followed by an additional dose at 9 months, in case they are not severely immunocompromised.
- Measles vaccine should be used pre-emptively for prevention of measles. To protect individual high-risk patients during an outbreak, vaccination within 2 days of exposure may modify the clinical course of measles or even prevent clinical symptoms. However, large-scale vaccination to control ongoing outbreaks is of limited value.

Contraindications:

- Measles vaccination should be avoided in high fever or serious disease and pregnancy.
- Administration of immunoglobulins or other antibody-containing blood products may interfere with the immune response to the vaccine. Vaccination should be delayed for 3 to 11 months after administration of blood or blood products, depending on the dose of measles antibody.
- Following measles vaccination, administration of such blood products should be avoided for 2 weeks, if possible.
- Mild, concurrent infections are not considered a contraindication, and there is no evidence that measles vaccination exacerbates tuberculosis.
- Persons with a history of an anaphylactic reaction to neomycin, gelatin or other components of the vaccine should not be vaccinated.
- Furthermore, measles vaccine is contraindicated in persons who are severely immunocompromised as a result of congenital disease, HIV infection, advanced leukaemia or lymphoma, serious malignant disease or treatment with high-dose steroids, alkylating agents or antimetabolites or in persons who are receiving immunosuppressive therapeutic radiation.

2.5 Dosage and administration

- Measles vaccine is lyophilized and reconstituted with pyrogen free double distilled sterile water (packed with the vaccine) immediately prior to administration by injection.
- Dose is 0.5 ml and should be administered subcutaneously in the right upper arm. The site is important for survey purposes.
- Each 0.5 ml dose of reconstituted vaccine should contain a minimum infective dose of at least 1,000 viral TCID₅₀ (median tissue culture infective doses).
- Other live and inactivated bacterial and viral vaccines can be administered simultaneously without problem.

2.6 Adverse reactions

Adverse reactions following measles vaccination are generally mild and transient & can be as follows:

- Slight pain and tenderness at the site of injection may occur within 24 hours, sometimes followed by mild fever and local lymphadenopathy.
- About 7 to 12 days after vaccination, up to 5% of measles vaccine recipients may experience fever of at least 39.4°C for 1 to 2 days. The fever may occasionally (1:3000) induce febrile seizures.
- A transient rash may occur in about 2% of vaccinees.
- Thrombocytopenic Purpura occurs in approximately 1 in 30,000 vaccinated individuals.
- Adverse events, with the exception of anaphylactic reactions, are less likely to occur after receipt of a second dose of measles-containing vaccine. Based on data from SIAs, the risk of anaphylactic reactions following measles vaccination in developing countries is closer to 1 in 1,000,000.
- No evidence of an increased risk of encephalitis, permanent neurological sequelae and also no evidence to support an increased risk of Guillain Barré syndrome following measles vaccination.
- The virtual disappearance of SSPE in countries where measles has been eliminated strongly suggests that the vaccine protects against SSPE by preventing measles infection.
- There is no evidence to support reports that measles vaccination may be a risk factor for inflammatory bowel disease or for autism.

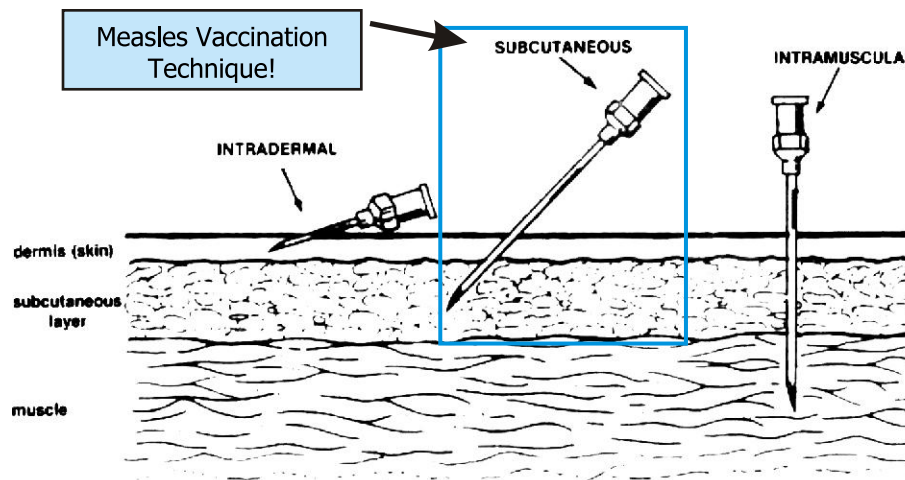
2.7 Immunization strategy for India

- In India, measles vaccination is given through routine immunization at or after 9 months and before 12 months of age. In case the child misses this opportunity, the child can be vaccinated at the first available opportunity up to 5 years of age.
- To optimize population immunity, all children should be given a second opportunity for measles immunization. The Government of India, in its multi-year strategic plan, is considering introduction of second opportunity through routine immunization in states that have achieved 90% measles coverage and local resources are available to sustain the strategy.
- In addition, the national expert group will decide providing second opportunity through catch up campaigns in states that have medium to low coverage.
- The modality of providing second opportunity through Routine immunization or supplementary immunization activities will depend upon the strengths of routine Immunization and disease epidemiology of the states.



Subcutaneous injection of measles vaccine

Diagram of different needle positions



3. STRATEGIES FOR MEASLES MORTALITY REDUCTION IN INDIA

The plan of action mentioned in “Measles mortality reduction - India strategic plan 2005 - 2010” addresses the issue of reducing the measles mortality by two-thirds by 2010, compared to 2000 estimates. The plan emphasizes achieving at least 90% coverage in 80% of the districts of the country by 2009 and collection and use of good quality epidemiological data from active surveillance and outbreak investigation to guide further action.

3.1 Key strategies

Envisaged to achieve the goal of measles mortality reduction are

- Achieving high routine measles vaccination coverage of infants at 9-12 months of age; provide measles vaccine to children over 1 year if not vaccinated earlier at the earliest contact.
- Establish effective measles surveillance that provides information about number of cases and deaths by month, age and vaccination status of cases and deaths and conduct outbreak investigation supported by laboratory confirmation.
- Improving management of measles cases, including vitamin A supplementation and adequate treatment of cases.
- Based on evaluated measles immunization coverage and surveillance data, providing a second opportunity for measles immunization to appropriate age groups of children through either a second routine dose of measles vaccine or through supplemental immunization activities.

3.1.1 Achieving high routine immunization

A dose of measles vaccine will be delivered to children (9-12 months) through strengthening routine immunization. First dose of Vitamin A will be delivered with routine measles immunization and subsequent doses as per national schedule. In addition, children who missed routine immunization during infancy will be immunized whenever they come into contact with the health system until they are 5 years old.

Increasing and sustaining high measles routine coverage (i.e. over 90%) is essential for achieving a sustainable reduction in measles mortality. Activities to improve routine immunization coverage should include

- Planning and implementation of regular immunization sessions at fixed and out reach immunization sites.
- Special strategies for reaching the un-reached.
- Reduction of missed opportunities and dropout rates.
- Training to improve management of immunization services at all levels.
- Enhancement of supervision.
- Design and implementation of information education and communication activities and materials.
- Regular analysis of routine immunization data and corrective action to ensure a sustained increase in the coverage of measles vaccination, concentrating on the communities / children not vaccinated.

3.1.2 Establish effective measles surveillance system

All States in India have a well established polio surveillance infrastructure, based on a network of Surveillance Medical Officers (SMOs) supported by WHO- NPSP (National Polio Surveillance Project), which will most probably continue to operate for several years until such time as global polio-free certification is achieved. States should take advantage of this infrastructure to support measles surveillance as appropriate.

In addition to the above system, the Integrated Disease Surveillance Project (IDSP) of the Government of India and disease surveillance project of various states are also involved with the surveillance of diseases including measles. It is therefore important to reconcile the data at all levels so as to ensure uniform reporting, data analysis, interpretation and action.

The primary focus on measles surveillance would be using the available surveillance data from all sources to track and investigate measles outbreaks. The data from outbreak investigations will be used to decide measles control activities. Efforts will be made to establish district based VPD surveillance mechanism involving public-private partnership.

Outbreak investigations are very useful for monitoring changes in measles epidemiology and identifying and correcting weaknesses that have led to outbreaks. The data collected through outbreaks would provide the critical

information such as age distribution of measles cases and age specific measles case fatality rates.

Field surveillance should be supported by a proficient measles laboratory network. A National Measles Laboratory Network will be built to process all the specimens collected during measles surveillance and outbreak investigation. It is envisaged that the measles network will require more national laboratories than the polio lab network. Priority will be given to the existing 8 polio laboratories and later the measles lab network will be expanded according to the needs of the programme. All states will have access to these laboratories to send samples collected for confirming diagnosis of measles.

3.1.3 Improved measles case management

Many children experience uncomplicated measles and require only supportive measures, including vitamin A supplementation, nutritional support and education for mothers about complications. However, an important proportion of measles cases in developing countries can be expected to have at least one complication and some may involve multiple systems. It is vital that measles cases, whether isolated or in outbreaks, receive vitamin A supplementation as part of the measles treatment. Several studies have shown that the administration of vitamin A during a measles episode reduces case fatality and the severity of measles. It is thought that the utilization of vitamin A is impaired during measles infection, irrespective of the total body stores of the vitamin. Vitamin A should be given to all measles cases, irrespective of whether it has previously been administered prophylactically or given as routine immunization. (For further details refer to the chapter on case management).

Case management guidelines will be nationally standardized and promoted. There is no specific anti viral drug against measles. Patients are managed symptomatically with supportive measures like continued feeding, provision of 2 doses of Vitamin A 24 hours apart, treatment for fever, appropriate antibiotics in case of complications, ORT for diarrhoea and monitoring and referral if needed.

3.1.4 Providing a second opportunity for measles immunization

Second opportunity is ensuring a dose of measles vaccine to those children who have never been vaccinated for measles, as well as, to those who were vaccinated but did not develop the

immunity. However, those who are not immune to measles could be identified only by testing measles specific IgG antibody levels. Since tests to detect antibody levels are much more expensive than measles vaccine and measles vaccine is a very safe vaccine, immunization activities to provide second opportunity should be given to all people in the targeted age group.

Sero-conversion rate of measles vaccine is 80-85%. Accordingly even in States where routine immunization coverage is high some children from each birth cohort remain susceptible to measles. When large numbers of susceptible children are accumulated over time, periodic outbreaks occur in these States.

Accordingly second opportunity for measles immunization is required in order to protect those children who have never been vaccinated as well as those who were vaccinated but did not develop the immunity. The second opportunity can be provided through supplementary immunization activities or through routine immunization. These two options need to be used carefully based on the strengths of the routine immunization programme of the country and disease epidemiology.

Second opportunity for measles immunization through routine immunization will be considered in States that have achieved 90% measles vaccine coverage through routine immunisation, good surveillance data is present and local resources available to sustain the strategy. The national expert group will decide regarding providing a second opportunity in other States that have medium to low measles immunization coverage. The decision will be based on the analysis of the surveillance data available.

3.2 National level coordination for measles control

A National Expert group with members from MoHFW, ICMR, IAP, NICD and partner agencies will be formed to provide technical and other support to the States.

States will introduce measles mortality reduction strategies in a phased manner, based upon

- Epidemiological evidence,
- Programmatic and service delivery situation,
- Cost benefit of introducing and sustaining measles mortality reduction strategies.

4. MEASLES SURVEILLANCE

The primary purpose of measles surveillance is to detect, in a timely manner, all areas in which measles virus is circulating. Accordingly, it is not necessary to detect every measles case. Timely notification of clinically diagnosed measles cases is required to detect outbreaks.

Establishment and maintenance of a surveillance system is important to ensure timely notification of all measles cases. All measles outbreaks should be serologically confirmed to differentiate them from other fever and rash outbreaks. The surveillance data should be analyzed at all levels to determine and improve the immunization strategies.

4.1 Case definitions

4.1.1 Clinical measles

Any person in whom clinician suspects measles infection or any person with fever and maculo-papular rash (i.e. non-vesicular or without fluid), with cough or coryza (running nose) or conjunctivitis (red eyes).

For the purpose of epidemiological investigation, a clinically diagnosed measles case would be a case which has occurred within the last three months.

4.1.2 Laboratory confirmed measles

A case that meets the clinical case definition and presence of measles specific IgM antibodies in the serum.

4.1.3 Epidemiologically confirmed measles

A case that meets the clinical case definition and is linked epidemiologically to a laboratory confirmed case.

4.2 Measles surveillance structure

The existing surveillance systems for identification of measles outbreaks can be linked to the AFP surveillance system that has been in place in India since 1997. Measles surveillance and outbreak identification takes place at the local level, district level and state level.

4.2.1 Surveillance activities at the local level

Measles surveillance at the local level should be institution based through a comprehensive network of reporting sites which may include those currently reporting AFP. This system should include health facilities, reporting units and informers. As of 2005, approximately 10,000 reporting units

and approximately 15,000 informer units have been enrolled under the AFP surveillance network throughout the country. The same network can be used for measles surveillance.

Reporting Units (RU): These include Government or private health facilities which are engaged in treating a large number of patients below 15 years. Most of them are larger facilities with both outpatient and inpatient departments. The RUs are geographically well distributed with at least one RU in every block in rural areas and every ward in urban areas. Examples are medical colleges, district hospitals, private hospitals, community health centers, primary health centers and private pediatric hospitals.

The identified RUs usually maintain documentation of the patients being treated by various doctors of the unit and in various specialty departments & wards etc. Each RU has a designated nodal officer for coordination of AFP surveillance. The same person should henceforth be coordinating measles surveillance as well. The RUs should report all measles cases in the weekly report. This report would be sent to the districts even when there are no AFP and /or measles cases. Nevertheless, they should continue to report all AFP cases immediately on identification.

The activities at the Reporting Units are both active and passive. The active component are the visits made by designated officials periodically for searching measles cases and sensitizing the staff of the RUs. The passive component is the routine weekly reporting.

Activities when measles cases are identified at the reporting unit

The reporting unit Medical Officers (MOs), pediatricians, physicians and nurses who see patients with measles should inform the designated Nodal Officer, immediately upon identification of the case. The nodal officer should immediately note down the details of the measles case in the VPD - H002 form. The Nodal Officer at each RU should report to the district by Monday of each week. The Nodal Officer for measles surveillance should visit all the wards/ contacts, likely to see measles cases and ensure that all measles cases have been reported to the DIO/ SMO. Even if measles cases are not detected by the reporting unit during the week, a zero report should be sent using VPD H002 form.

Informer Units:

These are smaller health facilities or clinicians who are visited by patients below 15 years but in relatively smaller numbers than reporting units and they should notify the district whenever they come across a measles case similar to the reporting of AFP cases. They need not send a weekly report but should inform the district (DIO/SMO) on seeing a measles case. They usually do not maintain detailed documentation of the patients visiting them. These can be individual child specialists, private practitioners and religious places such as temples that are visited by measles cases.

4.2.2 Surveillance activities at the district level

On behalf of the DIO, the designated person at each district should collect the VPD - H002 forms from all the reporting units, collate them in VPD - D001 form and compile the district report. The DIO should send this routinely every week to the State EPI officer, RC or State SMO by Tuesday of each week.

The DIO/SMO should analyse the available district data on a weekly basis, using and reconciling case information from different surveillance systems such as IDSP to identify outbreaks of measles. If outbreaks are identified, measles outbreak investigations should be initiated as described in Chapter 5, Measles Outbreak Investigation.

The VPD-D002 form should be used to track completeness and timeliness of reporting from the reporting units. This information should be sent on a quarterly basis by the DIO to the State Programme Officer.

The following surveillance activities need to be carried out at the district level

- Monitoring weekly surveillance reports of measles cases including zero case reports submitted by reporting units.
- Ensuring weekly analysis of measles cases and reconciling data with existing surveillance systems such as IDSP to identify if there are any outbreaks.
- Ensuring that all data from cases are properly collected, analyzed and interpreted for local action.
- Ensuring that surveillance and case investigation data are shared with other surveillance systems such as IDSP and forwarded to the national EPI/NPSU through proper channels.

Active surveillance visits to reporting sites:

Based on the process of prioritization, currently selected reporting units and informers should be visited regularly on a planned basis for the specific purpose of searching for AFP cases. This opportunity could be used for active surveillance for measles cases and to sensitize RU staff / Informers. Active case searches should be conducted at regular intervals by the DIO/SMO and the information on the frequency & results of these searches collated and compiled in form VPD D003.

Activities during active surveillance visits to reporting units:

During a visit to a reporting unit the DIO/SMO should meet the head of the reporting unit and the nodal officer, visit all relevant departments and check their inpatient and outpatient registers to scan for missed or unreported AFP and measles cases since the time of the last visit. This helps to verify the activity of the nodal officer and identify the training needs of the staff of the health facility or hospital. Active case searches followed by training sessions can greatly improve the reporting of measles cases by the health facilities. The visit should be documented by signing the registers/ records that are checked. The Active Case Search VPD - D003 form should be completed by recording the visit and the outcome of the active case search.

During visit to these units, the DIO/ SMO should also ensure the availability of blank weekly reporting formats (VPD-H002 form), copies of reports sent to district and display of posters for reporting measles cases in the OPDs and wards.

Activities during active surveillance visits to informers:

By meeting the informers in person, the DIO/SMO can emphasize the need to report both AFP and measles cases, check their records/ registers to scan for any missed or unreported cases since last visit and can also identify their training needs. The DIO/SMO should document the visit by signing the registers and records of the informer verified. The visit should also be documented in the Active Case Search VPD - D003 form separately maintained for informers.

Actions if unreported measles case(s) are found on Active Case Search:

- If the child is still admitted in the hospital, the RU should be advised to report the case/s in the VPD-H002 of the following week. The data should be

reconciled at the district level in the VPD-D001 form and a potential outbreak if any, identified and investigated.

- If the child is discharged from the hospital, the information to fill the VPD-H002 might not be available. Nevertheless reporting unit should be advised to find the available information from the records and report in the VPD-H002 form of the following week.

The DIO/SMO should reconcile and interpret data at the district level to find out whether other RUs or informers have reported these cases.

However if an unreported AFP case is detected, detailed investigation of the unreported AFP case should be carried out immediately.

Measles outbreak detection and investigation

A measles outbreak is said to occur when the number of

clinically diagnosed measles cases observed is greater than the number normally expected in the same geographic area for the same period of time. The decision about the investigation of a measles outbreak should be made at the district level. The details are described in detail in Chapter 5.

4.2.3 Surveillance activities at the state level

On Wednesday, the SEPIO/State Programme Officer should collect the information received in the VPD- D001 forms from all the districts in the state and collate the district reports in the VPD - S001 form.

The multidistrict data is interpreted to identify measles cases in districts with special emphasis given to clustering of cases in adjacent blocks of 2 or more districts. Feedback should be provided to the district officials when adjoining district clustering is identified. This information should then be transmitted to the Assistant Commissioner Immunisation, Ministry of Health and Family Welfare, Government of India, New Delhi.

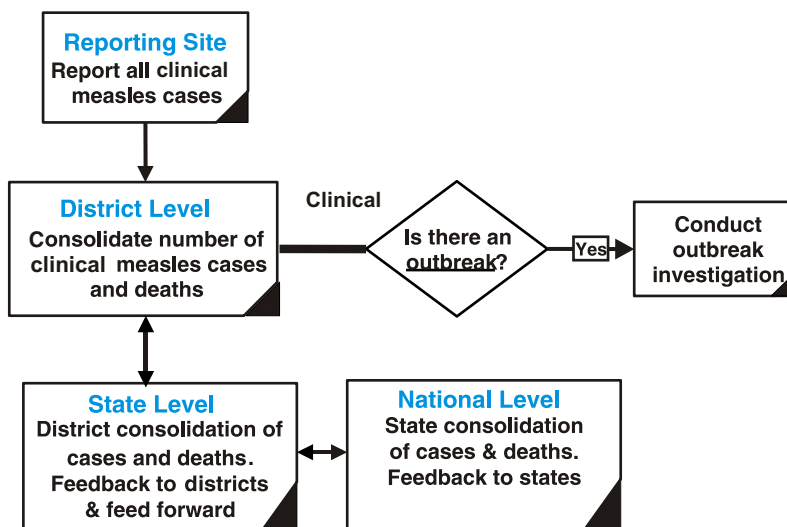
Completeness of weekly reporting (including “zero” reporting)

$$\% \text{ Complete} = \frac{\text{Number of weekly reports received} \times 100}{\text{Number of weekly reports expected}}$$

Timeliness of weekly reporting (including “zero” reporting)

$$\% \text{ Timely} = \frac{\text{Number of weekly reports received on time} \times 100}{\text{Number of weekly reports expected}}$$

Measles surveillance flow chart



5. MEASLES OUTBREAK INVESTIGATION

For timely measles outbreak investigation, it is imperative that routine measles data is collected, collated and analyzed regularly by District Immunization Officer (DIO)/Deputy Director Health Services (DDHS)/Block Medical Officer (BMO). Epidemic Response Team (ERT) should be formed in the district to oversee the measles outbreak investigations in the district.

5.1 Objectives of outbreak investigations

- Study the epidemiology of measles and define the population at risk.
- Review the dynamics of measles infection and impact of measles vaccination.
- Suggest ways to improve measles vaccine coverage.
- Reduce complications and deaths due to measles.

5.2 Epidemic Response Team (ERT)

The ERT should be constituted as soon as the programme is initiated in the district even before the occurrence of an epidemic so as to plan and prepare for the same. The SMO should act as technical guide to the ERT. The central role of the team would be to plan and guide investigation of the measles outbreak, should it occur, monitor progress in data collection, compile and analyze data and bring out a final report.

The epidemic response team may include representatives from

- The local health authority (DIO/DDHS, any district level epidemiologist/ district officer in charge of surveillance and concerned Block Medical Officer BMO)

- Surveillance Medical Officer (SMO) of NPSP
- Hospital clinician/PHN
- Laboratory representative
- NGO representative/Community leader
- Others as appropriate

The specific responsibilities of the epidemic response team should be to

- Plan the control and response strategies in the light of overall programme objectives.
- Decide on the type of outbreaks that need to be investigated. A threshold level may be used to identify large outbreaks for immediate investigation.
- Estimate and identify additional resources needed for rapid epidemic response.
- Ensure the availability of staff and training them for epidemic response.
- Analyse epidemiological information concerning the evolution of an epidemic.
- Establish clear lines of responsibility for planned actions.
- Meet regularly to review data and activities implemented.
- Communicate with the general public and the media.
- Evaluate the response.
- Evaluate the immunization programme.
- Produce a detailed report on outbreak response activities.

Clinical measles outbreak

> = 5 clinical cases of measles in a block in a week
or
Any measles associated death in a block in a week
or
> = 5 clinical cases in an area bordering more than one adjacent block

5.3 Measles outbreak

Unlike polio, population immunity for measles is not very high. Therefore measles is generally an endemic disease with sporadic outbreaks. Accordingly it is not easy to give a precise definition for measles outbreak. An outbreak is said to occur when the number of cases observed is greater than the number normally expected in the same geographic area for the same period of time.

5.3.1 Identifying a measles outbreak

Timely detection of an outbreak depends on the ability of the local health authority to recognize an increase in incidence of measles cases significantly above the number normally expected. Therefore, it is imperative that routine measles data is collected, collated and analyzed regularly by District immunization officer (DIO)/ Deputy Director Health Services (DDHS)/Block Medical Officer (BMO). This should be done by analyzing the routine reporting of measles cases to districts through passive surveillance as well as through the AFP/ measles surveillance network.

The surveillance data received from different hospitals in the VPD H002 forms in the district should be compiled by the DIO in the VPD D001 form. The data should be entered in the VPD D001 form as per the blocks and a measles outbreak as described earlier in this chapter can be identified. It is therefore necessary to sensitize the network of informers and the reporting units about the case definition of measles and the need to report such cases to the surveillance system.

Since measles is a very common disease among children, parents often do not seek health care. When complications occur, these cases go to a health facility to get treated. Therefore relatively few measles cases that get reported through the routine reporting system represent the tip of the measles outbreak.

Active searches at the reporting sites by DIO/SMO can provide information on the occurrence of measles cases in the field. Conversations with local health workers and local practitioners may also be a source of information about an unusual increase in the occurrence of measles. Sometimes the local press may report the outbreak of fever with rashes before any other source.

A policy decision regarding whether all outbreaks or only large outbreaks are to be investigated should be based on the programme needs of the state. A threshold level may be used

to identify large outbreaks for immediate investigation. The threshold level should be determined by looking at data of previous years.

For operational purposes, presence of measles outbreak should be verified if five or more than five clinically diagnosed cases of measles are identified in a block in a week, or five or more than five clinically diagnosed cases of measles occur in an area bordering several blocks in a week, or one or more than one death due to clinically diagnosed measles occurs in a block in a week.

If a measles epidemic affects a very wide geographical area of the state or district, it is recommended that outbreaks be investigated in a few locations that are more affected, e.g. a part or a complete rural block or an urban area as appropriate, rather than every block or every town.

5.3.2. Preliminary search

When the weekly data and or an active search at a reporting site by DIO/SMO points to a possible measles outbreak, the presence of the outbreak and its geographical spread needs to be ascertained through a preliminary search.

As a part of the preliminary search the DIO/DDHS should find out from the BMOs/MOs of the suspected outbreak area about the presence and geographical extent of the measles outbreak in their area. The BMO/MO/ Health Workers should visit the affected areas and perform a rapid assessment to know whether the reported cases are compatible with clinical case definition of measles. If clinical measles cases are found, then geographical extent of the spread of the outbreak to the surrounding villages/ blocks should also be ascertained by visiting the surrounding villages, speaking to local practitioners, speaking to village head, religious heads and other local leaders of the area.

After obtaining the results of the preliminary search, the ERT could decide whether it is necessary to conduct a comprehensive measles outbreak investigation and response in the area. Once it is decided to conduct measles outbreak investigation, the ERT/DIO should initiate the steps to investigate the outbreak.

5.4 Steps in measles outbreak investigations

It is essential that there should be a planned response to a measles outbreak. The following are the steps to be undertaken when a measles outbreak is investigated

- Identifying the measles outbreaks that need to be investigated and assigning an outbreak number
- Mobilization of Epidemic Response Team (ERT)
- Orientation & planning meeting at the local level
- Conducting measles case search
- Collection and shipment of specimens to the laboratory
- Laboratory confirmation of the outbreak
- Data analysis
- Conversion of data to information for action
- Report writing
- Giving feedback
- Initiating actions

5.4.1 Identifying the measles outbreaks that need to be investigated and assigning an outbreak number:

As described above, a decision needs to be made about which measles outbreaks need to be investigated. Every measles outbreak that is investigated should be allotted an outbreak ID number. The code of the outbreak ID number should consist of alphabetic characters and digits as follows

MOB- TN-CBE-05-001

Where MOB indicates measles outbreak, TN indicates the State code of Tamil Nadu, CBE indicates the District code of Coimbatore, 05 the year of onset 2005 and 001 denotes the outbreak number. Therefore MOB-TN-CBE-05-001 should be the code of the first measles outbreak investigated in Coimbatore district in Tamil Nadu in the year 2005.

5.4.2. Mobilization of Epidemic Response Team (ERT)

The Epidemic Response Team that has been formed at district level should hold a meeting as soon as a measles outbreak is identified. The ERT should decide on the area to be surveyed, plan and guide investigation of outbreak, monitor progress in data collection, compile and analyze data and bring out a final report.

5.4.3. Orientation & planning meeting at the local level

The ERT should organize a pre-investigation orientation and

planning meeting for medical officers, supervisors and health workers (HW) who will be participating in the house to house case search and other field activities. The following topics should be discussed in the meeting:

A. Epidemiological investigation

- Measles case definition
- Measles case identification
- Area affected by outbreak
- How to conduct search for measles cases and house marking
- Supervision of case search and data collection
- Mapping of measles cases

A map of the district/block showing location of the reported measles cases will help in identifying the affected area and planning the case searches. All affected areas should be included in the case search plan. The plan for case search should include day wise allocation of a defined area to each health worker. A map should also be prepared showing the day wise area allocated to each health worker. The distribution of work to each health worker should be carefully done so that the case searches can be performed efficiently. Similarly, each supervisor's area should also be clearly defined. Supervisors will need vehicles to facilitate field supervision activities.

B. Logistics and supplies should be adequate and timely to support the field investigation. The following should be arranged and supplied as per field requirements

- Transport arrangements
- Forms and formats
- Chalk pieces
- Vitamin A solution and spoon
- Medicines like analgesics, antipyretics and antibiotics
- Blood sample collection kit
- Arrangements to transport blood/ serum specimen in cold chain to the lab

C. Patient care:

- Vitamin A schedule & precautions
- Management of measles cases needing antibiotics

- Referral system for cases with complications

D. Feedback mechanisms

A practical demonstration of filling of all the forms and formats should be arranged. Various issues related with filling up of the formats correctly should be discussed. The procedure of getting back the forms after fieldwork, compilation and transmission of documents should be explained.

Outcomes of the orientation & planning meeting at the local level should include:

- Action plan for house to house measles case search
- Finalization of person days requirement for collection of data
- Finalization of transportation needs
- Finalization of timeline for each activity
- Logistics acquisition and distribution plan
- Basic understanding among health workers and supervisors on case search and data collection
- Fixing job responsibility and monitoring process
- Plan for case management including vitamin A supplementation for all and antibiotics for those needed and referral

5.4.4. Conducting measles case search

A. Role of the Health Worker

Each worker should conduct house-to-house searches to find measles cases in the designated area. All houses should be included in the active case search. The idea is to list all the cases of measles that have occurred in the recent past. All measles cases identified during the case search should fit the standard clinical case definition of measles.

The methodology of house-to-house measles case searches should be as follows. The health worker should carry Form VPD-OB001 & VPD-OB002 for this purpose. The outbreak identification number should be mentioned in the form

- Greet the family and explain the purpose of the visit.
- Find out the number of persons who have received measles vaccine in the past in each age group residing in that house. Fill this information in Form VPD-OB001. Similarly, find how many persons in each age

group have not received any measles vaccine so far.

- Enquire from an adult family member about the existence of a measles case or occurrence of measles in the recent past (three months) as per the measles case definition. Also enquire about death due to measles or its complication in the recent past. The best way to get this information from family is to first find if any deaths occurred in the past three months in the family, then ask whether those who died suffered measles before death. (measles may precipitate and cause death up to 3 months after the disease). Enter this information using tally marks.
- Information about all measles cases detected, should be line listed in Form VPD-OB002. Seek all relevant information and complete the line list. The health worker should enter all the information
- All identified cases of measles should be given the first dose of Vitamin A as per the policy/dosage guidelines. Explain the purpose of Vitamin A to the family. The supervisor should provide the second dose of Vitamin A next day.
- Members of the team who are authorized to treat patients should look for any complications of measles. They should give antipyretics, ORS and antibiotics for needy children. The children with severe complications who need admission should be referred to the nearby hospital. The supervisor should be informed about such cases.
- Request the family to report new measles cases or new complications in the present measles cases immediately if any occur, in the next few days to local health worker or nearest health center.
- If acceptable in the community mark the house with chalk. This will indicate which house has not been visited. An example of house marking that could be used is:

M

Date

- Move to the next house and repeat the process.
- At the end of the day, Form VPD-OB001 & VPD-OB002 should be handed over to supervisor.

B. Role of supervisor

Supervisors have a very important role in ensuring the high quality of case searches. They should ensure that:

- Houses are randomly checked for quality of work
- All areas are searched as per plan and no house is missed by health workers
- Adequate supplies are available
- Hands-on help and support is provided to the health worker in case of difficulty
- Support to refer measles cases with complication is provided
- They collect form VPD-OB001 & VPD-OB002 at the end of the day and check the totals in each row.
- All detected measles cases are line listed in Form VPD-OB002.
- Vitamin A is given to all cases of measles as per the recommended schedule
- Progress is monitored
- Daily feedback to ERT is provided.

The progress of the house-to-house case search should be monitored regularly by the ERT. They should make certain that data from all areas is received.

During the course of investigation, it may be possible that some other areas (not included in initial planning) may report fresh cases of measles. The ERT should make arrangements to undertake case searches in these new areas as well.

5.4.5. Collection and shipment of specimens to the laboratory

ERT should identify 5 cases of measles and depute a medical officer to take the blood specimen. Blood specimens should be collected from case with onset of rash 4 to 28 days prior to visit.

The following equipment and blood collection kit would be required

- 5 ml vacutainer tube (non-heparinized) with 23 g needle / 5 ml syringe with needle
- 5ml blood collection tubes if syringe and needle is used for blood collection

- Disposable gloves and face mask (one set each)
- Tourniquet
- Sterilizing swabs
- Sterile serum storage vials
- Specimen labels, marker pen
- Band aid
- Zip lock plastic bags
- Lab request form
- Cold box with ice packs
- First aid kit (along with address of nearest referral facility in case of complications during blood collection).

Collection procedure

- Collect 5 ml blood by venepuncture in a sterile tube labeled with patient identification and collection date.
- The blood should be kept at room temperature until there is complete retraction of the clot from the serum
- The blood can be stored at 4 to 8°C for up to 24 hrs before the serum is separated
- Do not freeze whole blood.

There are 2 options available to ensure that the specimen reaches the WHO accredited measles lab in good condition.

Option 1

Transport whole clotted blood specimen to laboratory in ice, if it can reach the laboratory within 24 hours.

Option 2

- The blood should be centrifuged at 1000g for 10 minutes to separate the serum, serum collected and transported
- If centrifuge is not available, carefully remove the serum using a pipette, avoid extracting red cells.
- Transfer the serum aseptically to a sterile externally threaded labeled vial.
- Store the serum at 4 to 8°C until shipment takes place

Shipment of blood specimens:

- Specimens should be shipped to the laboratory as soon

The ELISA test for the detection of measles-specific IgM antibodies is recommended for the WHO measles laboratory network.

as possible. Do not wait to collect additional specimens before shipping.

- Place specimens in zip lock or plastic bags.
- Use a thermos flask with ice or a vaccine carrier.
- If using ice packs (should be frozen) and vaccine carrier, place frozen icepacks along the sides and place the samples in the center.
- Place lab request form in plastic bag and tape to inner side of the styrofoam box /vaccine carrier
- Arrange a shipping date.
- When the arrangements have been finalized, inform the lab of the time and manner of transportation.

- Fill in Laboratory Request Forms (LRF) completely.
- Three dates are very important
 - Date of last measles vaccination
 - Date of onset of rash
 - Date of collection of sample.
- Sterile serum should be shipped on wet ice within 48 hours or stored at 4 to 8°C for a maximum period of 7 days.
- In case a delay is anticipated, sera must be frozen at -20°C and should be transported to the WHO accredited laboratory on frozen ice packs. Repeated freezing and thawing can have detrimental effects on the stability of IgM antibodies.

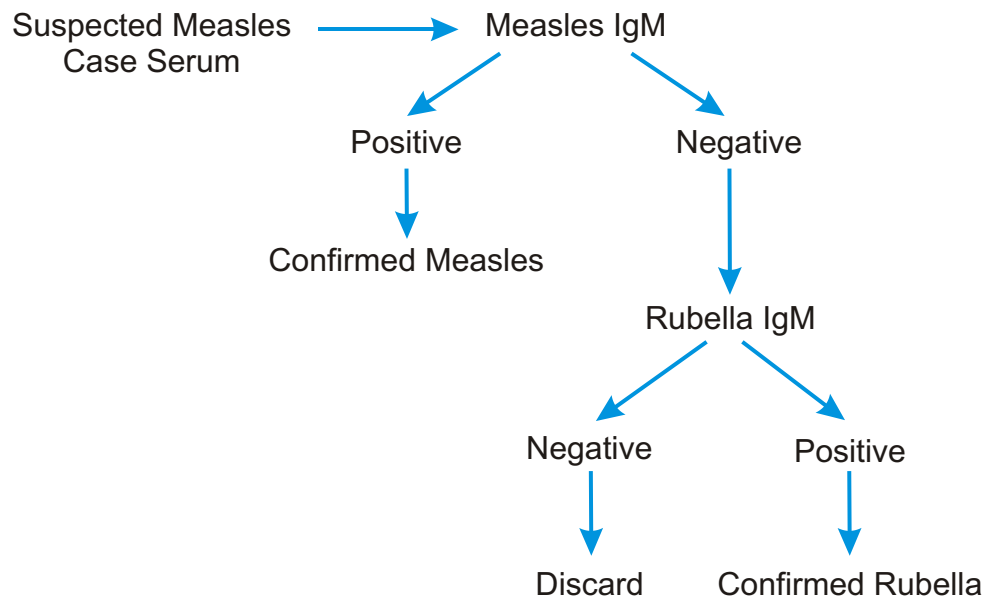
Points to be noted:

- Label the vial with the patient's name, outbreak ID number, specimen number, date of collection and specimen type. The specimens should be labeled with the outbreak ID and specimen number from 1 to 5. This must be identical to the code made in the VPD-OB002.

5.4.6. Laboratory confirmation of the outbreak

Measles-specific IgM antibodies appear within the first few days of the rash and decline rapidly after one month. Their presence provides strong evidence of current or recent measles infection. IgM is also produced on primary vaccination, and, although it may decline more rapidly than IgM produced in response to the wild virus, vaccine and wild

**Measles/Rubella IgM testing strategy
single blood sample collected**



virus IgM cannot be distinguished by serological tests. A vaccination history is therefore essential for interpretation of test results.

The correct timing of sample collection with respect to the clinical signs is important for interpreting results and arriving at an accurate conclusion. Detection of measles specific IgM antibodies confirms that the present outbreak is due to measles.

IgM ELISA tests are very sensitive between days 4 and 28 after the onset of rash. A single positive serum sample obtained within 28 days after onset of measles is considered adequate for confirmation of a measles case. At least 5 samples should be obtained from an outbreak. First all sera should be tested for Measles IgM. All measles negative sera should be further tested for rubella specific IgM antibodies. Since both measles and rubella are endemic in the country there are three likely situations

Laboratory confirmed measles outbreaks:

One or more samples are positive for measles IgM and none of the samples positive for rubella IgM

Laboratory confirmed rubella outbreaks:

One or more samples are positive for rubella IgM and none of the samples are positive for measles IgM

“Mixed” measles and rubella outbreaks

Some samples are positive for measles Ig M while some es

samples are positive for rubella IgM. In this situation if more than five samples are tested it might be possible to decide whether the outbreak is measles or rubella. However at the current state of measles control in the country this would not be needed.

5.4.7. Data analysis

A. Routine data Analysis:

The data collected routinely needs to be analyzed in time, person, and place.

Time: Number of measles by month and year should be analyzed for state, district and block.

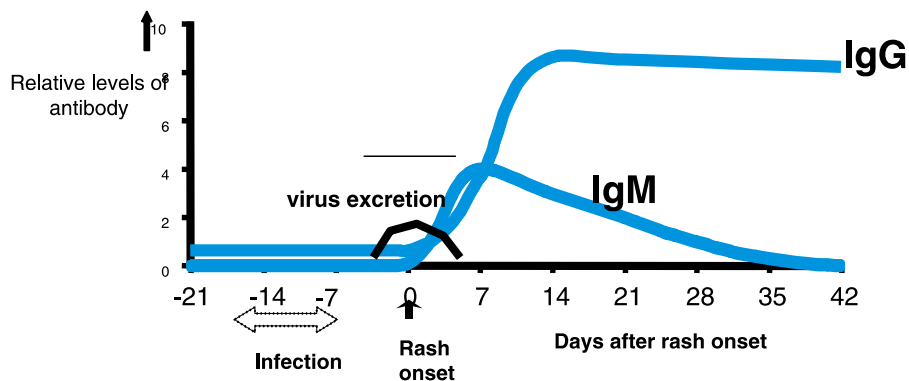
Person: The characteristics of the measles cases should be analyzed for state, district, and block. The characteristics include age, sex, and measles vaccine status and the characteristics of the clinically diagnosed measles death cases.

Place: Distribution of measles cases by state/ district and block. This is best analyzed by a spot map.

B. Data analysis for Outbreak investigations.

During an epidemic, collected data should be analyzed rapidly and locally to determine the extent of the outbreak, the impact of actions taken to date and identification of problems with the routine immunization system. Any delay in reporting should be investigated.

Measles virus infection (wild or vaccine)



Collection of samples:
 IgM: Single serum, 0-28 days post rash onset
 Isolation: Urine and 0-5 days post rash

Analysis of data will help to

Confirm the measles outbreak

- Is the reported number of cases greater than the expected number of cases for this period? (e.g. threshold)
- What proportion of cases fulfill the case definition?
- Results of the serological confirmation of five cases

Define the extent of the outbreak

- Time: What are the dates of onset of cases? (e.g. epidemic curve)
- Place: Where do cases live? (e.g. spot map)
- Person: Who are they? (e.g. tables for age distribution and immunization status)

Measure the severity of the outbreak

- How many confirmed cases died as a proportion of all cases? (Case Fatality Rate)

Measure the effectiveness of vaccination

- How many confirmed cases occurred in vaccinated individuals?

- How many confirmed cases occurred in unvaccinated individuals?
- How effective was the vaccine at preventing infection (vaccine efficacy)?
- How many cases could have been prevented by the immunization programme?

Basic analysis should include construction of an epidemic curve, graphing of the age distribution of cases, and spot mapping of cases. Vaccine efficacy and the proportion of cases that were vaccine-preventable should be calculated. If population data are available, calculate age-specific attack rates.

Epidemic curve: A graph showing cases by date of onset or by date of report helps to demonstrate where and how an outbreak began, how quickly the disease is spreading, the stage of the outbreak (start, middle or ending phase), and whether control efforts are having an impact (figure 1)

Graph or table of age distribution and immunization status of cases: A graph or table showing the attack rates in different age groups will indicate whether the disease pattern of measles has changed over a period of time. It will also help to identify the vaccine efficacy and provide information on the

Figure 1: Reported cases of measles by week of rash onset

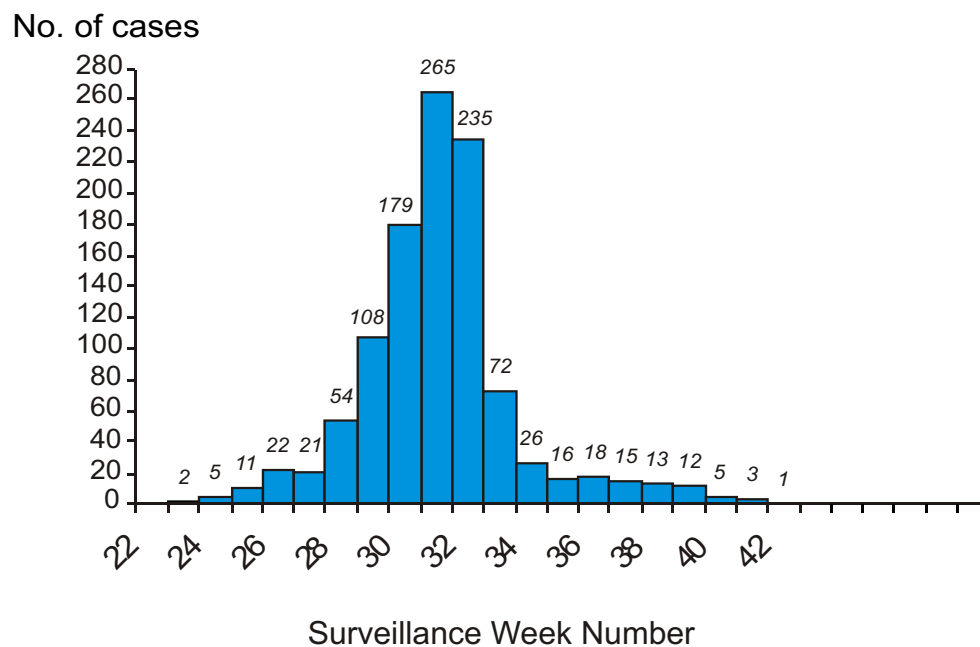
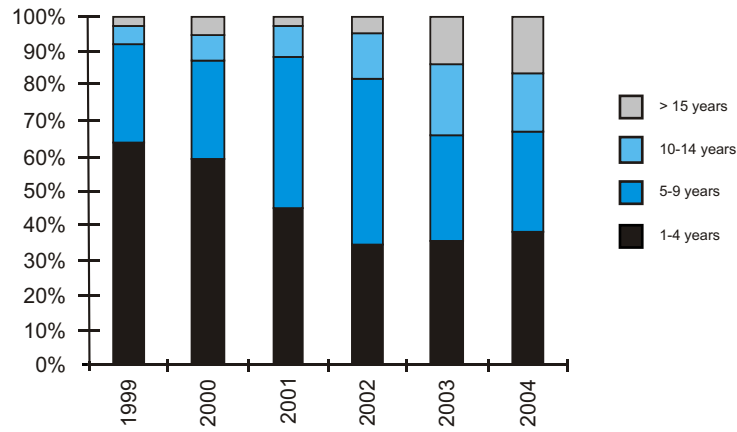


Figure 2: Age distribution of reported measles case



impact of the control programmes initiated and helps target interventions. This should be constructed from the line listing of cases. This information will be used for identifying the most affected age-groups and those cases which were not preventable (figure 2).

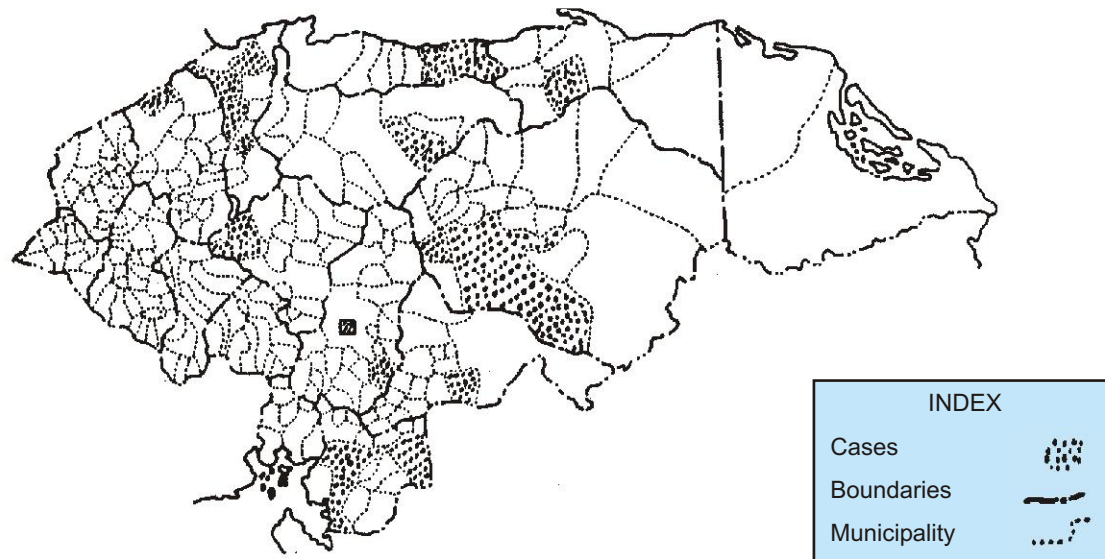
Estimation of vaccine efficacy: Using immunization history data one can tabulate those immunized but not protected (vaccine failures), and those who were not immunized.

Map of incidence rates: At a national level, it may be helpful to

map measles incidence per 100000 population by district. Where surveillance is weak, however, it must be realized that variation in measles incidence rates may reflect variations in reporting reliability.

Spot map of confirmed cases: A map of the area of the epidemic should be marked with the location of all confirmed cases. Investigators can use this “spot map” to identify areas with clusters of disease. Further investigation of these areas may reveal weaknesses in the local immunization programme (figure 3).

Figure 3: Spot map shown location of measles cases



Attack rate (AR):

Attack rate is an incidence rate (usually expressed as a percent), used only when the population is exposed to measles risk for a limited period of time such as during an epidemic. It relates the number of measles cases in the population at risk and reflects the extent of epidemic. Attack rate is calculated as follows:

$$\text{Attack Rate} = \frac{\text{Number of new cases of a specified disease during a specified time interval}}{\text{Total population at risk during the same interval}} \times 100$$

Age-specific Attack Rate : If population data are available for the area of the outbreak, age-specific attack rates can also be calculated as follows

$$\text{Attack Rate (0-11 months)} = \frac{\text{Number of measles cases in children 0 to 11 months of age}}{\text{Total number of children 0 to 11 months of age}} \times 100$$

Attack rates may also be calculated for other age groups. The denominator can be further refined to include only the population at risk (excluding those already vaccinated or who have suffered measles previously). This may give a more accurate attack rate among the susceptible population. The population included in the denominator should always be clearly stated in table 1.

Case-fatality rate (CFR)

Based on the case investigations and the total number of confirmed cases, this rate can be calculated as:

$$\text{CFR} = \frac{\text{Number of patients who died of measles}}{\text{Total number of cases of measles}} \times 100$$

CFRs should be estimated by age-group if possible.

Vaccine efficacy (VE):

This can be estimated from the data collected during an outbreak investigation and from routine coverage data. The coverage must be known or estimated for the age group in which cases are occurring.

This method is based on the difference between the attack rates among vaccinated persons (ARV) and those among the unvaccinated (ARU), expressed as a fraction of the attack rate among unvaccinated persons (ARU): The greater the proportional reduction of illness in the vaccinated group, the greater the vaccine efficacy.

$$\text{VE} = \frac{(\text{ARU} - \text{ARV})}{\text{ARU}}$$

Vaccine efficacy can also be estimated by plotting the percentages of measles cases in vaccinated individuals (PPV)

Table 1: Age specific attack rates in a measles outbreak in Uttar Pradesh, India 1986

Age	Population Surveyed	Reported Number	Measles %	Attack Rate %
0-11 months	58	13	1.7	22
1-14 years	512	279	36.2	54
5-9 years	628	290	37.6	46
10-14 years	447	158	20.5	45
15+ years	2896	31	4.0	1
TOTAL	4542	771	100	17

and the percentage of the population vaccinated (PCV) on a nomograph which shows the relationship between **PPV, PCV part and VE (figure 4)**. For instance, if 20% of measles cases are from individuals vaccinated against measles and if vaccination coverage is 80%, vaccine efficacy is close to 95%; if 60% of measles cases are from individuals vaccinated against measles and if vaccination coverage is 80%, vaccine efficacy is close to 70%.

Proportion of vaccine-preventable cases (PVPC):

It is also possible to estimate the proportion of vaccine-preventable cases. This is the number of cases occurring in children who were not immunized or who were immunized before the recommended age and not re-immunized at the correct age, as a proportion of the total number of cases. From case investigations and total number of cases, this rate can be calculated as:

$$PVPC = \frac{\text{Number of vaccine-preventable cases}}{\text{Total number of cases of measles}}$$

5.4.8 Using data for action

The data collected during an investigation should be analyzed to determine why the outbreak occurred. The data will help to identify in which group the susceptible individuals have accumulated. This will allow corrective measures to be taken. Although a measles outbreak may occur despite high levels of immunization, it is usually due to a failure to vaccinate.

The reasons for accumulation of susceptible individuals include:

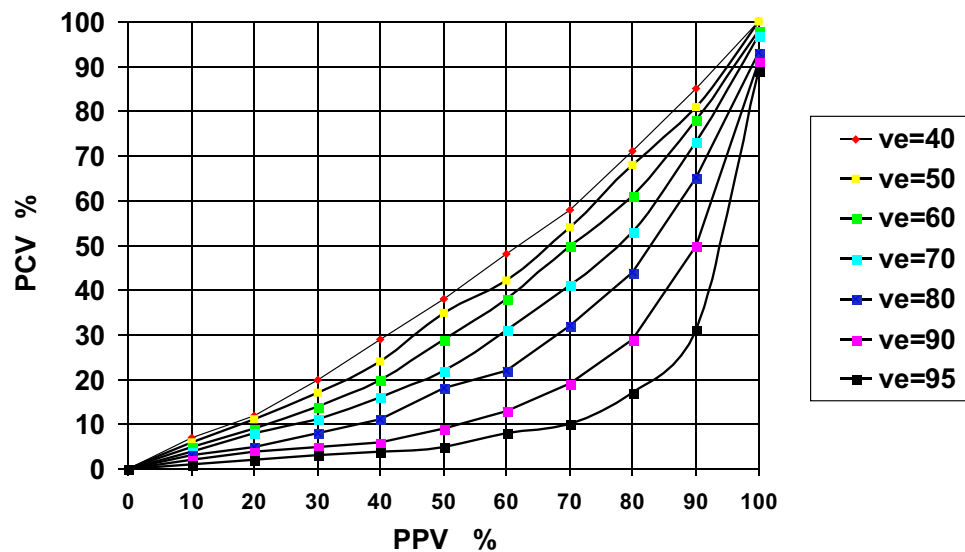
A. Failure to give vaccine

Some children may not be vaccinated: Despite the widespread availability of a safe and effective vaccine for over 30 years, failure to administer at least one dose of measles vaccine to all infants continues to be the main cause of measles mortality and morbidity. A high proportion of vaccine preventable cases (PVPC) in an outbreak would suggest that a failure to vaccinate children is a significant factor. Spot maps, demographic information and age-specific attack rates can help to identify reasons for a failure to vaccinate.

High-risk areas and groups can be identified with spot maps showing the location of cases. Maps should be examined for clusters of cases that reveal a failure of the programme to reach a specific geographic area or population subgroup. Spot maps of cases can be compared with those including coverage levels and other surveillance data to identify high-risk areas and focus future activities.

Some individuals may be too old to be immunized at the commencement of the programme: These persons might be outside the target age group for vaccination when the vaccine is introduced, and the vaccination programme reduces the incidence of measles to lower levels (thus reducing their chances of acquiring natural immunity).

Figure 4: The relationship between percentage of cases vaccinated (PVC) and percentage of the population vaccinated (PPV) for seven different percentage values of vaccine efficiency (VE)



The age distribution of cases and the age-specific attack rates should be examined to determine whether certain age groups are particularly susceptible. These age groups should be targeted for supplemental vaccination activities.

2. Vaccine failure

Decreased efficacy of measles vaccine: The measles-containing vaccines currently in use are safe and effective. However, these vaccines are not 100% effective. In India where the first dose is given at 9 months, vaccine efficacy is estimated to be approximately 85%. If the calculated vaccine efficacy (VE) is below 80% during an outbreak in any setting, cold chain practices and immunization should be examined.

Cold chain failure: If the efficacy of the vaccine appears to have been low across all age groups, especially during a specific period of time, the cold chain should be reviewed to ensure that it has been functioning correctly. Factors contributing to a cold chain failure must be identified and rectified.

Vaccine potency problems: The initial potency of the vaccine rarely needs to be re-examined. This is an expensive process and should only be undertaken in special circumstances and when adequate samples of vaccine vials are available (e.g., low vaccine efficacy where cold chain and immunization practices are proven to be excellent and when large amounts of vaccine are concerned).

5.4.9 Report writing

The measles outbreak investigation should be followed by a short comprehensive report at the end of the activity. The report should be written systematically including the following sections

- Introduction and background information about the area affected
- Review of measles and routine immunization
- Short review of measles outbreaks in the past
- Measles reporting and surveillance system
- Confirmation of outbreak by serology
- Data collection methodology
- Data analysis
 - Time, place and person analysis of cases
 - Mapping of cases

- Age distribution and vaccination status analysis
- Attack rate analysis
- Analysis of case fatality rate
- Vaccine efficacy analysis
- Proportion of vaccine preventable cases
- Probable reasons of outbreak

- Population at risk
- Case management and vitamin A
- Response to outbreak
- Conclusions and recommendations
- The report should also include
 - Relevant charts, maps & graphs
 - Key rates and indicators

The measles outbreak investigation report should be sent to state government, central government and NPSP.

5.4.10 Giving feedback

It is important to provide feedback to all levels on the outcomes of the measles outbreak investigations so as to ensure that all concerned are aware of the reasons for the outbreak, the actions initiated and the plan to prevent future outbreaks. Feedback should be provided to

- Local level (PHC/ Health Unit in the ward) including community leaders
- District Health Authority
- State Health Authority
- NPSP
- Government of India

5.4.11. Initiating actions

In all measles outbreaks, the activities of strengthening routine immunization, raising awareness of vaccination and effective case management should be a priority. It is critical to recognize that supplementary immunization activities may not have a substantial impact on the course of a measles outbreak and even when they are successful, the cost per prevented case can be very high.

If it is decided to implement supplementary vaccination campaigns, these should focus on areas not yet affected, but

where the outbreak is likely to spread. They should be started immediately (do not wait for completion of the outbreak investigation). It has been shown that supplementary immunization activities do not usually begin until well after the onset of an outbreak onset when disease spread has already occurred. Immunization in these circumstances usually fails to reach those missed by the routine programme. There is a marked decline in efficacy of post-exposure prophylaxis when vaccine is administered more than 72 hours after exposure.

If supplementary immunization activities are planned, staff and parents must be reassured that it is safe to give an extra dose of measles vaccine to a child already immunized.

6. MEASLES CASE MANAGEMENT

Significant morbidity and mortality are associated with measles. During an outbreak adequate case management is critical and should address the diagnosis, clinical assessment, severity status, and treatment.

6.1 Measles case diagnosis

For the diagnosis of measles, it is necessary to use the standard case definitions as described in the chapter on measles surveillance.

6.2 Clinical assessment

Initial assessment will normally be carried out in a health centre. Any child with a rash and fever, or suspected for other reasons of having measles, should be kept away from other children, particularly the young. Children must be examined for the signs and symptoms of complicated measles to determine the severity of disease and to ensure that those with complications are properly treated.

6.3 Severity status and case management

Measles case management depends on the severity of disease, two different levels are being distinguished:

Uncomplicated measles: a child with measles and none of the signs or symptoms of complicated or severe disease

Complicated measles: a child with measles and at least one of the signs or symptoms of complicated disease.

6.3.1 Uncomplicated measles

Many children will experience uncomplicated measles and will require only supportive measures

- Provide Vitamin A to all children as mentioned later in this chapter
- Continue breast feeding, or give as much weaning foods and fluids as the child will take.
- Yellow fruits and vegetables and dark green leafy vegetables are important for recovery.
- Give Oral Rehydration Solution (ORS) if there is any sign of dehydration (ensure mother knows the signs of dehydration and knows how to prepare ORS).
- Control the child's fever to reduce the risk of convulsion

- Fever will usually decline within 1 week and the rash will fade within 10-14 days.
- Treat the child at home as long as no complications develop; bring the child for treatment to a health centre if
 - the general condition worsens
 - breathing becomes rapid or difficult
 - diarrhoea continues or signs of dehydration incur
 - the child is unable to drink
 - rapid pulse, wasting, sore red mouth
 - child vomits everything
 - ear pain and ear discharge
 - convulsions
 - the eyes become painful, cloudy or there is a change in vision or
 - other diseases such as acute respiratory infection develop.

6.3.2 Complicated measles

In developing countries, a large proportion of cases can be expected to have at least one complication. Some complications may involve multiple systems. Early and effective treatment can greatly reduce the chance of a person dying from measles complications. In the event of complications it is recommended to

- Refer patient to a health facility for further management
- Follow the above recommendations for case management of uncomplicated measles and ensure that 2 doses of vitamin A are given
- 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 should be given four weeks later using the same dosage
- Clean ear discharge and treat with antibiotics
- Refer clinical encephalitis to hospital
- Treat malnutrition and diarrhoea with sufficient fluids

and a high quality diet

- Treat pneumonia with antibiotics
- Treat diarrhoea with ORS or intravenous fluids as appropriate
- Refer patient to a health facility for further management if required.

6.3.3 Administration of vitamin A

- Vitamin A dose should be given as recommended in the table below and dosage should never be exceeded under any circumstances. Use the spoon provided by the manufacturer.
- Only a properly trained health worker should be allowed to administer vitamin A dose.
- The schedule is for treatment of measles cases and not for Vitamin A prophylaxis.

Recommended vitamin A schedule and dosage for measles treatment

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



Vitamin A

7. MEASLES LABORATORY NETWORK

7.1 Categories of laboratories

WHO has recommended that all tests be performed in the WHO accredited laboratory using standardized IgM capture ELISA tests for diagnosis of measles. All measles negative sera will be further tested for rubella antibodies.

The network of laboratories to support measles surveillance include

National laboratory: The national laboratories perform serology tests for measles and rubella. Few of the national labs have capacity for virus isolation.

Regional laboratory: Regional laboratories perform serology tests for measles and rubella and measles virus isolation. The regional laboratory will have the capacity for training and provide quality assurance for the national labs.

Global specialized laboratory: The virus isolates from the national and reference labs would be sent to a global specialized laboratory for genetic sequencing

7.2 Serological tests

In outbreak situations, one blood specimen should be collected preferably between 4 and 28 days after onset of rash, from 5 cases and sent to measles laboratory as described in the chapter on measles outbreak investigation. Standardized ELISA kits for IgM detection will be used by all network laboratories. The results will be provided within 7 days on receipt of sample in the laboratory.

7.3 Tests to isolate measles virus & genetic sequencing

The isolation of measles virus from clinical specimens can also be used to confirm measles diagnosis, but it is relatively time-consuming and requires more sophisticated laboratory support than serology. However, recent advances in the molecular epidemiology of measles virus have made it possible to analyze viral nucleotide sequences and classify measles isolates according to probable geographic origin. Information obtained through molecular epidemiology can complement information obtained from the standard epidemiologic investigation. Therefore, appropriate clinical specimens need to be obtained for viral culture from every chain of measles transmission.

Suitable samples for isolation of measles virus are leukocytes, serum, throat and naso-pharyngeal secretions, and urine. Urine is the recommended sample for measles virus isolation for the network. Urine specimens for virus isolation should be collected early in the acute phase of infection (the prodrome phase through the first few days of rash), when the virus is present in high concentration. They should be refrigerated and transported to a designated national or reference laboratory within 48 hours.

Collection of urine samples for measles virus isolation

Urine samples may be collected from 2 to 3 cases of an outbreak. Samples should be collected within 5 days of onset of rash. Ten to fifty milliliters of urine is adequate. First passed morning specimens are preferable.

- Mid stream urine sample should be collected in sterile urine bottles.
- Label the container with name, outbreak number, specimen number and date of collection
- Complete the lab request form
- Urine sample should be kept at 4 to 8°C before shipment
- If refrigerated centrifuge is available, centrifuge at 500 x g (approximately 1500 rpm) for 5 minutes at 4°C
- Supernatant should be discarded and sediment re-suspended in 1ml of virus transport medium. DO NOT freeze the sediment if it can be shipped within 48 hours.
- Urine should not be frozen before centrifugation and separation of cells.

Transportation of urine samples

- Place the urine bottles in zip lock bags and secure. (Use separate bags for individual samples).
- Place the plastic bags in the vaccine carrier with ice pack
- Transport the urine sample at the earliest (within 24 hrs)
- Follow the same procedure that is followed for shipping blood

Initially the focus will be on confirmation of measles through serology

8. MONITORING AND EVALUATION

8.1 Monitoring & evaluation

Monitoring and evaluation will be needed to assess the outcome and impact. The following aspects need to be monitored and evaluated

- Routine immunization programme
- Surveillance indicators
- Outbreak investigations
 - Measles Attack Rates
 - Case Fatality Rates
 - Vaccine Efficacy
- Laboratory confirmation of outbreaks
- Laboratory proficiency

8.1.1 Routine immunization coverage

Coverage levels of successive birth cohorts can be monitored regularly from the reported data. Reported data are at times unreliable. Hence there is a need for independent coverage evaluation surveys to determine reliable coverage levels. Correct estimates of measles coverage levels are essential to determine community immunity levels and plan for SIAs (to provide second opportunity) in an attempt to reduce susceptible populations.

8.1.2 Surveillance indicators

The following indicators are used to monitor the quality of measles surveillance

Proportion of reporting sites that report each week

- At least 80% of reporting sites should report each week on the presence or absence of measles cases.

Proportion of sites reporting at least one clinically confirmed measles case per year

- At least 80% of surveillance sites should report one or more clinically confirmed measles cases per year.

Proportion of outbreaks investigated

- This will be determined by measuring the proportion of outbreaks investigated against the threshold level identified by the Epidemic Response Team.

8.1.3 Outbreak monitoring & evaluation

Data collection under investigation of outbreak of measles should focus on determining

Attack Rates : Age specific attack rates for measles must be monitored to direct focus on appropriate age groups through routine immunization or supplementary immunization

Case Fatality Rates: Case fatality rates are required for organizing proper referral & case management in future

Vaccine Efficacy: In case vaccine efficacy is lower than 80%, vaccine storage & cold chain should be reviewed to determine any breaks in cold chain.

8.1.4 Specimen collection and transport

Both processes require careful monitoring to ensure proper testing of samples in the laboratory.

- Percent cases with adequate specimen (One blood specimen collected between 4 and 28 days of onset of rash).
- Percent specimens arriving at the laboratory in “good condition” (“good condition” means that upon arrival there are frozen ice packs or ice, or a temperature indicator (showing < 8°C) in the container, the specimen volume is adequate (5ml of blood) there is no evidence of leakage and appropriate documentation (laboratory request/reporting form) is completed).
- Percent laboratory results within 7 days of receipt of specimens.

8.1.5 Proficiency testing of laboratories

Periodic proficiency testing requires ensuring working of labs as per WHO accreditation standards.

8.2 Project progress indicators

Impact indicators

- Estimated annual number of measles deaths.
- Number and proportion of states in the region with measles elimination targets which have interrupted measles virus transmission.

Process indicators

- Proportion of states with a plan of action for measles

Monitoring And Evaluation

control.

- Proportion of states achieving at least 90% measles coverage through routine immunization services.
- Proportion of states that have introduced a second opportunity for measles immunization (supplemental or routine).
- Proportion of states implementing mass measles campaigns which have assessed the status of injection safety before the campaigns using appropriate guidelines.
- Proportion of states implementing mass measles campaigns which have conducted complete campaign evaluation.
- Proportion of states with access to measles proficient/accredited laboratories.

Annexure

List of Forms

VPD-H002	ACUTE FLACCID PARALYSIS AND MEASLES SURVEILLANCE SYSTEM - WEEKLY HOSPITAL REPORT
VPD-H003	REPORTING UNIT/HOSPITAL ACTIVE SEARCH FORM
VPD-D001	ACUTE FLACCID PARALYSIS AND MEASLES SURVEILLANCE SYSTEM - WEEKLY DISTRICT REPORT
VPD-D002	SUMMARY TIMELINESS AND COMPLETENESS OF WEEKLY REPORTS
VPD-D003	ACTIVE SEARCHES OF REPORTING SITES
VPD-S001	ACUTE FLACCID PARALYSIS AND MEASLES SURVEILLANCE SYSTEM - WEEKLY STATE REPORT
VPD-OB001	MEASLES OUTBREAK INVESTIGATION: NOTIFICATION
VPD-OB002	MEASLES OUTBREAK INVESTIGATION: COMMUNITY SURVEY
VPD-OB003	MEASLES OUTBREAK INVESTIGATION: DATA ON CASES
VPD-MLRF1	MEASLES LABORATORY REQUEST FORM AND RESULT FORM - FOR BLOOD SPECIMENS
VPD-MLRF2	MEASLES LABORATORY REQUEST FORM AND RESULT FORM - FOR URINE SPECIMENS
	MEASLES OUTBREAK INVESTIGATION : SUMMARY

ACUTE FLACCID PARALYSIS AND MEASLES SURVEILLANCE SYSTEM - WEEKLY HOSPITAL REPORT

After review of all wards and registry books, please send this report to the following person every Monday.

Name: _____

Address: _____

Fax: _____

Name of Reporting Hospital: _____

Year: Week No. Period included in the report: From: To: Number of cases identified: AFP* Clinical Measles**

If no cases were identified, write Zero (0)

Fill up information on all Measles cases below:

Patient's name and Father's name	Age in months	Sex	Received measles vaccine (Y/N/U)*	Village name and landmark	PHC name	Block name	District name	Outcome: Died? (Y/N/U)*

* Y=Yes, N=No, U=unknown

Name of person filling this report: _____

Date report sent to District: _____

Approval of Medical Director: _____

* All cases of AFP in children under 15 years of age should be reported and investigated
 ** All cases of clinical measles of any age should be reported

REPORTING UNIT/HOSPITAL ACTIVE SEARCH FORM

Year: _____

Half: 1st / 2nd

State: _____

District: _____

Nodal Officer: _____

Every Monday morning, Nodal officer should ask all relevant medical staff regarding AFP and Measles cases that were seen during previous week. He/ She should also visit the wards and emergency/ casualty areas. Please mark "X" when staff could not be contacted. Write the number of cases seen by the doctor. If no case seen, then write "0".

	Week number (enter 1-26 for 1st half year, 27-53 for 2nd half year)																																																						
Today's date (write date when consulted) →																																																							
Dr. _____																																																							
AFP cases reported																																																							
Measles cases reported																																																							
Dr. _____																																																							
AFP cases reported																																																							
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Measles cases reported																																																							
Dr. _____																																																							
AFP cases reported																																																							
Measles cases reported																																																							
Signed initials of Nodal officer																																																							
Total number of AFP cases found																																																							
Total number of Measles cases found																																																							

The nodal person responsible for AFP/ Measles surveillance should visit all the departments and wards where children under 15 years of age could receive medical attention and search for cases of AFP/ Measles. Once all sources of information are consulted, he/she should prepare the weekly report (VPD H002) and send to the District Immunization Officer.

ACUTE FLACCID PARALYSIS AND MEASLES SURVEILLANCE SYSTEM - WEEKLY DISTRICT REPORT

Please send this report to the following person every Tuesday:

Name: _____ Address: _____ Fax: _____

Name of reporting district: _____ Year:

Week No: Period included in the report: From: To:

No of units expected to report: _____

No of units reporting on time: _____ Number of AFP Cases identified: _____

Names of Reporting Units not reported on time this week:

Write EPID numbers of AFP cases identified and reported this week:

Fill up information on all clinical measles cases below

Blocks within the reporting district	Block name	Put a tally mark for each clinical measles case	Total cases	Put a tally mark for each clinical measles death	Total deaths	
	District total clinical measles cases				District total clinical measles deaths	

Blocks outside of reporting district

District name	Block name	Put a tally mark for each clinical measles case	Total cases	Put a tally mark for each clinical measles death	Total deaths

Write the number of measles outbreaks identified this week

Note: Use another sheet, if required

The number of measles deaths should be counted as measles cases also

Outbreak is defined as ≥ 5 cases per block per week OR ≥ 5 cases on the borders of the contiguous blocks in a week OR ≥ 1 death due to measles per block per week

Name of person filling out report: _____ Date report sent to State: _____

Approval of District Immunization Officer _____

All districts should report weekly even if no cases of AFP or clinical measles were identified

ACTIVE SEARCHES OF REPORTING SITES

Year: _____

District: _____

State: _____

Reporting officer: _____

Indicate the date of each active search and the number of unreported cases found.

Name of reporting site	Code	VHP/HP/ LP*	Action / findings	Month												Totals	
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			date searched														
			No. AFP cases														
			No. Measles cases														
			date searched														
			No. AFP cases														
			No. Measles cases														
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			date searched														
			No. AFP cases														
			No. Measles cases														
			date searched														
			No. AFP cases														
			No. Measles cases														
Total number of searches																	
Total number of unreported AFP cases found																	
Total number of unreported Measles cases found																	

* Prioritization of reporting units will remain same as in AFP surveillance system

ACUTE FLACCID PARALYSIS AND MEASLES SURVEILLANCE SYSTEM - WEEKLY STATE REPORT

Please send this report to the following person every Wednesday:

Name: _____ Address: _____ Fax: _____

Name of reporting state: _____ Year:

Week No: Period included in the report: From: To:

No of units expected to report: _____

No of units reporting on time: _____ Number of AFP Cases identified: _____

Write EPID numbers of AFP cases identified and reported this week:

Fill up information on all clinical measles cases below:

	District name	Block name	Total cases	Total deaths	Number of clinical measles outbreak identified
Districts within the reporting state					
	State total				

Districts outside of reporting state:

State name	District name	Block name	Total cases	Total deaths	Number of clinical measles outbreak identified

Write measles outbreak ID of outbreaks being investigated this week:

Note: Use another sheet, if required

The number of measles deaths should be counted as measles cases also

Outbreak is defined as ≥ 5 cases per block per week OR ≥ 5 cases on the borders of the contiguous blocks in a week OR ≥ 1 death due to measles per block per week

Name of person filling out report: _____ Date report sent to GoI: _____

Approval of State Immunization Officer _____

All states should report weekly even if no cases of AFP or clinical measles were identified

MEASLES OUTBREAK INVESTIGATION: NOTIFICATION

Outbreak ID: _____

Village / Urban ward affected: _____

Sub-center: _____

PHC/UHC: _____

Block: _____

District: _____

State: _____

Date of beginning of investigation planned: _____

Date of notification to state govt, state SMO and NPSU: _____

Note: Notification should be by email/ fax as soon as ERT decides to investigate the outbreak.

MEASLES OUTBREAK INVESTIGATION: COMMUNITY SURVEY

Village / Locality name: _____

Date of search: _____

Block/ Urban Ward: _____

Search done by: _____

District: _____

Outbreak ID: _____

Fill up information of persons surveyed:

Row Number	Age Group	Category	Number received measles vaccine		Number not received measles vaccine		Number with unknown vaccination status	
			Tally Mark	Number	Tally Mark	Number	Tally Mark	Number
1	< 1 year	Measles						
		Non-measles						
		Death due to measles						
2	1-4 years	Measles						
		Non-measles						
		Death due to measles						
3	5-9 years	Measles						
		Non-measles						
		Death due to measles						
4	10-14 years	Measles						
		Non-measles						
		Death due to measles						
5	≥ 15 years	Measles						
		Non-measles						
		Death due to measles						

Note: -- All persons who in the last three months had measles or died due to measles or are presently having measles should be recorded in the linelist format (Form VPD-OB002).

- Number of death due to measles should be counted as measles also.

- Death due to measles usually occurs due to complications.

MEASLES OUTBREAK INVESTIGATION: DATA ON CASES

Village / Area: _____ PHC: _____ District: _____ State: _____

Outbreak ID: _____ Urban / Rural _____ Report sent by _____ Date Sent: _____

Patient number	Patient's name, father's name and address	Sex (M/F)	Age in years & months	Received measles vaccine (circle)	Date of last measles vaccine (dd/mm/yyyy)	Date of onset of rash (dd/mm/yyyy)	Death (circle)	Date of blood specimen collection (dd/mm/yyyy)
				Yes No Unknown			Yes No Unknown	
				Yes No Unknown			Yes No Unknown	
				Yes No Unknown			Yes No Unknown	
				Yes No Unknown			Yes No Unknown	
				Yes No Unknown			Yes No Unknown	
				Yes No Unknown			Yes No Unknown	
				Yes No Unknown			Yes No Unknown	
				Yes No Unknown			Yes No Unknown	
				Yes No Unknown			Yes No Unknown	
				Yes No Unknown			Yes No Unknown	
				Yes No Unknown			Yes No Unknown	
				Yes No Unknown			Yes No Unknown	
				Yes No Unknown			Yes No Unknown	

Note: - Outbreak ID should consist of State code / District code / Year / Outbreak Number; should be filled by the district team

MEASLES LABORATORY REQUEST FORM AND RESULT FORM - FOR BLOOD SPECIMENS

Address: _____ State: _____

Block: _____ District: _____ Outbreak ID: _____

Part I: Case information							Part II: to be filled out by receiving laboratory			
Patient name	Specimen code*	Age	Date of rash onset	Date of last measles dose	Specimen collection date	Specimen identification number	Date of result		Test result	
							Measles	Rubella		

Date specimens sent: _____

Name of person sending the specimens: _____

Address: _____

Date specimens received: _____

Receiving laboratory name: _____

Comment: _____

Signature: _____

Note: Blood specimen should be collected between 4 and 28 days after the onset of rash
 * Specimen code is the code given to each sample of blood. Specimen code to each sample of blood will be outbreak ID-B-patient number.

MEASLES LABORATORY REQUEST FORM AND RESULT FORM - FOR URINE SPECIMENS

Address: _____ State: _____
 Block: _____ District: _____
 Outbreak ID: _____

Part I: Case information				Part II: to be filled out by receiving laboratory			
Patient name	Specimen code*	Age in months	Date of rash onset	Specimen collection date	Specimen identification number	Date of result	Virus isolated (circle) Yes No
							Yes No
							Yes No
Date specimens sent: _____				Date specimens received: _____			
Name of person sending the specimens: _____				Receiving laboratory name: _____			
Address: _____				Comment: _____			
				Signature: _____			

Note: Urine specimen should be collected within 5 days of onset of rash
 * Specimen code is the code given to each sample of urine. Specimen code to each sample of urine will be outbreak ID-U-patient number.

MEASLES OUTBREAK INVESTIGATION: SUMMARY

Outbreak ID: _____

Notification

First case reported by: _____ Name of DIO: _____
 Designation: _____ Name of SMO: _____
 Date of notification of the first case: _____

Location of the outbreak

Village / Urban ward affected: _____ Sub-center: _____
 PHC/UHC: _____ Block: _____
 District: _____ State: _____
 Cross notification needed Yes / No

Preliminary search

Date/s of preliminary search: _____
 Number of health facilities searched: _____ Number of sub-centers/ urban wards searched: _____
 Number of areas* searched: _____ Total number of clinical measles cases: _____
 Date of Epidemic Response Team meeting: _____
 Whether considered as an outbreak requiring house to house investigation: Yes / No
 If No, reason: Too small a sample
 House to house outbreak investigation done in last three months in the same area
 Others (specify) _____
 If Yes, provide details of outbreak investigation below

Details of outbreak investigation

Date of pre outbreak investigation orientation: _____
 Date of outbreak investigation From: _____ To: _____
 Number of health facilities involved: _____ Number of sub-centers/ urban wards involved: _____
 Number of areas* involved: _____ Total population investigated: _____
 Total number of measles cases: _____ Total number of deaths due to measles: _____
 Date of onset of first case: _____ Date of onset of most recent case: _____

Laboratory investigation details

Specimen code**	Age	Sex	Date of last measles dose	Date of collection	Date sent to lab	Date received in lab	Result Measles / Rubella/ Negative	Date of Result

Note: * Areas are villages, towns, municipalities or corporations.

** Specimen code is the code given to each sample of blood or urine. If sample collected is blood, specimen code will be outbreak ID-B-patient number or if the sample is urine, specimen code will be outbreak ID-U-patient number.

Data analysis of outbreak investigation

Outbreak ID: _____

Age Group	Number of measles cases received measles vaccine (A)	Number of measles cases not received measles vaccine (B)	Number of measles cases with unknown vaccination status (C)	Number of non-measles received measles vaccine (D)	Number of non-measles with unknown vaccination status (E)	Total population (F)	Age specific attack rate ((A+B)/F)*100	Age wise distribution of measles cases ((A+B)/(G+H))*100	Attack rate among not vaccinated/ unknown (ARU) (B/(B+D))*100	Attack rate among vaccinated (ARV) (A/(A+C))*100	Vaccine Efficacy (ARU-ARV)/ARU	Case Fatality rate (CFR) (E/(A+B))*100
< 1 year												
1 - 4 years												
5 - 9 years												
10 - 14 years												
>=15 years												
Total	(A)	(B)	(C)	(D)	(E)	(A+B+C+D)	((A+B)/F)*100	((A+B)/(G+H))*100	(B/(B+D))*100	(A/(A+C))*100	(ARU-ARV)/ARU	(E/(A+B))*100

Any other relevant details